

3.4.5 Bibliometrics of the publications during the last five years based on average Citation index in Scopus/ Web of Science/ PubMed

Sr. No	Title of the paper	Name of the author	Title of the journal	Year of publication	Citation Index
AY 2022-23					
Automobile Engineering (International)					
1	Component Sizing of Electric Vehicles: A Programming Approach	Nihar Pednekar, Satyajit Patil	SAE Technical Papers	06-10-2022	1.2
2	NAAC Student Satisfaction Survey: A Reliable and Effective Instrument for Institutional Quality Assurance	Satyajit R. Patil, Sushma S. Kulkarni	Journal of Engineering Education Transformations (JEET)	Jan-23	0.8
3	Design and Numerical Investigation for Reduction of Hand-Arm Vibrations from Steering Wheel of an Agricultural Tractor	Sumit S. Naygaonkar, Sandeep R. Desai	International Journal of Vehicle Noise and Vibration	16-09-2022	0.6
4	Effect of fin density and fin height on flow-induced vibration behavior of finned tube arrays subjected to water cross flow	Sandeep Rangrao Desai, Mangalsing Narsing Sonare	Multidiscipline Modeling in Materials and Structures	24-02-2023	4.8
5	Investigation on vibration parameters in aluminum finned tube arrays subjected to water cross flow	Pravin H. Yadav, Sandeep R. Desai, Dilip Kumar Mohanty	Multidiscipline Modeling in Materials and Structures	23-08-2022	4.8
6	Fluid Elastic Instability and Vortex Shedding in Finned Tube Arrays: The Effects of Tube Material and Fin Density	Pravin Hindurao Yadav, Sandeep R. Desai, Dilip Kumar Mohanty	World Journal of Engineering	29-11-2022	3.7
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8	Effectiveness of Think Aloud Pair Problem Solving and Case Study based active Learning Techniques for Engineering Classroom	Supriya S. More, Dipali M. Kadam	Journal of Engineering Education Transformations (JEET)	Jan-23	0.8
9	Free vibrational behavior of bi-directional perfect and imperfect axially graded cylindrical shell panel under thermal environment	Pankaj S. Ghatage and P. Edwin Sudhagar	Structural Engineering and Mechanics	Jan-23	4.7

10	Free Vibrational Behavior of Bi-Directional Functionally Graded Composite Panel with and Without Porosities Using 3D Finite Element Approximations	Pankaj S. Ghatage, P. Edwin Sudhagar	International Journal of Integrated Engineering	28-02-2023	1.3
11	An Attempt to Enhance the Visualization, Imagination and Drawing Skill of Freshman Engineering Students through Problem Based Learning Approach	Sachin N. Sawant, Pankaj S. Ghatage, Sachin K. Patil	Journal of Engineering Education Transformations (JEET)	Jan-23	0.8
12	Enriching life-long learning Skills of Students by Poster Development and Presentation (PDP) Approach	Aniket Suryawanshi, Yogesh Patil, Shirish Mane	Journal of Engineering Education Transformations (JEET)	Jan-23	0.8



Component Sizing of Electric Vehicles: A Programming Approach

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Citation: Pednekar, N. and Patil, S., "Component Sizing of Electric Vehicles: A Programming Approach," SAE Technical Paper 2022-01-5085, 2022, doi:10.4271/2022-01-5085.

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Abstract

The rising demand for battery electric vehicles has resulted in market saturation in terms of various start-ups, and established automakers are also introducing new models every year. The automakers have to put a lot of effort into sizing powertrain components optimally to get the best performance and efficiency. This paper proposes a programming approach for estimating the preliminary component sizing based on analytical

equations regarding electric motor power rating and battery-pack energy capacity. Estimating tractive force for various vehicle performance goals dictates the motor power rating. The battery sizing for lead-acid and Li-ion batteries is proposed based on the empirical relationship between vehicle curb weight and battery-pack weight and the energy consumption approach. The validation and verification of the program based on output accuracy and user experience are presented.

Keywords

Sizing, Electric vehicles, Battery capacity, C program, Motor rating

I. Introduction

There are thousands of electric vehicles produced every year with BEVs accounting for 74% of EV sales [1] due to increased demand and environmental concerns regarding conventional internal combustion vehicles. More and more start-ups and established automakers are in a battle of designing and producing new electric vehicles. These automakers are held back by certain constraints such as time limitation, resource exhaustion, and expenses in research and development. While designing a new electric vehicle, certain parameters are to be considered such as traction battery-pack capacity, motor sizing and selection, and the like. These components directly affect range, cost, complexity, losses, and vehicle performance characteristics. An electric vehicle has fewer components and that is why component sizing in an electric vehicle becomes a crucial aspect in meeting optimal performance requirements.

Rigorous research has been going on in order to improve the relatively limited driving range of electric vehicles while having good performance without a major cost increase. Hence, it becomes important to investigate the effects on energy efficiency as well as performance that different design choices have when it comes to the design of primary powertrain components of an electric vehicle such as traction battery pack and motor. An interesting research aspect is to suggest

appropriate drive system components according to vehicle category and its performance requirements.

Till now, some studies have been done on the component sizing of electric vehicles. Mineeshma et al. [2] represented a backward simulation approach to choose optimal design specifications and performance for making an efficient EV/HEV system where component and vehicle requirements had to be defined in terms of range, gradeability, and the like to generate optimum component specifications. Unnewehr and Knoop [3] developed and presented a method for modeling electric vehicles that are used in the prediction of electric vehicle performance and range over variable driving cycles. The model could also be used for studying the size, power rating, and cost of the electrical drive train. Colzi et al. [4] used real-world driving avoiding standard cycles, where the data was collected on four different vehicles and was used as input to a longitudinal dynamic model of the vehicle, which was helpful in the preliminary sizing procedure. Sandeep et al. [5] presented a mathematical model for battery-pack sizing to evaluate the vehicle energy consumption. Factors such as battery mass and energy needed were predicted using inputs such as battery-specific energy, range, and so on. The outputs are evaluated and an ideal battery pack is suggested. Looking at the past work it can be seen that many have focused on

NAAC Student Satisfaction Survey: A Reliable and Effective Instrument for Institutional Quality Assurance

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Abstract: The effectiveness of academic practices and hence student satisfaction in terms of academic engagement is a critical issue for any higher education institute. This work proposes the NAAC student satisfaction survey as a reliable and effective instrument to gauge the academic health of the institute. It demonstrates that the student feedback on the academic practices if analyzed and followed up with appropriate actions, helps improve the student satisfaction index at the institute level and that of departments. The work proposes the hypothesis that the improvement in the student satisfaction index of the institute over four years belongs to concerted efforts and actions taken based on annual survey findings. The hypothesis is tested with the help of ANOVA to validate the findings and conclusion of the work.

Keywords: NAAC student satisfaction survey; student satisfaction index; academic health; ANOVA

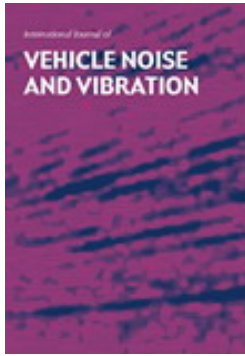
I. INTRODUCTION AND LITERATURE REVIEW

Teaching-learning process is at the core of any teaching-intensive higher education institute. The effectiveness of this process directly influence the graduate outcomes in terms of placements, higher learning, research outputs or entrepreneurial efforts. Thus, assessment of teaching-learning process and the need for a metric indicating academic health of the institute becomes evident. Many institutes collect course-specific feedback from the students to gauge the academic effectiveness; however, a general feedback on teaching-learning, irrespective of faculty or the course, is desired to form an overall impression about the institutional academic ambience. Hence, student satisfaction in terms of academic engagement becomes pivotal for any higher education institute.

Earlier works have addressed student satisfaction issue in various contexts like evaluation of a new program or distance learning program, outcomes based pedagogy, effectiveness of vocational program, evaluation framework and some other. Daultani et al. (2021) identified key attributes of student satisfaction in the context of e-learning while Ghansah et al. (2021) investigated student satisfaction determinants for academic and administrative services of a private university. Silva et al. (2020) lends the students satisfaction perspective from Brazil about higher technical-vocational education. Garnjost and Lawter (2019) investigated undergraduate student perceptions across various pedagogies. Gunn (2018) addressed student satisfaction while developing a Teaching Excellence Framework (TEF) for a

university in UK. Skea (2017) presented his arguments on settling and unsettling of student expectations as a part of quality culture of an institute. Gibson (2010) reviewed the attributes which influence the students' perception of overall satisfaction. Möller (2006) presented development of a student satisfaction monitoring instrument at Utrecht University (UU) while Douglas (2006) designed and developed a questionnaire to measure student satisfaction at the faculty of business and law in a university. The abundant literature available also underlines the significance of the aspect of student satisfaction for a higher learning institute. The simplicity and reliability of the instrument used for the assessment of student satisfaction level is a key aspect.

The NAAC (National Assessment and Accreditation Council), a statutory body of UGC (University Grants Commission) is responsible for the institutional assessment and accreditation of higher educational institutes in India. The NAAC as a part of its standard process, uses Student Satisfaction Survey (SSS) - a twenty-one question questionnaire, to evaluate the teaching-learning process of the institute based on the feedback of the students. The NAAC conducts this survey online or through emails as a part of the assessment and accreditation process of the institute and offers five percent weight for the score. Out of twenty-one questions, twenty are objective while one is subjective in nature. These questions cover all the important and relevant dimensions of teaching and learning process like academic planning, course design and delivery, performance evaluation and feedback to the students. The student responses are sought on the five-point rating ranging from 0 to 4, indicating various levels of conformance to the statement. The questionnaire is available at http://www.naac.gov.in/docs/Apply%20now/SSS-Questinnnaire_Students.pdf (2021). The student feedback collected offers insights into academic practices and culture; and help gauge the academic ambience of the institute though it doesn't provide feedback on individual course or course teacher. This work makes an effort to demonstrate leveraging NAAC Student Satisfaction Survey questionnaire as a reliable instrument to gauge academic health of an engineering institute and thereby improve the academic experience for its students. The findings are validated statistically with the help of ANOVA. Section 2 presents details about the deployment of the survey by the institute while section 3 presents the key findings based on the analysis of collected feedback. The 'Discussion' section discusses efficacy of this tool for academic health monitoring and further validated with the help of ANOVA in section 5 which is followed by the conclusion section.



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Design and numerical investigation for reduction of hand-arm vibrations from steering wheel of an agricultural tractor

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Design and numerical investigation for reduction of hand-arm vibrations from steering wheel of an agricultural tractor

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Abstract: Steering wheel vibration affects the driver's comfort in an agricultural tractor. In order to increase driver comfort and reduce the hand-arm vibration syndrome (HAVS) effect, it is necessary to reduce the vibrations in agricultural tractors. The tuned mass damper concept is used to reduce vibrations from the tractor's steering wheel. The paper is focused on measuring steering wheel vibration characteristics on the actual tractor, designing a vibration control system and carrying out impact assessment using numerical analysis. The amplitude of vibration at the steering wheel measured by physical measurement on an actual tractor is compared to that determined using MATLAB Simulink. The outcomes of the numerical analysis suggest that the amplitude of vibration can be reduced by using a tuned mass damper (TMD) to achieve the proposed target levels. The effect of hand-arm vibration syndrome can also be decreased, resulting in an increased driver comfort.

Keywords: agricultural tractors; hand-arm vibration syndrome; HAVS; hand-transmitted vibration; steering wheel vibration; tuned mass damper; TMD; vibration exposure.

Reference to this paper should be made as follows: Naygaonkar, S.S. and Desai, S.R. (2022) 'Design and numerical investigation for reduction of hand-arm vibrations from steering wheel of an agricultural tractor', *Int. J. Vehicle Noise and Vibration*, Vol. 18, Nos. 1/2, pp.119–138.

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Effect of fin density and fin height on flow-induced vibration behavior of finned tube arrays subjected to water cross flow

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Multidiscipline Modeling in Materials and Structures

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Abstract

Purpose

The prediction of critical velocity at instability threshold for shell and tube heat exchangers is important to avoid failure of tubes as a result of flow-induced vibrations due to water cross

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Investigation on vibration parameters in aluminum finned tube arrays subjected to water cross flow

Pravin H. Yadav et al., Multidiscipline Modeling in Materials and Structures, 2022

Investigation on vibration parameters in aluminum finned tube arrays subjected to water cross flow

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Abstract

Purpose – Predicting the critical velocity is crucial at the instability threshold for shell and tube heat exchangers in order to prevent tube failure due to vibrations. In this study, the vibration response of an aluminum tube bundle subjected to water cross flow was analyzed experimentally. Aluminum tubes are preferred over steel tubes because of aluminum tubes' excellent corrosion resistance, ease of manufacture, and high thermal efficiency.

Design/methodology/approach – The fluid elastic instability and vortex shedding mechanisms in a finned tube array of aluminum tubes with a base tube diameter of 19.05 mm and pitch of 34 mm were investigated. The current study considers parallel triangular finned tube arrays with fin heights of 3 mm and 6 mm with a uniform fin thickness and fin pitch. The plain tube array was tested to compare the finned tube array results. The tube vibration response was measured using an accelerometer mounted on the middle tube of the third row. In order to define the fluid elastic instability behavior of various tube arrays, the critical velocity at the instability threshold is measured. By finding the Strouhal number at the small peaks before instability, the vortex shedding behavior of the tube arrays is examined.

Findings – The results reveal that the critical velocity at instability for coarse finned tube arrays increases as the fin height increases. The effect of the tube material is evaluated by comparing the results with those previously reported for parallel triangular tube arrays made of steel. Finally, the occurrence of vortex shedding in a tube array is confirmed based on the Reynolds number and Strouhal number relationship. The instability constant K for the plain tube array of steel and aluminum material are 4.97 and 4.87, respectively.

Originality/value – This paper provides the research findings on the effect of fin height on coarse density finned tube array. This will add substantial knowledge to the literature in the field of fluid elastic instability and vortex shedding, which is needed for the safe functioning of shell and tube heat exchangers.

Keywords Critical velocity, Fluid elastic instability, Coarse fin tube array, Vortex shedding

Paper type Viewpoint



Nomenclature

A	Test section cross-sectional area (m^2)	d_b	Tube external diameter (mm)
A_g	Amplitude of vibration in terms of "g" ($g = 9.81 \text{ m/sec}$)	d_f	Diameter of fin (mm)
A_m	Amplitude of vibration (mm)	d_{eff}	Tube effective diameter (mm)
c	Damping coefficient	D_e/D	Confinement factor
d_i	Tube internal diameter (mm)	E	Young's modulus of elasticity (N/m^2)
		f_n	Tube natural frequency in the air (Hz)

Fluid elastic instability and vortex shedding in finned tube arrays: the effects of tube material and fin density

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Abstract

Purpose – The purpose of this paper is to present investigations on the significant influence of the tube material and fin density on fluid elastic instability and vortex shedding in a parallel triangular finned tube array subjected to water cross flow.

Design/methodology/approach – The experiment was conducted on finned tube arrays with a fin height of 6 mm and fin density of 3 fins per inch (fpi) and 9 fpi. A dedicated setup has been developed to examine fluid elastic instability and vortex shedding. Nine parallel triangular tube arrays with a pitch to tube diameter ratio of 1.78 were considered. The plain tube arrays, coarse finned tube arrays and fine finned tube arrays each of steel, copper and aluminium materials were tested. Plain tube arrays were tested to compare the results of the finned tube arrays having an effective tube diameter same as that of the plain tube.

Findings – A significant effect of fin density and tube material with a variable mass damping parameter was observed on the instability threshold. In the parallel triangular finned tube array subjected to water cross flow, a delay in the instability threshold was observed with an increase in fin density. For steel and aluminium tube arrays, the natural frequency is 9.77 Hz and 10.38 Hz, which is close to each other, whereas natural frequency of the copper tubes is 7.40 Hz. The Connors' stability constant K for steel and aluminium tube arrays is 4.78 and 4.87, respectively, whereas it is 5.76 for copper tube arrays, which increases considerably compared to aluminum and steel tube arrays. The existence of vortex shedding is confirmed by comparing experimental results with Owen's hypothesis and the Strouhal number and Reynolds number relationship.

Originality/value – This paper's results contribute to understand the effect of tube materials and fin density on fluid elastic instability threshold of finned tube arrays subjected to water cross flow.

Keywords Natural frequency, Water cross flow, Parallel triangular tube array, Stability constant, Tube material

Paper type Research paper

Nomenclature

A	= Test section cross-sectional area (m^2);
A_g	= Amplitude of vibration in terms of "g";
A_m	= Amplitude of vibration (mm);
d_i	= Tube internal diameter (m);
d_b	= Tube external diameter (m);
d_f	= Fin diameter (m);
d_{eff}	= Tube effective diameter (m);
D_e/D	= Confinement factor;
E	= Young's modulus of elasticity (N/m^2);
f_n	= Tube natural frequency in air (Hz);
f_w	= Tube natural frequency in water (Hz);
K	= Connors' stability constant;

m	= Tube mass (kg/m);
m_t	= Tube structural mass (kg/m);
X_p	= Tube pitch ratio;
m_h	= Tube hydrodynamic mass (kg/m);
M_r	= Mass ratio;
P	= Pitch between the tube (m);
P/D_{eff}	= Effective pitch ratio;
p_f	= Fin pitch (mm);
Q	= Flow rate (m^3/h);
t_f	= Fin thickness (m);
V_f	= Free stream velocity (m);
V_g	= Gap velocity (m);
V_c	= Critical gap velocity (m);
δ	= Logarithmic decrement;
ρ	= Mass density of the tube (kg/m^3);
ρ_f	= Mass density of the fluid (kg/m^3);
α	= Connors' exponential constant; and
ζ	= Damping factor.

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Implementation of a Team Game Tournament a Collaborative Learning Method and Study of its Impact on Learners' Development

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Abstract— The paper showcases the encouraging results of the cooperative learning (CL) method Team Game Tournament (TGT). TGT helps students to improve and accelerate their learning. In TGT success of the team is dependent on the success of the individual [5]. A tournament is played between small academically balanced teams. Facilitators form such teams and note the performance of each team by visual monitoring, data from student questionnaires, and exam results. Exam results of Third Year Automobile course Machine Design (AE301) with and without TGT are compared. Students' performance in exams is improved, they show to be focused and participative, to develop their critical thinking. Because of TGT, deep discussions happened on topics by students in a group. They enjoy the new learning format. Social skills like teamwork and managing conflict are developed in students. Students' feedback and improvement of their performance in exams confirm the above perceptions.

Keywords— Cooperative learning, Team Game, Tournament (TGT), Student attitude.

JEET Category—Practice paper

I. INTRODUCTION

In Cooperative learning (CL) students work in small groups to help each other learn. CL helps a student to learn the material better due to the facility to share their knowledge and discuss it with the team. It also improves the social and cooperative behavior of learners. The subject AE301 is a traditionally difficult subject. Students suffer to understand, remember and apply the number of design processes discussed in the subject. Many work on selective topics to earn a passing percentage. Slow learners find it difficult to pass the course on the first attempt. Few advanced learners only achieve excellence in it. Therefore, the new learning method needs to provide the student with an ability to efficiently work as part of a team in addition to facilitating an early and thorough grasp of concepts. In Cooperative Learning (CL) students attain their learning outcomes through team activities. The success of CL depends upon the following elements [1, 2].

- i *Accountability of individual in group success*: the success of a group is dependent on the performance of each member of the group.
- ii *Group Accountability*: The contribution of each member is accountable so members help each other.
- iii *Encouragement to each other*: Group members encourage each other to achieve goals.
- iv *Social Skills*: Skills like leadership, communication, managing conflict, and building trust are getting developed in students.
- v *Group Processing*: Group members prepare a plan to study material and to find out all possible questions and answers.
- vi *Group structure*: Heterogeneous mix of students in a group conforms to fair competition.
- vii *Equal Opportunities for Success*: Every group and student gets an equal opportunity to score because of the TGT structure.

The students participate in TGT more actively because:

- i they get an award when the group wins,
- ii they get recognition in school/class,
- iii interaction with peer help them to understand the concepts.
- iv by explaining to others they understand better.
- v even after an initial loss, they get a chance to excel.

Here TGT is chosen to be implemented in AE301.

II. TGT PROCESS

In the early '70s, DeVries & Edwards developed TGT [6-8]. In TGT teams are formed as per the ranking of the students. Competition between similar ranking students of different teams takes place [9]. The facilitator prepares questions and answers in card format. He puts cards on each table. In each table, one of the students reads the question, and the other students can "pass" or "challenge" the question. If the challenger gives the correct answer, then he/she and his/her team get a score. For every question role of the student changes. The current nature of TGT is not suitable for AE301 because of its nature. In AE301 calculations are required so some modifications are made to a traditional method.

Effectiveness of Think Aloud Pair Problem Solving and Case Study based Active Learning Techniques for Engineering Classroom

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Abstract— Engineering and Technology is a very dynamic sector and change is very rapid. The knowledge gained in traditional classrooms, through online lectures, through search engines, online video books, and Wikipedia is just helping to understand the theoretical concepts. These information sources cannot develop abilities to apply the theoretical concept to real-world problems. This can be developed through experiential learning in workshops, industrial visits, field visits, etc. The advanced courses are not having this scope due to limited lab capacities, high instrument costs, a variety of instruments, quick revisions in technology, less number of industries, IP securities, and many more reasons. The Automobile sector is a vibrant one and the Automobile Engineering department is always facing these issues. This study presents the teaching-learning experience of the course Automotive Control Engineering which faces the above issues. The study was conducted for T.Y.B.Tech Automobile Engineering students for the years 2018-19. The aim of the study was to increase the concept implementation ability of the students. The theoretical knowledge that was being received through books, lectures, and search engines were used to correlate the working of advanced technology. Think Aloud pair problem-solving technique (TAPPS) and case study presentation of the real-world system tools have been used for the course delivery. The course attainment level of the experimental group increased by 11%. The students have shown enhancement in competencies like problem-solving, application of theoretical concepts, critical thinking, lifelong learning, etc. Learning from peers and in groups also improved classroom engagement and the joy of learning.

Keywords— Active learning; Control Engineering; Life-long learning; OBE; Problem based learning; Think Aloud Problem Solving Technique.

JEET Category— Research

I. INTRODUCTION

Automotive is ever changing field of Engineering and technology. The control system plays a key part in

efficient and safe working of an automotive system. It becomes inevitable to learn concepts of automotive control for Automobile Engineering students. Automotive control and allied industries are the most fascinating pocket for an automotive engineer. Teaching Control Engineering course to Automobile Engineering students is a challenging task, as students have not studied the basics of electronics and the advanced, emerging technologies are complex and setting new trends day by day (Govindasamy, 2001; Shulman, 1986). This is an era of transformation and engineering education field is also started transforming from the conventional chalk and talk method of teaching learning to outcome based design, delivery, and assessment of curriculum (Jwaid, Clark, & Ireson, 2014; Archambault & Barnett, 2010). The domain-specific engineering education is all about developing the problem solving skills by applying theoretical knowledge they learnt. Nowadays various cooperative and collaborative active learning techniques like think-pair-share, jigsaw, project-based learning, STAD, puzzle-based, and problem based learning are used to make classroom learning more effective so that students themselves demonstrate the skills by active participation. Various task-based activities with proper planning and execution make classroom learning more effective as they are based on ‘learning-by-doing’ principle (Hayne, 2011). The methods like reciprocal and modified reciprocal teaching (Alfassi, 1998; Kadam & Sawant, 2020) are effectively used as peer learning techniques.

There are many evidences in literature in which different concepts are worked out and experimented for delivery of control engineering course (Govindasamy, 2001). The Technological Pedagogical Content Knowledge (TPACK) method of learning has been used which helped to communicate fresher with specialist (Chilukuri, 2020). The Visual literacy aids like the intuitive approach adopted and implemented successfully some specially designed tracks for better learning of this course are documented (Bencomo, 2004; Krathwohl 2002; Pantoya, Hughes, & Hughes, 2013). Problem solving technique and case study approach have been also implemented for enhancing course delivery and classroom engagement of engineering courses (Johnson & Chung, 1999; Kani & Shahrill.

Free vibrational behavior of bi-directional perfect and imperfect axially graded cylindrical shell panel under thermal environment

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Abstract. This study presents the free vibrational responses of bi-directional axially graded cylindrical shell panels using 3D graded finite element approximation under a temperature field. The cylindrical shell panel is graded in two directions and made of metal-ceramic materials. To extract material properties, the Voigt model is combined with a Power-law material distribution. Convergence and validation studies are performed on the developed computational model to ensure its accuracy and effectiveness. Furthermore, a parametric study is performed to evaluate the developed model, which demonstrates that geometrical parameters, imperfect materials (porosity), support conditions, and surface temperature all have a significant impact on the free vibration responses of a bi-directional axially graded cylindrical shell panel in a thermal environment.

Keywords: 3D elasticity theory; FEM; free vibration; functionally graded materials; porosity

1. Introduction

Functionally graded materials (FGMs) are sophisticated materials that fall under the umbrella of composites, consisting of the gradation of properly tailored properties to achieve desired characteristics. Material property variations can be one-directional or multi-directional, and they can be graded continuously or discontinuously. The generally used FGMs are unidirectional and continuously graded Swaminathan and Sangeetha (2017). However, multidirectional functionally graded composite materials have attracted growing interest in aviation as well as other engineering applications due to their enormous advantages over conventional laminated composites and unidirectional FGMs. The cylindrical structure is well-known as one of the most common structural components in engineering applications Dai *et al.* (2016). Hence, researchers have paid more attention to estimate the free vibration behavior of FG cylindrical structures with the help of numerical, analytical, and experimental approaches in the last few decades.

Pradhan *et al.* (2000) conducted a vibrational analysis of a unidirectional FG cylindrical shells considering various boundary conditions. Kadoli and Ganesan (2006) used first-order shear deformation theory (FSDT) and presented thermal buckling and the linear free vibrational behavior of 1D-FG cylindrical shells with clamped-clamped boundary condition.

Free vibration behavior of non-homogeneous FG

magneto-electro-elastic cylindrical shells in conjunction with the finite element approach was investigated by Bhangale and Ganesan (2005). Pradyumna and Bandyopadhyay (2008) investigated the free vibrational behavior of unidirectional FG curved structures, including cylindrical shells using a higher-order FEM approach. Tornabene (2009) conducted a free vibrational analysis of a one-directional FG conical and cylindrical shells based on FSDT. A four-parameter power-law index is used to grade the material in the thickness direction. Tornabene *et al.* (2009) studied the vibrational behavior of one-directional FG conical and cylindrical shells along with annular plate structure using FSDT, the results were compared with results obtained from different commercial software. Zhao *et al.* (2009) used an element-free KP-Ritz technique and FSDT to investigate the static response and vibrational behavior of a unidirectional FG cylindrical shell under mechanical and thermomechanical loads. Li *et al.* (2010) studied the free vibration of a triple-layered cylindrical shell with a unidirectional FG middle layer. Malekzadeh and Heydarpour (2012) used FSDT to study the free vibrational behavior of a FG spinning cylindrical shell in a temperature environment. Fantuzzi *et al.* (2016) proposed three different two-dimensional and three-dimensional models to analyze the free vibration of unidirectional FG cylindrical and spherical panels and compared them to show the limitations of the two-dimensional model. Haddadpour *et al.* (2007) conducted a free vibrational study of a unidirectional cylindrical shell while taking temperature-dependent material characteristics into account. The power law index's influence on natural frequencies in a thermal environment was demonstrated. Punera and Kant (2017) performed a free vibrational study of unidirectional FG open cylindrical shells using models of higher-order shear and normal deformation theory (HOSNT), first-order shear deformation

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Free Vibrational Behavior of Bi-Directional Functionally Graded Composite Panel with and Without Porosities Using 3D Finite Element Approximations

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Abstract: The frequency characteristics of bi-directional functionally graded (FG) rectangular panels with and without porosities are examined in this work using 3D finite element approximations. The properties of graded panel consist metal and ceramic material varied smoothly in bi-direction. The material properties of this highly heterogeneous material are obtained using the Voigt material model and Power-law. The present model is developed using a customized computer code and discretized using three-dimensional solid 20-noded quadrilateral elements. The mesh refinement is conducted to present the convergence test. The validation test is presented by showing comparison of the obtained findings with the results reported in the previous literature. At a later stage, comprehensive parametric research is presented through numerical illustrations which reveal that the geometrical and material parameters of bi-directional functionally graded panel affect its frequency characteristics, significantly. Finally, the developed 3D FEM model to predict the free vibrational characteristics of multidirectional FG rectangular plates with and without porosities will be the reference for the continuation of research in this area.

Keywords: Bi-directional FGs, free vibration, finite element approximation

1. Introduction

Recently, multidirectional functionally graded composite materials show significant improvement in their characteristics, which results in attracting considerable attention in aerospace as well as other engineering application because of their enormous advantages over laminated composites and unidirectional functionally graded materials (FGMs). Koizumi [1] had proposed the idea of FGM in Japan for producing thermal barrier materials, in the 19th century many researchers had contributed to the development of unidirectional FGMs but some modern structures like advanced space crafts, shuttles, etc. demand advanced FGMs, whose micromechanical properties should vary not only in one direction but also vary in two or more than two directions and hence the concept of multidirectional FGMs was introduced in plate structure in which the micromechanical properties graded in two or more than two directions from one surface to another. FGM structures are typically composed of a grouping of metal and ceramic, metals exhibit good strength and toughness while ceramic materials are having good anti-oxidant as well as thermal resistance behavior. Free vibrational behavior of plate structure is one of the important concerns for structural designers; hence various researches have been conducted to evaluate the free vibrational behavior of FGM structures [27-29], whereas in recent decades, a group of researchers has worked to model and analyze multi-directional FGM structures [2-10].

An Attempt to Enhance the Visualization, Imagination and Drawing Skill of Freshman Engineering Students through Problem Based Learning Approach

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Abstract— The Engineering Drawing is one of the important and compulsory course for all the engineering students in first year engineering. This course improves the visualization, imagination and drawing skill of the students which are helpful them to draw their ideas clearly and rapidly, to read the drawing drawn by others and to create successful design. Engineering Drawing course includes projection, section and development of solids in which students are expected to imagine, visualize and develop the drawing as per given conditions also it includes orthographic projections in which 3D objects are required to convert in 2D drawing. The students of first year engineering find this task difficult due to no prior basic knowledge of technical drawing, poor imagination and visualization skill. Hence the attainment of the course learning outcome related to these topics is recorded low. To overcome this problem, a problem based learning approach implemented along with classroom teaching in order to enhance the, visualization, imagination and technical drawing skill of first year engineering students. In this article, the author has presented the efforts taken to improve the visualization, imagination and drawing skill through active engagement of students for learning in the classroom and outside of classroom. Due to systematic implementation of problem based learning (PBL), student's engagement towards learning, attainment of the course outcomes (COs) and overall exam result of the course have been improved.

Keywords— Course Learning Outcome, Engineering Graphics, Engineering Drawing, Problem Based Learning

JEET Category—Engineering Education for sustainable development

I. INTRODUCTION

Engineering drawing is a universal technical language of an Engineers which is globally accepted technical language to communicate between engineering professionals. Based on Engineering drawing skill Engineers can able to create designs, represents them on drawing sheet and finally prepare blue print before the manufacturing (Murthy et al., 2015). The ability to understand important topics in engineering drawing such as orthographic projection, isometric drawing, hidden views, and

sectional views are very critical as it represents the fundamentals of engineering drawing education (Serdar and De Vries ,2020). Engineering drawing is the compulsory course in first year engineering class to improve the drawing and imagination skill of the students, however due to lack of prior basic knowledge of technical drawing, poor imagination skill of the students and time restrictions in the classroom teaching, it is challenging for the faculty members to train the students for good drawing skill with conventional teaching methodology. Hence many faculty members implemented innovative teaching methodologies. Murthy et al. (2015) implemented Augmented Reality (AR) as a tool for teaching Engineering Drawing and improved 3D visualization of the students. Chen et al. (2011) developed tangible and AR models for Engineering Drawing course to increase the learning interest of students and to improve the visualization of the students. Pucha and Utschig (2012) implemented learning-centered strategies like case studies and real-world problems for freshman engineering students while teaching Engineering Drawing course. Authors have presented the impact of the learning-centered strategies on students learning, engagement and performance. Soundattikar and Naik (2016) conducted case study while teaching Total Quality Management course. They found that case study is effective tool for engaging students with different learning styles. Perumaal (2018) created effective learning environment for the course Engineering graphics through different active learning activities to improve the spatial visualization of students. Govil (2021) introduced sketching as an iterative tool in engineering education to improve visual communication skill of the students. Shreeshail et al. (2021) implemented problem-based learning technique to impart engineering drawing standards. Zemke (2018) discussed case study on efforts taken to teach Engineering Graphics for blind students. The author has presented the progress of blind students while learning orthographic and isometric projections. Moyano et al. (2009) presented the case study on Engineering Graphics learning, author evaluated the prior knowledge and background of the freshman engineering students. Author concluded that the rate of students' cognitive development does not follow the efforts

Enriching life-long learning Skills of Students by Poster Development and Presentation (PDP) Approach

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Abstract— In recent years' students are very reluctant to read books for studying for any course. They are preferring only teachers' notes or PowerPoint slides and mobile apps for exam study. Any type of information or study material is easily available on various networking sites. This can lead to poor interest and less engagement of students in the classroom teaching learning process. Also, in class activities are not fulfilling the expected level of learning of students, especially in the conceptual courses. So students need an activity based learning approach in the classroom. Nowadays most of the teachers in engineering institutions face these challenges. Hence, to utilize the capabilities of students, make them aware of course related books and achieve expected level of learning of students, a poster presentation module was implemented. In this practice paper, implementation of poster development and presentation (PDP) to improve learning of course fluid mechanics and machineries is detailed. This PDP approach empowers the student in life-long learning skills.

Keywords— Poster development and presentation, assessment, book reading, life-long learning.

JEET Category— Research Paper

Poster presentations are commonly used for assessment in the all disciplines of education, this is an innovative approach of assessment in disciplines such as business, law, and the humanities. Posters have the ability to demonstrate reflection in learning and are an excellent demonstration of experiential learning and assessing authentically.

An educational poster is a tool that enables visualization in the classroom to foster student learning. A great example is an educational poster in the format of an infographic. An infographic is a collection of imagery, charts, and minimal text that gives an easy-to-understand overview of a topic.

The main function of a poster is to capture a moving audience with a message. When designing a poster, plan its design carefully. Within a short amount of time posters will attract audience and hold attention.

The best advantage of poster making is that it facilitates team work and understanding along with facilitating creative thinking. It provides students with an opportunity to learn by doing, in turn strengthening the learning.

The basic purpose of this activity that students can synthesize information visually at a glance on one page. Poster should be self-demonstrated so anyone can understand the concept. The prepared poster can help student in the exam study. The poster will present the individual learning of students.

The purpose of these activities is to get students out of being passive audience and observers and to keep the student into the learning-teaching phenomenon in person. But it is not only to participate simply in the learning process for the learners but also to encourage them to use their mental abilities, to think themselves, to comment on learned topics, and to make relevant decisions in the learning process. The student is actively involved in the learning process, directs his / her own learning, uses high-thinking and decision-making skills, and engages in cooperation with friends.

Posters include original studies that the students perform on a specific topic with their friends in the classroom. Thus, an authentic learning environment is created in the classroom. In such an environment, students involve in their own activity and they are also in an active process. Therefore; the students learn the knowledge permanently by keeping their learning alive on their own. Thus, the students use library resources effectively, develop critical thinking, group work and presentation skills.

Individual presentations improve the validity of an assessment as it is easier to gauge the performance of students individually. As Dunn et al. point out "an assessment task is considered to be valid if it permits a student's performance, on what has actually been taught, to be measured: a task would be valid if it measures what the teacher intended it to measure." Individual assessments are necessary to evaluate the efficacy of a course as well as the progress of students enrolled in the course.

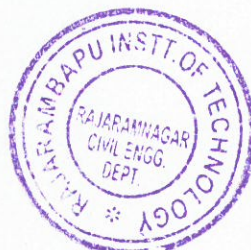
I. MOTIVATION OF ACTIVITY

In this paper, the authors have introduced an assessment method that motivates students, encourages them to relate Fluid Mechanics and Machineries course with other fields. This paper describes an innovative approach of the poster presentation to these challenges that involve a mixture of traditional and modern assessments. Creating and presenting

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3.4.5 Bibliometrics of the publications during the last years based on average Citation index in Scopus/ Web of Science/ PubMed

Sr. No	Title of the paper	Name of the author	Title of the journal	Year of publication	Citation Index
1	Artificial Neural Network approach for assessment of residual compressive strength of geopolymer concrete exposed to elevated temperature	Sana D. Sayyad, Dr.H.S.Jadhav	YMER	2022	0.2
2	A case study on course outcome and program outcome mapping levels based on competency and performance indicator.	Ansar Allauddin Mulla, Dr. H. S. Jadhav, Dr. A. P. Shah	Journal of Engineering Education Transformations	2023	0.8
3	Comparative study on load carrying capacities of castellated beams provided with mild steel and CFRP stiffeners	Dr. P.D. Kumbhar A.M. Jamadar	Materials Today: Proceedings journal	2023	3.2
4	Development of Interaction Surfaces for Rcc Columns Subjected to Axial Load and Biaxial Bending Reinforced with Fe550 Steel	Shweta R. Patrekar Dr. Popat D. Kumbhar	Indian Concrete Journal	2023	1
5	A novel way to designing the undergraduate mechanical engineering curriculum using active stakeholder participation	Sachin B Khot, Sachin K Patil, Dr. Sushma S Kulkarni	Journal of Engineering Education Transformations	2023	0.8
6	Inculcating Design Thinking Methodology in the Minds of First Year Engineering Students: A Step Towards Entrepreneurial Thinking	Pratik A Patil, Sachin K Patil, Dr. Sushma S Kulkarni	Journal of Engineering Education Transformations	2023	0.8
7	NAAC Student Satisfaction Survey: A Reliable and Effective Instrument for Institutional Quality Assurance	Satyajit R Patil, Dr. Sushma S Kulkarni	Journal of Engineering Education Transformations	2023	0.8
8	Effectiveness in Jigsaw Strategy on Student Achievement in Engineering Education	Dr. Y. M. Patil, Dr. P. D. Kumbhar	Journal of Engineering Education Transformations	2023	0.8



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Sr. No	Title of the paper	Name of the author	Title of the journal	Year of publication	Citation Index
9	Improving of Placements, Higher Studies and Entrepreneurships of Civil Engineering Students through Quality Circle Activity	Patil Y. M. ,Kumbhar P. D.	Journal of Engineering Education Transformations	2023	0.8
10	Hydrogeochemical Evaluation of Groundwater for Drinking and Irrigation Purposes in the Upper Piedmont Area of Haridwar, India	Kanchan Deoli Bahukhandi, Anamika Kushwaha, Lalit Goswami, Uday Bhan, Vishal Kamboj, Nitin Kamboj, Aditi Bisht, Amit Kumar Sharma, Sandip S. Sathe, Vipin Kumar Saini, Bhavtosh Sharma	ACS ES&T Water	2023	3.2
11	Magnetic and structural characterization of Sn doped cobalt ferrites; A visible light-driven photocatalysts for degradation of rhodamine-B and modeling the process by artificial intelligence tools	S.D. Zimur Pratapsingh Gaikwad A.V. Mali Amit Prakash Patil S.H. Burungale, P.D. Kamble	Journal of Alloys and Compounds	2023	10.9
12	Seismic Comparison of flat slabs and conventional slabs for structure with irregular shapes	Shruti A. Brahme Pramod B. Salgar	YMER	2022	0.2



Head, Civil Engineering Department



Artificial Neural Network approach for assessment of residual compressive strength of geopolymer concrete exposed to elevated temperature

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Abstract

The population growth and industrial activities nowadays creates a considerable volume of rubbish, producing disposal challenges and major environmental hazards. The cement industry is a major generator of greenhouse gases like carbon dioxide. The use of waste resources, which avoids disposal worries while lowering greenhouse gases emissions into the atmosphere. This is a major reason for the advancement of cement-free Geopolymer Concrete. Fly ash (FA) and ground granulated blast furnace slag (GGBS) geopolymer concrete cubes were treated to various temperatures ranging from 27 °C to 800 °C in a 75:25 ratio. The mechanical properties were then evaluated. This study demonstrates the use of an Artificial Neural Network (ANN) approach to calculate the 28-day compressive strength of Geopolymer concrete (GPC) from input materials. 255 test examples from previously published studies were used for training, testing, and verifying the ANN model. Non-Destructive tests (NDT), Rebound Hammer (RH) and Ultrasonic pulse velocity (UPV) were done at the same curing age to confirm the compressive strength estimated by the Destructive test. A test project was also built to collect experimental data for testing the prediction capacity of the ANN model. According to the study's findings, the ANN model applying the "trainlm" learning strategy generated the highest predictive results. The unseen set of data had a prediction error of about 3.5MPa on average.

Keywords: compressive strength, elevated temperature, geopolymer concrete, artificial neural network

A Case Study on Course Outcome & Program Outcome Mapping Levels Based on Competency & Performance Indicators.

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Abstract— This Paper gives an insight into an essential part of practicing outcome-based education (OBE). One of the crucial parts of OBE is measuring the quality and quantity of Program learning skills that student has acquired through various assessments. Course Outcome attainment heads up the learning in a specific course. However, the Program Outcome (PO) attainment needs the relation of Course Outcome & Program Outcome (CO-PO), i.e., mapping levels for calculations. The author has demonstrated the CO-PO mapping level underpinning the competency and Performance Indicators. The methodology for CO-PO Mapping has been shown in the Paper. A review on Mapping has been taken on an online feedback survey and found that mentoring is required in the CO-PO mapping level and interpreting it at hard-shell. CO-PO Mapping for a course has been demonstrated w.r.t. the process followed, and calculations to the end have been explained. There is an opportunity to take PO assessment methods further with mapping levels concentrating on defining competencies and Performance Indicators.

Keywords—Course Outcome (CO), Program Outcome (PO), CO-PO Mapping, Competency, Performance Indicators OBE.

JEET Category—Choose one: Research, Practice, or Op-Ed. (Please note, Op-Eds are by invite only. Refer to the Paper Submission and Review Guidelines for more details.)

I. INTRODUCTION

THE teaching-learning process is the heart of any educational system at a level and takes the stakes to their wisdom. Outcome-based education has emphasized the same, and the focus of learners' learning is at the center of the teacher's teaching.

In outcome-based education, the education focuses on learners' skill development at Cognitive, Psychomotor, and Attitude levels. The above skill level varies with education streams and level of education from school to higher education colleges & universities. (Mulla, 2021) While implementing outcome-based education ensures a certain amount or level of measurement quality has been imparted to the learner.

Measuring of quality of education imparted to students leads to the assessment and evaluation of learning by students in examinations (Yuet Yen Wong, 2015). AICTE has been defined and guided through Examination reforms and Policies,

which also support better assessment in studies, measuring outcomes at the course and program levels. Model question papers that will help in the evaluation program skills incorporated by a student.

Exam Reforms (REFORMS, 2018) this reform has guided the Assessment strategy for outcome-based Education (OBE). It suggested a two-step process bringing clarity to PO, Mapping PO to examinations/examination tools, what skills competencies curriculum of a program develops, and performance indicators through which can assess these competencies. Examination tools that evaluate higher-order abilities and professional skills are also demonstrated (Dr. A. Kavitha, 2018).

It becomes abstruse to justify the CO-PO mapping level defined by the course teacher. There becomes a necessity for scientific or any statistical relevance that will rigid the CO-PO mapping level. The Mapping of the CO-PO level concerning Competency and Performance Indicators makes it a cakewalk for the course in charge to demonstrate for a third person.

Competencies are simplified statements that focus on different abilities to be attained by the learners. These are Domain-specific and can be used to assess the student's learning ability.

Competencies are statements that showcase what students demonstrate concerning PO from the program curriculum. Each PO and Program Specific Outcome (PSO) can be implied by an ability that is needed to be shown by the program student/learner. This demonstrative ability requires assessment procedures, creating a shared understanding that students want to achieve through their respective programs. A program needs to identify what competencies and various skills can be built in students concerning each PO, these competencies will give an idea for performing indicators through which we can measure these competencies, and subsequently, the quality of PO can be measured.

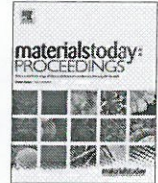
Performance Indicators (PI) - Measuring tool in Assessment, Performance Indicators are the statements used to evaluate various competencies; they can be designed to find the appropriate level of Competency of each indicator so that instructors can target and students can achieve the acceptable level of proficiency

A feedback survey has been taken, and an understanding of CO-PO mapping levels and how mapping levels are justified is analyzed. The next section describes the feedback survey



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Comparative study on load carrying capacities of castellated beams provided with mild steel and CFRP stiffeners

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ABSTRACT

This paper focuses on determining load-carrying capacity of castellated beams provided with transverse stiffeners of mild steel (MS) and carbon fiber reinforced polymer (CFRP) under two-point loading using ABAQUS software and comparing them with control beam. Results indicate that the load-carrying capacity of beams get enhanced due to transverse stiffeners of both materials. The variation in load carrying capacities of beams with MS and CFRP stiffeners is found to be only 8%. However, the load carrying capacities of beams provided with both types of stiffeners is found to be more by an average value of 10.65% over control beam. Further, the deflection of beam with CFRP stiffener is found to be less by 12.04% and 16% less as compared to the deflections of control beam and the beam with MS stiffeners respectively. The study concludes that the CFRP stiffeners can be preferred over MS stiffeners as they contribute in increasing load-carrying capacity with weight reduction and ease of application.

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1. Introduction

The requirements of steel and composite structures for maximum space utilization, efficiency during construction and cost-effectiveness demands the use of long-spanned, shallow, light-weight steel beams [1]. In the modern building constructions, the spans are becoming longer and one way of fulfilling these demands is to use castellated beams. The concept of producing single web openings in wide-flange steel beams for passing the service lines through the beam goes back to the early use of steel sections. The steel beams with expanded web sections and repeating openings in the web were first used in 1910 by the Chicago Bridge and Iron Works [2]. In 1935, this concept of providing web openings in the steel beams was also developed independently in Argentina and later it was patented in the United Kingdom. The patent was granted to Geoffrey Murray Boyd because of which it was called at that time the Boyd beam. Later this name was changed to castellated beam as its appearance and similarities were found to be similar with castle fortifications. The castellated beams are typically consisting of hexagonal or octagonal openings.

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In the 1940s, use of castellated beams was considerably increased throughout the Europe mostly due to the overall lack of steel rolled sections because of the World War II. However, such beams could be efficiently produced by steel mills into larger sections by employing manual methods for expanding steel beams due to the low labour-to-material cost ratios [2]. Further, it was possible to design the castellated beams of lighter sections with subsequent cost saving in foundations due to their versatile property for high strength to weight ratio. They were most commonly used for parking garages due to their long-span capabilities.

The castellated beams are produced by cutting a saw tooth pattern in the web of rolled steel 'I' section the length of the span. Then the two separated pieces are welded together by joining their tips as shown in the Fig. 1.

The beam section thus fabricated gets increased in its depth by 50% (i.e. 1.5 times) when compared with its original or parent I section. Due to the increased depth, the section modulus of the beam gets increased by approximately 2.25 times that of the original beam section. Thus, the load-carrying capacity of the beam increases considerably.

Castellated beams have been popular in structural applications in recent years due to their excellent strength-to-weight ratio. Nowadays, the beams are used for a variety of applications, such

DEVELOPMENT OF INTERACTION SURFACES FOR RCC COLUMNS SUBJECTED TO AXIAL LOAD AND BIAXIAL BENDING REINFORCED WITH FE550 STEEL

SHWETA R. PATREKAR*
POPAT D. KUMBHAR

Abstract

RCC elements subjected to axial load and biaxial bending generally come across in design practice; a corner column in an RCC-framed structure is a typical example. Failure of any column subjected to bending, for a particular axial load, can be shown by a failure surface called an interaction surface. This interaction surface is required for designing columns subjected to axial load and bending. An interaction diagram is a vertical section of the interaction surface showing a plot of the axial load a column could carry against its moment capacity. In recent years, higher grades of concrete and steel (Fe550, Fe550D) are being used in many construction projects. With the introduction of such new grades of materials, it has become necessary to develop interaction surfaces and diagrams to meet the design requirements. This paper presents the interaction surfaces developed using ETABS and MATLAB software for RCC columns of different sizes subjected to axial load and biaxial bending considering M20, M25, and M30 concrete grades and Fe415, Fe500, and Fe550 steel grades. Results indicate that for the same column size and concrete grade, the moment-carrying capacity of the column increases by 18.22 % and 29.81 % for Fe500 and Fe550 steels respectively when compared to the column with Fe415 steel. Also, for the same column size and steel grade, the moment-carrying capacity of the column increases by 7.91 % and 13.26 % for M25 and M30 concrete grades respectively when compared to the column with M20 concrete grade. As the developed interaction diagrams are not available in the SP16 code for Fe550 steel, it would be beneficial for designers to verify if the designed column is safe or unsafe.

Keywords: Axial load; Biaxial bending; Fe550; Interaction diagrams; Interaction surfaces; Moment carrying capacity; RCC rectangular columns.

1. INTRODUCTION

Structural members subjected to axial load and biaxial bending come across commonly in the design process of Reinforced cement concrete (RCC) structures. A typical example of a member subjected to axial load and biaxial bending is the corner column in a framed structure. Analysis of RCC column sections generally deals with the determination of moment carrying capacity for a given value of the axial load or vice versa^[1]. Since the column is subjected to axial load along with the bending, its capacity becomes a function of both the actions i.e., axial load and biaxial bending moments. Hence, a column section does not have only one value of ultimate load and moment, but a failure surface needs to be determined^[2]. This failure surface becomes useful in deciding whether the column is safe or unsafe based on the location of a point of intersection of load and bending moment acting on the column section. Thus, when the axial load and bending moment intersection fall inside the failure surface, the column under consideration is said to be safe as per the design guidelines in IS: 456 (2000)^[3]. This failure surface is formed by plotting axial load vs. bending moments is termed as an interaction surface; whereas, the vertical section of this interaction surface is termed an interaction curve or interaction diagram. A typical interaction curve indicating the points viz. pure axial compression (point A), compression with minor bending (point B), compression control (point C), balanced or critical condition (point D), tension control (point E), pure flexure (point F), pure axial tension (point G) and regions of compression and tension control regions are shown in Figure 1.

The interaction curve shows the relationship between the moment carrying capacity of the column section for varying values of axial loads^[4,5]. The interaction diagrams (or curves) indicate the combinations of the structural elements' acceptable axial and moment-carrying capacities. The exact design of the column subjected to axial load and biaxial bending is extremely

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A novel way to designing the undergraduate mechanical engineering curriculum using active stakeholder participation

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Abstract— Curriculums that are adaptable to the demands of the communities they serve are the most effective. Whether you intend to modify an existing curriculum or develop one from scratch, you must first undertake an evaluation. This article outlines the creative method utilised to develop the new curriculum in accordance with AICTE requirements. The first stage in formulating a plan is to determine the industries where graduates will find work and the skill sets they will require to be successful in those professions. The strategy emphasizes the need of including important stakeholders in curriculum development at an early stage. According to the findings of a survey given to a diverse group of stakeholders, there are issues with the current curriculum as it is assessed. This paper presents a case study of the development of the mechanical engineering curriculum at Tier-I institution from western Maharashtra for undergraduate (UG) students.

Keywords— Curriculum Design; stakeholders' involvement; active participation; Mechanical Engineering.

JEET Category— Practice paper

I. INTRODUCTION

CONCERNS have been raised all over the globe about the market potential of graduates from educational programmes in technical fields like engineering. According to the findings of a study conducted in 2021 on the subject of talent shortages the countries with the most severe talent shortages are Taiwan (88%) and Portugal (85%). Near to 90% of the companies polled in Singapore (84%), china (83) India (83%), said that talent shortages restrict them from recruiting candidates with the required expertise. This issue is pervasive across Asia Pacific. Global average of talent shortage is about 75% [1].

Today's industrial workplace is characterised by a high-performance work ethic, intense competition, a greater emphasis on quality or value addition, a greater range of

products and services, and an increase in automation. The business world demands college grads who are job-ready, meaning they have the necessary skills and are able to immediately begin working on whatever projects or responsibilities have been delegated to them. Not only are technical knowledge and abilities included on the list of anticipated competences for graduates, but also the capacity to collaborate effectively in groups, leadership, interpersonal skills, communication, creative thinking, and flexibility. Due to the shortage of professionally trained people in the industry, businesses will need to invest time, money, and resources into training workers so that they are ready to work. Due to the situation, there must be more contact and collaboration between the different engineering institutes and the industry. Even if a lot of subcomponents of the technical education system require improvement, the curriculum and teaching techniques are the two subcomponents that require immediate attention in order to produce graduates who are industry-ready [3].

A crucial part of every curriculum is ensuring that student learning is directly applicable to real-world contexts. The primary issue with curriculum is that it eventually becomes irrelevant and cannot fulfill external demand. The distractions will make it hard for students to learn. A lack of motivation to learn will slow a student's progress. Not doing so is not in the student's best interest.

To address this issue, the curriculum must be evaluated on a regular basis. The faculty has a unique opportunity to keep track of the curriculum he/she is presenting and give adjustment ideas as he/she goes. Thus, an attempt was made for design and development of UG mechanical engineering curriculum at tier-I institution of western Maharashtra with an innovative approach. Section 2 contains the details about the methodology adopted. Section 3 describes the implementation of proposed methodology and procedure of involvement of various stakeholder in curriculum design & development. Section 4 discusses the result and analysis of feedback survey from stakeholders.

Inculcating Design Thinking Methodology in the Minds of First Year Engineering Students: A Step Towards Entrepreneurial Thinking

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Abstract—Every economy needs entrepreneurs to fill gaps and promote innovative products with the necessary expertise and hard work. An entrepreneurial culture hastens a nation's overall development because it promotes nurturing a greater number of venture capitalists which eventually boosts nation's economy. Rajarambapu Institute of Technology (RIT) Rajaramnagar, an Autonomous Institute has adopted choice-based curriculum system (CBCS) in 2017-18 which included Entrepreneurship development (ED) as one of the four tracks with the objective to transform students into entrepreneurs. It was observed that, there is dire need to initiate entrepreneurial thinking course in first year engineering curriculum to acquaint students with problem solving and creative thinking skills, communication skills and teamwork which are very important for an entrepreneur. Hence, the course 'Creativity, Design Thinking and Entrepreneurial Mindset' was commenced as an open elective for first year engineering students from the academic year 2018-19. In this paper, course details are presented along with course outcomes and In-Semester evaluation (ISE) plan. Design thinking methodology is illustrated phase wise with help of students' project case study. Innovative active learning tools and techniques were developed to map the required skills for an entrepreneur. Due to this strategically developed active learning tools, course CO attainment has improved from the year 2018-19 to 2021-22; CO1 has improved by 37.09 %, CO2 increased by 47.54%, CO3 by 40.30 % and CO4 improved by 28.98 %. Moreover, number of prototypes developed by the students were 4 in the year 2018-19, which elevated to 15 (increased by 275 %) in the year 2021-22. Furthermore, there was improvement in final year ED track students of 2021-22 as compared to 2020-21; 25 students entered ED track during the year 2020-21, out of which 6 students (24 % students) converted their ideas into startups, while during the year 2021-22, 28 students opted for ED track, from which 13 (46.4 % students) established their startups. Lastly, ED track mentors survey results are reported for the year 2020-21 and 2021-22, which clearly illustrate that ED track students' entrepreneurial knowledge and abilities, students' attitude towards entrepreneurship as a career option and students' entrepreneurial self-efficacy has improved than the previous years.

Keywords— Design Thinking; Entrepreneurial culture; Startup Ecosystem; Active learning.

I. INTRODUCTION

Entrepreneurs play a vital role in building nation's economy. They help in solving customers' pain points and thus lead to the development of new product, technology or service which eventually creates an employment. As a result, government place a high priority on promoting entrepreneurial activities because they are correlated with a nation's level of economic growth (Bosma, Hill & Ionescu-Somers, 2020). India, which has the second-highest population in the world and aims to have the third-largest economy by 2030, is making significant efforts to cultivate an entrepreneurial culture in this environment (Hassan, Anwar, Saleem, Islam & Hussain, 2021). However, there are many challenges involved in penetrating this Entrepreneurial culture in the society (Irfan, Rajamallaiah & Ahmad, 2018). The majority of engineering students concentrate primarily on MNC jobs because they believe these positions have a bright future (Lynch, Kamovich, Longva & Steinert, 2021). Therefore, there is a tremendous need to instill an Entrepreneurial culture in students' brains, which will help few of them become successful Startup founders. Rajarambapu Institute of Technology (RIT), Rajaramnagar has implemented choice-based curriculum system (CBCS) since 2017-18. According to this system, final year students can opt for any one choice between Undergraduate research experience (URE), Industry internship and projects (IIP) and Entrepreneurship development (ED) (Suryawanshi, Patil & Kulkarni, 2021). However, it was observed that ED track students are lagging in some prerequisites required for becoming successful startup owners. As a result, we determined which skill sets should be covered in a foundation course during the first year of engineering. Problem solving, creative thinking, communication skills and teamwork are very crucial primary stages of entrepreneurship journey (Jonassen, Strobel & Lee, 2006; Passow & Passow, 2017). Secondly, young entrepreneurs must also comprehend how technology can be successfully commercialized and brought into the market (Barr, Baker, Markham & Kingon, 2009; Bilén, Kisenwether, Rzasas & Wise, 2005). In addition, students have myths about creativity, innovation and feel that creativity is not methodical. Hence there was overall need to develop students' entrepreneurial mindset which gave rise to foundation course entitled

NAAC Student Satisfaction Survey: A Reliable and Effective Instrument for Institutional Quality Assurance

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Abstract: The effectiveness of academic practices and hence student satisfaction in terms of academic engagement is a critical issue for any higher education institute. This work proposes the NAAC student satisfaction survey as a reliable and effective instrument to gauge the academic health of the institute. It demonstrates that the student feedback on the academic practices if analyzed and followed up with appropriate actions, helps improve the student satisfaction index at the institute level and that of departments. The work proposes the hypothesis that the improvement in the student satisfaction index of the institute over four years belongs to concerted efforts and actions taken based on annual survey findings. The hypothesis is tested with the help of ANOVA to validate the findings and conclusion of the work.

Keywords: NAAC student satisfaction survey; student satisfaction index; academic health; ANOVA

I. INTRODUCTION AND LITERATURE REVIEW

Teaching-learning process is at the core of any teaching-intensive higher education institute. The effectiveness of this process directly influence the graduate outcomes in terms of placements, higher learning, research outputs or entrepreneurial efforts. Thus, assessment of teaching-learning process and the need for a metric indicating academic health of the institute becomes evident. Many institutes collect course-specific feedback from the students to gauge the academic effectiveness; however, a general feedback on teaching-learning, irrespective of faculty or the course, is desired to form an overall impression about the institutional academic ambience. Hence, student satisfaction in terms of academic engagement becomes pivotal for any higher education institute.

Earlier works have addressed student satisfaction issue in various contexts like evaluation of a new program or distance learning program, outcomes based pedagogy, effectiveness of vocational program, evaluation framework and some other. Daultani et al. (2021) identified key attributes of student satisfaction in the context of e-learning while Ghansah et al. (2021) investigated student satisfaction determinants for academic and administrative services of a private university. Silva et al. (2020) lends the students satisfaction perspective from Brazil about higher technical-vocational education. Garnjost and Lawter (2019) investigated undergraduate student perceptions across various pedagogies. Gunn (2018) addressed student satisfaction while developing a Teaching Excellence Framework (TEF) for a

university in UK. Skea (2017) presented his arguments on settling and unsettling of student expectations as a part of quality culture of an institute. Gibson (2010) reviewed the attributes which influence the students' perception of overall satisfaction. Möller (2006) presented development of a student satisfaction monitoring instrument at Utrecht University (UU) while Douglas (2006) designed and developed a questionnaire to measure student satisfaction at the faculty of business and law in a university. The abundant literature available also underlines the significance of the aspect of student satisfaction for a higher learning institute. The simplicity and reliability of the instrument used for the assessment of student satisfaction level is a key aspect.

The NAAC (National Assessment and Accreditation Council), a statutory body of UGC (University Grants Commission) is responsible for the institutional assessment and accreditation of higher educational institutes in India. The NAAC as a part of its standard process, uses Student Satisfaction Survey (SSS) - a twenty-one question questionnaire, to evaluate the teaching-learning process of the institute based on the feedback of the students. The NAAC conducts this survey online or through emails as a part of the assessment and accreditation process of the institute and offers five percent weight for the score. Out of twenty-one questions, twenty are objective while one is subjective in nature. These questions cover all the important and relevant dimensions of teaching and learning process like academic planning, course design and delivery, performance evaluation and feedback to the students. The student responses are sought on the five-point rating ranging from 0 to 4, indicating various levels of conformance to the statement. The questionnaire is available at [http://www.naac.gov.in/docs/Apply%20now/SSS-Questinnnaire Students.pdf](http://www.naac.gov.in/docs/Apply%20now/SSS-Questinnnaire%20Students.pdf) (2021). The student feedback collected offers insights into academic practices and culture; and help gauge the academic ambience of the institute though it doesn't provide feedback on individual course or course teacher. This work makes an effort to demonstrate leveraging NAAC Student Satisfaction Survey questionnaire as a reliable instrument to gauge academic health of an engineering institute and thereby improve the academic experience for its students. The findings are validated statistically with the help of ANOVA. Section 2 presents details about the deployment of the survey by the institute while section 3 presents the key findings based on the analysis of collected feedback. The 'Discussion' section discusses efficacy of this tool for academic health monitoring and further validated with the help of ANOVA in section 5 which is followed by the conclusion section.

Effectiveness of Jigsaw Strategy on Students Achievement in Engineering Education

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Abstract— Outcome-Based Education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). OBE is playing a great role in engineering education, the world over and in traditional educational settings as well as in continuing education. It is a student-centric teaching and learning process in which it deals with the planning, course delivery, and students' assessment to achieve stated outcomes. A number of classroom assessment techniques (CAT) or active learning tools like think-pair-share, flipped classroom, problem based learning (PBL), and cooperative learning techniques such as jigsaw are used for achieving effective learning of the students. The jigsaw technique is one of the active learning techniques which has proved to be an effective method for classroom teaching and hence it is widely used for teaching engineering courses. The present paper focuses on the use of 'jigsaw technique' for teaching the course 'Biology for Engineers', a core course of B. Tech. program, to study students' performance in the End Semester Examination. The course content is difficult to get understood by the engineering students. Therefore, some difficult concept from this course is taught by using jigsaw technique. The students were divided into 8 groups with 8 students in each group. All the groups were assigned a topic with eight different subtopics for study and the jigsaw technique was implemented. The results of study indicated that the use of jigsaw technique improves students' performance by 15% and helps them in developing their lifelong learning skills.

Keywords— Cooperative Learning; Experiential Learning; Graduate Attribute; Jigsaw; Outcome Base Education; Student Performance.

JEET Category—Research

I. INTRODUCTION

The Outcome-based education (OBE) is education in which an importance is placed on a clearly articulated idea of what students are expected to know and be able to do, that is, what skills and knowledge they need to have, when they leave the college system. The OBE empowers students to choose what they would like to study and how they would like to study it. Not only does it adapt to a learner's strengths and weaknesses, but it also provides sufficient time to attain proficiency and fluency in the subject matter in Civil

Engineering program. OBE aims to assess the capabilities of learners in their totality. It takes a holistic approach in describing the capability of a learner in terms of knowledge, skills and values, and assessing capability by using a variety of assessment approaches. OBE is a pedagogical model that involves the restructuring of curriculum, pedagogy and assessment practices to reflect the achievement of high-order learning, as opposed to a mere accumulation of course credits. OBE means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experience.

Nowadays, OBE and Graduate Attributes (GA) as prescribed by National Board of Accreditation (NBA) plays important role in engineering education in India. Collaborative learning is the educational approach of using groups to enhance learning through working together. Groups of two or more learners work together to solve problems, complete tasks, or learn new concepts. For attainment of GA engineering faculty must use collaborative and cooperative learning tools like jigsaw, flipped classroom, gallery walk technique, problem based learning and project based learning.

In present research paper jigsaw technique was used for Biology for Engineers course which is offered in 6th semester of Under Graduate (B. Tech.) program. The course outcome for Biology for Engineers is as given below:

CO 1: Apply biological engineer's principles, procedure needed to solve real world problem.

CO 2: Demonstrate the functions of biological systems

CO 3: Analyze biological phenomena with math and physics to gain important insight.

CO 4: Explain working of different biological instruments

CO 5: Select the sensors for given biological applications

CO 6: Explain relevant aspects of movement control process

This course deals with Circulatory system; Respiratory and Cardiovascular system, Gastrointestinal system; Kidney and excretory system which plays very important role in human body. The content of human body system was taught by using jigsaw technique. After implementation of jigsaw technique

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Improving of Placements, Higher Studies and Entrepreneurships of Civil Engineering Students through Quality Circle Activity

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Abstract—Outcome Based Education (OBE) system is playing a vital role in engineering education as per New Education Policy 2020. In OBE, different types of active learning tools, varying from a simple, class room assessment tools like one-minute paper, think-pair-share, flipped classroom, to a more complex technique like problem based learning, cooperative learning, peer supported independent study are used so that the engineering graduates get equipped with required skill sets to make them industry ready. In India, nowadays the quality of education provided by the institutions and the programs run by these institutions is evaluated by two major bodies namely NBA and NAAC. Accreditation of the programs and institutions by NBA and NAAC is based on some criteria and it has become an essential requirement to ensure the quality technical education. In NBA and NAAC, students' placements, higher education, entrepreneurship, industry internship and connect with industry are considered to be the key indicators for ensuring quality technical education and a higher weightage has been provided in the evaluation process. In this paper, an attempt has been done to improve students' placement index (i.e. placements, higher studies and entrepreneurship) by implementing the concept of Quality Circle (QC) activity for the students of civil engineering department of Rajarambapu Institute of Technology, Rajaramnagar. The results indicate that implementation of QC concept could improve placement index by 10% for last two batches and could maintain progress even during COVID pandemic. Thus, study concludes that implementation of QC concept helps in enhancing placement index of department.

Keywords—NAAC; NBA; Outcome Base Education; Placement Index; Quality Circle;

JEET Category—Research

I. INTRODUCTION

The engineering education is an important field for achieving full human potential, developing an equitable and just society, and promoting national development. Universal

high-quality education is the best way forward for developing and maximizing our country's rich talent and resources for the growth of the individual, the society, the country, and the world. India will have the highest population of young people in the world over the next decade, and our ability to provide high-quality educational opportunities to them will determine the future of our country. The global education development agenda reflected in the 4th sustainable development goal (SDG4) for sustainable development adopted by India in 2015 which seeks to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" by 2030.

The world is undergoing rapid changes in the knowledge background. With various dramatic scientific and technological advances, such as the rise of big data, machine learning, many unskilled jobs worldwide may be taken over by machines, while the need for a skilled workforce, particularly involving mathematics, computer science, and data science, in conjunction with multidisciplinary abilities across the sciences, and humanities, will be increasingly in greater demand. The growing emergence of epidemics and pandemics will also call for collaborative research in infectious disease management and development of vaccines and the resultant social issues heightens the need for multidisciplinary learning.

With the quickly changing employment background and global ecosystem, it is becoming increasingly critical that engineering students not only learn, but more importantly learn how to learn. The Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centered, discussion-based, flexible, and, of course, enjoyable. The curriculum must include basic arts, crafts, humanities, games, sports and fitness, languages, literature, culture, and values, in addition to science and mathematics, to develop all aspects and capabilities of learners; and make education more well-rounded, useful, and fulfilling to the learner. All these abilities are possible to be achieved in the presently adopted OBE system. The NBA and NAAC are the two major bodies at the national level which play a great role in evaluating the performance of programs run by

Hydrogeochemical Evaluation of Groundwater for Drinking and Irrigation Purposes in the Upper Piedmont Area of Haridwar, India

Kanchan Deoli Bahukhandi, Anamika Kushwaha, Lalit Goswami, Uday Bhan, Vishal Kamboj,*
Nitin Kamboj, Aditi Bisht, Amit Kumar Sharma, Sandip S. Sathe, Vipin Kumar Saini,
and Bhavtosh Sharma

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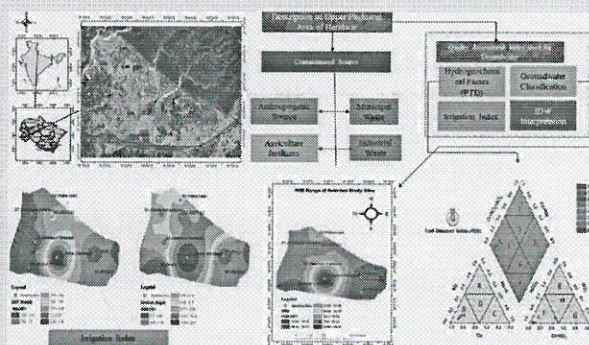
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ABSTRACT: In this study, the suitability of groundwater quality for the purpose of drinking and irrigation was evaluated in the upper piedmont area of Haridwar, India. In this regard, inverse distance-weighted interpolation, water quality index (WQI), principal component analysis (PCA), piper trilinear diagram (PTD) analysis, and sodium absorption ratio (SAR) methods were used to assess the geospatial variation of groundwater quality. The results showed that groundwater was partially affected by rapid industrialization and urbanization practices. The groundwater quality revealed the presence of different cations and anions in the following order: $\text{Ca}^{2+} > \text{Na}^+ > \text{Mg}^{2+} > \text{K}^+$ and $\text{HCO}_3^- > \text{NO}_3^- > \text{SO}_4^{2-} > \text{Cl}^- > \text{SiO}_2^- > \text{F}^-$. WQI showed an excellent range (29.94–45.17) for sampling sites S1–S3 and S5–S8 and a good value for site S4 (99.2). In addition, PTD confirmed that the calcium and magnesium bicarbonate type and mixed type for groundwater while PCA revealed that nitrate was dominant at site S4. In addition, the SAR and Na contents were in excellent ranges, indicating their suitability for irrigation purposes. The outcomes of this study indicated that geogenic and anthropogenic processes were the major reasons for the change in groundwater quality in this region.

KEYWORDS: groundwater quality, hydrochemical properties, hydrochemical facies, inverse distance-weighted interpretation, principal component analysis



1. INTRODUCTION

Water is the most crucial natural resource on Earth and exists in glaciers, surface water, and groundwater.^{1–4} Humans utilize forms of water to meet their daily needs; ~43% of agricultural land is irrigated using groundwater globally.^{5–7} In the 21st century, groundwater quality is degrading due to natural and anthropogenic factors triggered by rapid industrialization and urbanization. Some natural factors affecting groundwater aquifers are lithological, hydrological, topographical, and climatic.^{8–11} In addition, overexploitation, anthropogenic activities such as intensification of the urban and industrial sectors, and agricultural practices affect the hydrochemical properties by enhancing the cation and anion properties and heavy metal contamination.^{12–17} Nevertheless, conserving groundwater aquifers is one of the most challenging tasks in preventing a drinking water crisis in the near future.^{18–23} Most developed and developing countries are seriously affected by these problems and are working on restoring groundwater aquifers.^{24–28} The depletion of groundwater quality via organic and inorganic pollutants will certainly have ill effects on humans, flora, and fauna.^{29–32} Some recent studies reported various diseases, namely, hypertension, dental

fluorosis, methemoglobinemia, seizures, epilepsy, neurological disorders, cardiovascular malfunction, kidney disorders, and carcinogenicity.^{33–37} Therefore, collecting information related to water quality monitoring, the status of water resources, water types, and contributing factors that degrade quality is essential for management of groundwater aquifers.^{38,39} Various techniques for assessing the status of water quality are available, including the water quality index (WQI), which can be used to determine water quality for both drinking and irrigation purposes.^{1,16} For the evaluation of groundwater types, the responsible geogenic process that regulates the hydrochemistry can be determined by using the piper trilinear diagram method,¹⁰ Gibbs diagram, cation exchange, Durov

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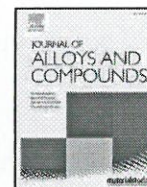
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Magnetic and structural characterization of Sn doped cobalt ferrites; A visible light-driven photocatalysts for degradation of rhodamine-B and modeling the process by artificial intelligence tools



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ABSTRACT

Tin (Sn) substituted cobalt ferrites $\text{Co}_{1-x}\text{Sn}_x\text{Fe}_2\text{O}_4$ with composition ($x = 0.0, 0.1, 0.2, 0.3, 0.4$ and 0.5) were synthesized utilizing sol-gel auto combustion method. All synthesized powders were characterized for their structural, magnetic and optical characterization after calcination. The single phase spinel with good crystallisation and a decreasing crystallite size with Sn substitution is confirmed by the powder X-ray diffraction (XRD) pattern. The magnetic measurements were carried out at room temperature where saturation magnetization values show sufficient magnetic nature of calcinated ferrites. The bandgap values for pure cobalt and Sn-substituted cobalt ferrites were closer to the experimental value. The visible light photocatalytic degradation of Rhodamine B was carried out in presence of Sn substituted cobalt ferrites that shows good catalytic activity up to 87% degradation for $\text{Co}_{0.5}\text{Sn}_{0.5}\text{Fe}_2\text{O}_4$ catalyst. Additionally, this study used Artificial Neural Network (ANN) and Adaptive Neuro-Fuzzy Interface System (ANFIS) models to simulate degradation efficiency with inputs including time, pH, and catalyst dosage. The results revealed that the 3-2-2-1 structure ANN4 model outperformed the other ANN and ANFIS models in the testing phase (RMSE = 6.90% and NSE = 0.92). According to the findings of this study, artificial intelligence models are capable of precisely predicting Rhodamine B degradation.

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1. Introduction

Spinel ferrites garnered a lot of attention due to their inexpensive cost, excellent chemical stability, moderate saturation magnetization, high surface area, robust wear resistance, low density, low thermal expansion coefficient, and negligible toxicity to both human health and the environment [1,2]. Due to their distinctive magnetic characteristics and crystalline structure, which are caused by minute variations in the particle size, composition, presence of surface effects, they have attracted researcher's attention in a number of fields [3,4].

The modern era of ceramic research contains the synthesis and study of spinel ferrites with general formula $\text{M}^{2+}(\text{Fe}^{3+})_2\text{O}_4$ (where

$\text{M}^{2+} = \text{Co, Mg, Zn and Ni}$) because of their exceptional chemical and physical properties [5]. Cobalt ferrite a kind of spinel ferrite is gaining popularity because it can be easily modified for use as an adsorbent [6,7]. In order to synthesize ultra-fine ferrite particles, a number of synthetic techniques have been developed, including chemical co-precipitation [8,9], solid state [10], sol-gel [11,12], micro-emulsion [13], hydrothermal [14], cetyl trimethyl ammonium (CTAB) assisted hydrothermal [15], and chemical reduction [16]. As a result, the sol-gel auto combustion method is regarded as a simple, approachable, perfectly composition-controlled, and remarkably reproducible procedure. Low processing time and very low external energy usage are requirements for this method [17]. The material can also be doped with various ions in a range of concentrations to modify its structural [18], optical [19], electrical [20], and magnetic [21] characteristics. Variations in the structure and crystallinity of ferrites are caused by the distribution of various elements between the tetrahedral (A) and octahedral (B) sites. Ferrites nanoparticles

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Seismic comparison of flat slabs and conventional slabs for structures with irregular shapes

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Abstract

For a building to perform well during an earthquake, its configuration is crucial. The parameters behave differently in flat slab structures compared to conventional slab structures. A significant factor in the collapse of many high-rise structures is seismic load. Devastation is also caused by structural irregularity, which worsens the effects of earthquakes. This study investigates a comparison between the conventional slab and flat slab buildings considering the effect of structural irregularity on them. The study is carried out for a 14-storey building using response spectrum analysis. The zones considered for analysis are IV and V. The shapes of buildings considered are L-shape, T-shape and Cross-shape. Also, the effect of various parameters like storey displacement, storey shear, storey drift, etc. on the structures has been studied. Results have shown that cross-shape building is having good overall performance with conventional slab system. For flat slab system, T-shape building has performed well.

Keywords: conventional slab; flat slab; storey displacement; storey drift; storey shear; structural irregularity

1. Introduction

Since the inception of earthquake engineering, earthquake-resistant design of RC buildings has become a highly investigated field [7]. Due to the significant loss of life and property caused by recent earthquakes, it is now necessary to build structures that are earthquake resistant or cause the least amount of damage [9]. The multistoreyed building is becoming a necessary part of our polished and tasteful living with increase in request for space [2]. A high-rise, multi-storey building's seismic assessment is essential for analysing how an earthquake may affect the structure.

When subjected to seismic excitation, the conventional slab system and flat slab system behave differently. Seismic analysis of their behaviour considering parameters like storey displacement, storey drift, storey shear is therefore absolutely required [5]. Unlike the traditional slabs system, which uses beams, the flat slab is a beamless slab with or without drops supported by columns, with or without flare heads. From the slab to the columns and then immediately to the footing, the load is transferred directly [8]. The flat slabs are typically expanded near the columns to increase shear strength and decrease the amount of negative reinforcement in the support region. In malls, theatres, and other buildings that demand broad beams and open spaces, flat slabs are offered. Types of flat slabs: a) Flat slab with drop panel, b) Flat slab with column head, c) Flat slab with drop panel and column head, d) Flat slab without drop panel and column head [3]. When compared to flat slab constructions, conventional slabs have more expensive and complex formwork since the load from the slabs is first transferred to beams and then to columns, increasing the weight of the structure [4].

Punching shear is one of the main issues with flat slab construction. The flat slab connections become a weak link in the entire flat slab structure because of unbalanced moment and vertical shear carried by the slab column connection, that will result in catastrophic damage or even collapse. Buildings with flat slabs frequently experience unbalanced moments, which are brought on by uneven spans or stress on each side of the column. When such situations occur, the


3.4.5 Bibliometrics of the publications during the last five years based on average Citation index in Scopus/ Web of Science/ PubMed

Sr. No	Title of the paper	Name of the author	Title of the journal	Year of publication	Citation Index
1	Textile Production Line Monitoring System Using Wavelet-Regression Neural Network	Dr. N. V. Dharwadkar, Anagha R. Pakhare, Wen-Ren Yang, Department of Electrical Engineering, National Changhua University of Education, Taiwan, Rajinder Kumar Mallayya Math.	Journal of Cases on Information Technology (JCIT) 24	August 2022	No Citation
2	A Novel Method to Classify Rolling Element Bearing Faults Using K-Nearest Neighbor Machine Learning Algorithm	More A. Vishwendra Pratiksha S. Salunkhe Shivanjali V. Patil Sumit A. Shinde P. V. Shinde R. G. Desavale P. M. Jadhav Nagaraj V. Dharwadkar	ASCE:ASME Journal of Risk and uncertainty in engineering systems, Part B: Mechanical Engineering	September 2022	5
3	Sine cosine bird swarm algorithm based deep convolution neural network for reversible medical video watermarking	Ingaleshwar, S.S., Jayadevappa, D. & Nagaraj V. Dharwadkar	springer-Multimed Tools and Applications	March 2023	No Citation
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7	Deep learning and computer vision for leaf miner infestation severity detection on muskmelon (Cucumis melo) leaves	RajinderKumar M. Math, Nagaraj V. Dharwadkar	Elsevier-Computer and Electrical Engineering	May-23	No Citation



Textile Production Line Monitoring System Using Wavelet-Regression Neural Network


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ABSTRACT

This paper presents design and experiments for a production line monitoring system. The system is designed based on an existing production line mapped to the smart grid standards. The discrete wavelet transform (DWT) and regression neural network (RNN) are applied to the operation modes data analysis. DWT used to preprocess the signals to remove noise from the raw signals. The output of DWT energy distribution is given as an input to the GRNN model. The neural network GRNN architecture involves multi-layer structures. Mean absolute percentage error (MAPE) loss has used in the GRNN model, which is used to forecast the time-series data. Current research results can only apply to the single production line, but in the future, it will be used for multiple production lines.

KEYWORDS

Discrete Wavelet Transform, Frames, Normalization, Power System, Regression Neural Network, Smart Grid

1. INTRODUCTION

The paper presents research based on the textile factory production line. For textile manufacturers, the production line's power quality and motor monitoring are essential to operational stability. The purpose of power quality and motor status monitoring is to conduct maintenance in advance to avoid system downtime or malfunctions. New long-distance transmission lines are required to harness these resources to provide an ever-growing load centre. Presumably, these new lines could be high-voltage DC (HVDC) transmission systems owned by companies that break away the standard utilities, which need small and native AC to DC converters. In recent years, many renewable energy sources are wont to generate DC (DC); during this situation, DC to AC inverters must be to interconnect the DC electricity generators to AC systems. Additionally, new power electronics-based controllers like those that the Flexible AC Transmission Systems (FACTS) will install for improving power transfer and providing voltage support are vital factors for reliable operations. Thus, the transmission during a

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A Novel Method to Classify Rolling Element Bearing Faults Using *K*-Nearest Neighbor Machine Learning Algorithm

*A novel method is proposed in this work for the classification of fault in the ball bearings. Applications of *K*-nearest neighbor (KNN) techniques are increasing, which redefines the state-of-the-art technology for defect diagnosis and classification. Vibration characteristics of deep groove ball bearing with different defects are studied in this paper. Experimentation is conducted at different loads and speeds with artificially created defects, and vibration data are processed using kurtosis to find frequency band of interest and amplitude demodulation (Envelope spectrum analysis). Bearing fault amplitudes are extracted from the filtered signal spectrum at bearing characteristic frequency. The decision of fault classification is made using a KNN machine learning classifier by training feature data. The training features are created using characteristics amplitude at different fault and bearing conditions. The results showed that the KNN's accuracies are 100% and 97.3% when applied to two different experimental databases. The quantitative results of the KNN classifier are applied as the guidance for investigating the type of defects of bearing. The KNN Classifier method proved to be an effective method to quantify defects and significantly improve classification efficiency. [DOI: 10.1115/1.4053760]*

Keywords: bearing, defects, KNN, features

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Sine cosine bird swarm algorithm-based deep convolution neural network for reversible medical video watermarking

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Abstract

Recently, advancements in multimedia have made a huge impact on watermarking technologies. The digital video watermarking is the process of embedding the data in the video. One of the major concerns in digital video watermarking is maintaining the quality of video besides preserving the privacy of the data. The aim of the research is to develop a reversible medical video watermarking using Sine Cosine Bird Swarm Algorithm-based Deep Convolutional Neural Network (SCBSA-based Deep CNN) for embedding the secret message in video frames. The development methodology is explained as follows. The SCBSA is developed by integrating Sine Cosine Algorithm (SCA) with the Bird Swarm Algorithm (BSA). The key frames are extracted from the input video using Minkowski distance and Wavelet distance. The features, like Neighborhood-based features, Convolutional Neural Network (CNN) features, Local Optimal Oriented Pattern (LOOP), and histogram features are obtained from the key frames. The interesting region is identified using DCNN, which is trained using the developed SCBSA. The secret message is embedded in the video in the embedding phase, whereas the embedded secret message is extracted in the extraction phase. The embedding and extracting process are carried out through two level decompositions using wavelet transform and inverse wavelet transform. The developed SCBSA-based Deep CNN uses the metrics, such as correlation coefficient, Mean Square Error and Peak signal-to-noise ratio (PSNR) for evaluating the performance. The developed SCBSA method is evaluated using the Mean

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A Medical Image Steganography Scheme with High Embedding Capacity to Solve Falling-Off Boundary Problem Using Pixel Value Difference Method

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Abstract. Medical images have a vital role in the healthcare industry. The medical sector uses the internet to facilitate the distant sharing of medical information among hospitals and clinics and provide patients with e-health services. We must share a patient's report secretly so that the intruders can't steal the patient's data. The pixel value differencing technique is utilised in this study to store a patient's medical information report in various medical imaging, such as ultrasound images, computed tomography scans, X-rays, magnetic resonance images, electrocardiographs, and microscopic images. The fundamental objective is to maintain the visual appearance of the medical images so that physicians can analyse and give accurate results and extract information reports precisely. This PVD scheme works on different types of image formats such as Portable Network Graphics (PNG), Joint Photographic Experts Group (JPG or JPEG), BitMaP (BMP), and Tag Image File Format (TIFF). Measurement metrics such as embedding capacity, the difference in histograms between the stego and the cover image, and the peak signal-to-noise ratio (PSNR) are employed to evaluate the effectiveness of the suggested method. On a series of medical images, we have tested this new PVD approach and found that it provides significant payload capacity with the high visual quality of the stego image. The majority of PVD techniques described in the literature only apply to grayscale images, and those that apply to RGB images have falling off boundary problem. RGB images have pixel values that span from 0 to 255, but when the pixels are modified using the PVD technique, sometimes these pixel values fall outside of this range, which causes erroneous results to be obtained during extraction. Additionally, utilising a difference in the histograms of the stego and the cover image, the attacker in a typical PVD technique can disclose the existence and length of the secret message. This novel PVD methodology tackles the classic PVD technique's falling-off boundary issue and provides some security to the secret message from the histogram quantisation attack.

Keywords: Steganography · PSNR · PVD · RGB · LSB

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High Embedding Capacity Color Image Steganography Scheme Using Pixel Value Differencing and Addressing the Falling-Off Boundary Problem

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In this paper, we changed the methodology for pixel value differencing. The proposed method work on RGB color images improves the existing PVD technique in terms of embedding capacity and overcomes the issue of falling off boundaries in the traditional PVD technique, and provides security to the secret message from histogram quantization attack. Color images are composed of three different color channels (red, green, and blue), so we cannot apply the traditional pixel value differencing algorithm to them. Due to that, the proposed technique divides the RGB photograph in red, blue, and green channels. Following that the modified pixel value differencing algorithm is employed to all successive pixels of color channels. We get the total embedding capacity by adding the embedding capacities of each color component. After embedding the data, we concatenate the color channels to get the stegoimage. On a series of color images, we tested our pixel value differencing approach and found that the stego-picture's visual excellence and payload capacity were reasonable. The variation in histogram between the stego and cover photographs was minor, making it resistant to histogram quantization attacks, and the suggested approach also solves the issue of falling off the boundary.

Keywords: Steganography; PVD; PSNR; RGB; FOBP; IEP.

1. Introduction

The Internet usage has increased a lot over many years, so one of the major concerns in this digital world is information security while communicating through the internet. There are two main methods for securing data: steganography and cryptography. In cryptography, we encrypt the sensitive information in a meaningless format such that the intruder can't identify it. In steganography, we don't do

Design and Implementation of Land Area Calculation for Maps Using Mask Region Based Convolutional Neural Networks Deep Neural Network

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Abstract—Maps of the land are developed by the surveyor, map developer according to survey of land. In such maps land boundaries are shown using property lines. So the area of land is also mentioned in the maps to the valuation of the property. Area calculation is one of the main work of the surveyor so it is important for him to calculate it fast. So we have implemented a system which can help surveyor, land map developers to calculate the area. We implemented this using image processing and the deep learning model mask region based convolutional neural network (RCNN). For better results, we implemented this at a basic level. At base level synthetic dataset consists of 2 dimensional images of different geometry shapes (triangle, quadrilateral, pentagon, hexagon, octagon) and training our model to detect the shape in the image and based on this further process of area calculation of that shape takes place. This solution is unique for land developers because it uses deep learning and image processing to obtain results.

Keywords: mask region based convolutional neural network, deep learning, land area, shape detection, land maps, geometric shapes, area of shapes

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INTRODUCTION

The “surveyor” and “topographer” are both major factors of a land surveyor. The role of a land surveyor is to go to the place and analyze the place, take details and identify the configuration of the place and after that have to do some geometric calculation and then have to develop maps to use this information for land and property developments. In the world of technology still, some sectors have not accepted technology completely. Still, in the modern world, land surveyors draw land maps using scale, pencil, and using other instruments on paper. Also in our country, old land maps are drawn already on paper. So in case of any issue like plotting of land, boundary declaration, NA (non-agricultural) plotting, division of property, and others like that, you have to go to the city survey office of town and do the process from the surveyor officer. This office contains land maps of all town regions in paper format. So in case of the above issue, he has to check manually your land’s map and do the process. In this case, for calculating the area of land he has to go to the location and take measurements and again draw new maps. In some cases, there is confusion about areas in old maps due to paper becoming too old and it may be damaged. So surveyor officers

need to cross-check and find the area of land or property. There are various existing methods for such work. Some surveyors use various mobile applications which show the location of land, area of specific land using a GPS. Also, use the application for finding online documents of the land. But in case of drastic change in the geolocation of fields, such applications are not much effective for getting a value of the boundary points or you can say the coordinates of the edges. Assume there is a new road plan created and for this road, some land of the people is used and these people will get a refund for the land from the government. In such a case surveyors have to draw new maps for the part of the land used in the road. So the surveyor has to draw himself a new map, no GPS application is helpful for him. because GPS gives works on existing geolocation but in the above situation surveyor has to assume and draw a map according to plan.

For land surveyors and the property map developers’ area calculation system will be helpful because the system helps in calculating the area of land from maps of the land. The new learner can use this at the learning phase to cross-check the area given by the system and the area calculated by the user manually of the same shape. At the base level, we are trying to detect the shape in the image and calculate the area of that shape. In advance to such system, we are trying to get area from just scanning the image from computer’s camera. That is, the user has to just scan this map

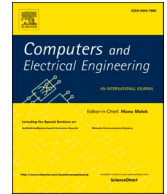
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Deep learning and computer vision for leaf miner infestation severity detection on muskmelon (*Cucumis melo*) leaves[☆]

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This paper is for CAEE special section VSI-sacs. Reviews processed and recommended for publication to the Editor-in-Chief by Guest Editor Dr Zuurro Antonio.

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ABSTRACT

Crop protection against pests is known to play a crucial role in developing efficient crop management strategies for Precision Agriculture. A recent estimation by Food and Agriculture Organization (FAO) shows that the perennial loss due to crop pests and diseases amounts to nearly 40% of agricultural crop production at a global level. Identifying pests and diseases and eradicating them without automation is laborious and time-consuming. Automation in detecting and identifying miners at the onset and their eradication is possible using deep learning (DL) and computer vision. This study aims to develop a *Detectron2*-based framework to detect and localize miner infestations on muskmelon leaves by developing a detection model that integrates DL and a computer vision library to enhance detection capabilities. The approach develops, experiments, and compares a region-based detector (Faster Region-based Convolutional Neural networks (R-CNN)) with a region-free (RetinaNet) by training and validating the bounding box annotated custom dataset of leaf miner infected muskmelon leaves imaged using a smartphone camera. The results show that the RetinaNet-based detector outperforms the Faster R-CNN-based detector in recognizing the infestation severity levels, significantly increasing mean average precision and acquiring faster detection speeds.

1. Introduction

Crop pests, insects, and diseases have severely threatened global agricultural fruit and vegetable cultivation. These pests severely impact the crops of poorly managed fields and favour pest growth. Controlling crop pests is possible by using a proper field management strategy, such as proper irrigation management [1], that ensures optimal moisture levels for the crops and avoids pest infestations due to high moisture levels in the soil. The conventional farming practices, the only method to mitigate the effects of unwanted pests/insects was to manually identify the crop pest or diseases and eradicate them using the required quantities of pesticides. The downside of manual detection of pests and diseases is unreliable, time-consuming, and demands highly skilled labour. An automatic system capable of detecting and identifying crop problems can be a feasible solution to overcome the challenges faced by manual detection and identification. The earlier automated systems used image processing techniques to identify and classify crop pests or diseases, but the limited availability of image data was a bottleneck. Technological advancements such as power IoT (PIoT)

[☆] This paper was recommended for publication by Associate Editor Dr Zuurro Antonio.

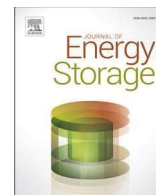
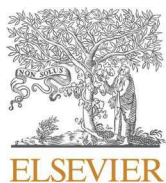
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Research papers

Battery energy storage train routing and security constrained unit commitment under solar uncertainty

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ARTICLE INFO

Keywords:

Battery energy storage train
Solar generation
Security-constrained unit commitment
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ABSTRACT

The location of solar parks far from load areas may lead to transmission congestion and thus solar curtailment for secure system operation. Battery energy storage (BES) Train as mobile storage can transmit solar energy from site to load centers using a transport network while relieving lines from congestion. Therefore, stochastic security-constrained unit commitment (SCUC) with BES Train is modeled in this paper under solar uncertainty and N-1 critical line contingency. Time-space network models transportation constraints of BES Train routing problem. To reduce the computational burden, this paper proposes modeling of line outage distribution factor (LODF) for DC power flow that reduces the nonzero coefficients of post-contingency network constraints. The benders decomposition technique simplifies stochastic optimization for the mixed-integer linear programming (MILP) problem. BES Train integrated modified IEEE reliability test and 118-bus system is investigated as a case study. Simulations evaluate the effect of BES Train, solar uncertainty and critical line contingency state with LODF on operation costs, BES Train scheduling, solar curtailment, congestion and computational time. The proposed model shows that BES Train is an economical option for large solar integration to reduce transmission congestion and curtail solar power effectively.

1. Introduction

1.1. Motivation

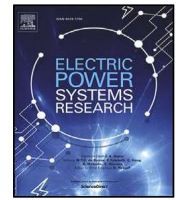
To cope with the environmental impact of greenhouse emissions, integrating renewable energy systems (RES) in present power systems is highly required. Among different RES, the large-scale Photo Voltaic (PV) integration is getting attention due to its abundance and mature methodology, primarily in PV-dominated countries like India, having an RE integration target of 17 % by 2022 [1]. Literature suggests that 512 GW of PV is installed worldwide by the end of 2018, with a target of 121 GW for the year 2019 [2]. The PV installed capacity is comparable to the wind installations of 586.6 GW (at the end of 2018) worldwide. Huge integration of intermittent RES escalates system security and reliability concerns for system operators [3]. Moreover, it is also a matter of consideration that large conventional and RES power plants are generally erected in energy-rich geographic regions, commonly far from inhabited load areas. Building new transmission lines from RES sites,

load growth and RES investments lack cohesion. The issue of the right of way in highly populated regions of the world. Thus, the limited lines are subjected to network congestion. RESs are necessary; the transmission congestion may call for RES curtailment in contrast to conventional plants subjected to lesser uptime, operational constraints, and system inertia as well as network security challenges.

The real-time scheduling of generators needs to introduce an effective method to solve network-constrained unit commitment (SCUC) with solar PV uncertainties. Also, energy storage systems (ESSs) have been widely used to improve power system operation and reliability of the system [4]. The introduction of a battery energy storage (BES) Train for transportation networks provides system security and flexibility by reducing network congestion, overall operational costs and solar PV uncertainty [5]. Also, the BES train transportation network has a lot of potentials and can be used in transmission network systems. Transportation network with power transmission system manages rail roads by balancing electric network infrastructure to utilize the batteries from the generation to high-demand positions.

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Learning based short term wind speed forecasting models for smart grid applications: An extensive review and case study

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ARTICLE INFO

Keywords:

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Machine learning models
Linear regression model

ABSTRACT

This paper provides an extensive review of learning-based short-term forecasting models for smart grid applications. In addition to this, the paper also explores forecasting models including physical, statistical, hybrid, and uncertainty analysis models for wind speed forecasting. The learning-based models are classified into three broad categories, namely classical machine learning, advanced machine learning, and probabilistic learning. In this work, 41 different models are employed to forecast the wind speed. Dataset for this case study is collected from the site of Jodhpur, India. Dataset have 8759 sample with five features i.e., wind speed, pressure, humidity, temperature, and dew point. This forecast also includes the seasonal effects. Model accuracy has been tested considering single and multiple features in the input data. A comparative analysis of the performance of these 41 learning-based models is conducted based on coefficient of regression and error indices. It is observed that the performance of these models varies with the variability in the season. On the basis of the evaluation of these models, future recommendations are also framed out. These recommendations target of energy storage planning, energy market and policymakers, and reliability and reserve sizing direction. These recommendations can be utilized by authorities for effective planning and coordination of power.

1. Introduction

Renewable energy (RE) solutions are growing popular as cost-effective green tools to meet escalating demand [1]. These RE sources can overcome conventional energy system challenges such carbon emissions, fuel scarcity, high maintenance cost, and operational cost. Due to intermittence and uncertainty of these RE sources makes it difficult for grid integration [2]. Further, power system planning and operation (i.e., optimal power dispatch, energy market policies, optimal energy storage sizing, optimal reserve size determination, reliability enhancement, profit maximization, and reserve size determination) viewpoint uncertainty remains a research concern [3]. RE sources forecasting is one of the technical solution of these challenges. However, the forecasting accuracy is one of the major challenge associated with RE sources [4]. The source forecasting is classified into four

major categories in literature. Presenting extremely short-term, short-term, medium-term, and long-term forecasting and their applications. Power system operators use short-term forecasting (up to a few hours ahead) [5] to design a profitable power dispatch strategy, determine system scale, evaluate system reliability, and identify energy market trends [6]. Similar, long term forecasting is important for planning prospective. Forecasting is used for power system operation and maintenance planning, turbine regulating, and market clearing, according to the literature. RE integrated smart grid wind energy penetration is rising. The variable nature of wind speed poses various challenges to smart grid operations that include scheduling [7] and dispatch of electricity to the grid. Wind speed forecasts aid smart grid management and operational planning. The brief outlook of global and Indian wind scenario is illustrated in the next Section 1.1 and Section 1.2, respectively.

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Centralized Energy Management Scheme for Grid Connected DC Microgrid

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Abstract—Energy management in DC microgrid is complex and challenging due to the stochastic nature of renewable energy sources and load demand. Coping with the deficit power, peak demand, and power converter control operations are a few major concerns. The photovoltaic (PV) system and battery energy storage system (BESS) utilization need special attention for the reliable and efficient operation of the DC microgrid. Hence, this article proposes the centralized energy management scheme (CEMS) in the DC microgrid to address the abovementioned challenges. The CEMS coordinates among the various physical layer components and computational layer (i.e., control layer) of the DC microgrid. It utilizes the multi-optimization for energy management during the peak and off-peak load demand, optimal usage of PV-BESS, and performs the optimal load shedding operation. Furthermore, an optimal utilization of the PV-BESS problem is formulated and solved using linear programming to avoid excess usage of AC grid power. In deficit PV power, the optimal load shedding operation is formulated as mixed-integer linear programming problem to ensure the DC bus voltage regulation and power balance. The proposed CEMS demonstrates the effective operation of the PV system in maximum power point tracking, OFF-MPPT mode (i.e., voltage control), and BESS's charging/discharging operation. It is showcased that the hierarchical control structure of CEMS improves the performance, efficiency, and reliability of the DC microgrid operation. Hence, a 48 V and 1.2 kW PV-BESS-based DC microgrid system is developed to show the efficacy of the proposed algorithm under different scenarios in MATLAB/Simulink. The real-time simulator results of the developed system, obtained using OPAL-RT OP4510, confirmed the effectiveness and reliability of the proposed scheme.

Index Terms—Battery energy storage system (BESS), centralized energy management scheme (CEMS), DC microgrid, load shedding, photovoltaic (PV) system.

I. INTRODUCTION

RENEWABLE energy sources (RES) integration provides a new paradigm for sustainable future grids. DC microgrids are becoming popular as they offer efficient infrastructure for the integration of a large number of RES and loads over the AC grids [1], [2]. DC microgrid clusters [3], [4], [5] improve system quality, resiliency, efficiency, and economy. Furthermore, unlike the AC grid, the DC microgrid is not affected by synchronization and harmonics. The various RES such as photovoltaic (PV)

system, wind energy, and fuel cell have flexibility to integrate via power converters with the DC microgrid to form the low, medium, and large voltage grid [6], [7]. Among the RES, the PV system is a promising renewable energy because of abundance availability of solar energy. The declining installation cost of the PV technology has leveraged the deployment of PV systems in the electric grid. However, the PV system power output is sensitive (i.e., power fluctuation in power output) to environmental factors such as solar irradiations and surrounding temperature. To address this issue, battery energy storage systems (BESS) are installed with PV systems to maintain a reliable output power.

With the availability of RES and consumer demand, the need for an effective energy management solution in a DC microgrid has become necessary [8]. In [9], [10], and [11], challenges such as stochasticity in PV output and battery utilization for DC microgrid energy management through optimizing utilization of resources are addressed. The literature [12], [13], [14] suggest the hierarchical coordination operation to execute the economic dispatch and power exchange in a DC microgrid. An energy management strategy is investigated in [15] and [16] for optimal planning and operational cost in hybrid AC-DC microgrid. Several power management strategies are introduced for the efficient and reliable operation of DC microgrid [17], [18], [19]. More emphasis on providing the controller than energy management and optimal solution of RES utilization. A power management strategy with three-layered modularized model of a DC microgrid explained in [20]. The DC signal scheme is used for coordinated control and power flow. However, the optimal energy management of the microgrid is not investigated. A decentralized control and power sharing methods are proposed in [21], [22], and [23] for optimal operation scheduling of hybrid AC-DC microgrid.

The energy management issues such as load shedding and optimal power sharing are addressed in [24], [25], [26], [27], and [28]. In [29], a linear and quadratic approach based on model predictive control is developed for smart home energy management in grid-connected mode. This article can be extended for the energy storage operations considering the optimal load shedding and maximum utilization of PV during peak and off-peak load demand. Further in [30], the master energy coordinator algorithm for energy management is developed for dispatching a BESS, distributed energy resources in the grid. However, study need to be extended for the consideration of the uncertain condition of PV power, load demand, BESS, and load shedding solution. Nowadays increased advanced metering infrastructure based energy management schemes

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An economic/emission dispatch based on a new multi-objective artificial bee colony optimization algorithm and NSGA-II

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Abstract

The conventional energy resources have limited reserves and their utilization is adversely affecting the environment. Hence, it is necessary to generate electricity with the least cost and emission. The studies in the past reveal that the combined economic emission dispatch (CEED) problem has been solved by evolutionary and swarm intelligence-based optimization algorithms. However, the methodology to identify the best compromising solution for the CEED problem has not been studied much in the literature. In this paper, a multi-objective optimization algorithm, which reduces fuel cost of power generation as well as emission simultaneously, is presented. The algorithm is a combination of an artificial bee colony algorithm (ABC) and a non-dominated sorting genetic algorithm (NSGA-II) with a new constraint handling feature. To validate the effectiveness of the proposed algorithm it is applied to three benchmark systems, commonly used to study the effectiveness of optimization algorithms. Moreover, the best compromising solution, obtained by the proposed algorithm, is identified by using sixteen multi-attribute decision-making (MADM) methods. The non-dominated solutions reported in the past literature, for different test systems, are also analysed using MADM methods. It has been shown that the proposed algorithm gives better results without violating the constraints and with the minimum number of iterations.

Keywords Economic emission dispatch · Multi-objective artificial bee colony · NSGA-II · MADM · Optimization · Pareto optimal

1 Introduction

Due to the limited availability of primary energy resources and environmental concerns, the combined economic emission dispatch (CEED) problem has been an area of research for many years [1]. To reduce the cost of electricity generation, an economic dispatch problem is solved and the output power of power plants is adjusted to cater to the demanded load. However, the best generation schedule, obtained to generate electricity at minimum cost, increases emission. There are several power generation strategies tried, in the past, by power plant operators to reduce emission from the power plants. These include the use of clean coal technologies [2], using better quality fuels, replacing outdated burners, modernizing

power plant components [3], and scheduling emissions [4]. An emission scheduling strategy can be a commercially viable option that can minimize emission and fuel costs at the same time [5]. So, in addition to fuel cost, as one of the objective functions, an emission as an additional objective function, needs to be considered in the optimization framework while minimizing emission and fuel cost simultaneously. There are several approaches proposed by the past researchers to deal with this bi-objective CEED problem, however it is found that the results for different test systems in terms of best fuel cost and best emission cost are sub-optimal or violates technical constraints. On other hand, the best compromising solution reported in the past literature is non-dominated solution and there is no methodology proposed which can identify best compromising solution for commonly studied systems. Hence there is need to explore other approaches which can address above concerns.

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Optimal electric vehicles charging scheduling for energy and reserve markets considering wind uncertainty and generator contingency

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Summary

Decarbonization of electrical systems encourage high wind power into electric power systems and the electrification of transport sectors through electric vehicles (EVs). The increasing penetration of uncertain wind power generation and transportation networks via EV charging stations has introduced challenges for system operators to manage power systems and market operations. In this context, this paper presents a stochastic AC security-constrained unit commitment (SCUC) model to clear day-ahead energy and reserve markets considering transportation–electricity networks through EV charging stations in the presence of uncertain wind power and generator contingency. Pre-contingency ranking is a common strategy for reducing the time of the SCUC problem, but it provides high-impact outages. To address this issue, generator outages ranked first are identified using the post-contingency generator response ranking approach. The main contribution of this paper is the development of a structure with the most effective outages in the presence of uncertain wind power and transportation networks. The stochastic optimization approach is modeled through scenarios with corresponding probabilities to manage the wind uncertainty. The computationally complex proposed model is solved by a prominent bender decomposition approach. Case studies are shown on a modified IEEE 118-bus system with 26 nodes and 74 connected links of the electricity transportation network. The results show that optimal EV travel scheduling can optimize the transportation network and a sufficient energy reserve, confirming the security of the power system with minimum operating cost.

KEYWORDS

bender's decomposition, electric vehicle, generator response, stochastic security-constrained unit commitment, transportation network, wind uncertainty

1 | INTRODUCTION

1.1 | Overview

Electric vehicles (EVs) and renewable energy (RE) are commonly used to pursue an environmentally

sustainable approach for the society.^{1,2} Wind power is an important RE, with a total installed capacity reaching 348 GW in 2020 to 2024 worldwide.^{3,4} In particular, the integration of RE and EVs into the power system has been estimated to reduce greenhouse gas emissions.⁵ Several studies have looked into the effects of EVs on traffic



Economic Operation Scheduling of Microgrid Integrated with Battery Swapping Station

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Abstract

Battery swapping station (BSS) is an emerging form of energy storage that can be integrated with microgrid (MG) for economical operation of the system. To manage the scheduling between MG and BSSs, this paper proposes an optimal scheduling model for promoting the participation of BSSs in regulating the MG economic operation. The proposed grid-connected MG consists of wind turbine, photovoltaic (PV) modules, and BSSs. After the BSSs are connected to MG, the batteries in the BSSs can offer auxiliary service to grid through the battery to grid (B2G) operation. Battery swap requests, electricity prices, and MG load influence the decision making in operation scheduling of MG and BSSs. Case studies prove the effectiveness of proposed model by minimizing the MG net costs and maximizing the profits of the BSS with B2G technique and charging strategy that reduces daily charging cost.

Keywords Battery swapping station · Electric vehicle · Microgrid · Optimal power flow · Optimal scheduling · General algebraic modeling system

1 Introduction

Electrical vehicles (EVs) are superior to conventional vehicles in terms of low maintenance and pollution-free performance. But the major demerit EVs are the long charging time compared to the driving habits of conventional vehicles even with available fast charging technology. However, alternative refueling option of battery swapping can solve this problem as it mechanically replaces the depleted batteries with fully charged ones (within 2 to 3 min). Currently, research on battery swapping station (BSS) can be sorted in following areas: charging strategies, BSS-EV scheduling, BSS as energy storage, battery swapping techniques, energy management, renewable energy integration, and BSS location [1].

Due to the problems of environmental pollution and shortage of non-renewable energy sources, microgrids (MG) and

EVs are getting more attention as they are essential for the sustainable ecosystem. MG is a small- or medium-scale power system that can consist of distributed energy resources, energy storage systems, BSS, and controllable loads. In MG, the BSS can be an economical option as an energy supply mode for EVs compared to charging station [2].

MG and BSS can act as independent operators for their individual cost benefits. Optimal operation scheduling for MG and BSS is necessary since their objective is essentially contradictory [3]. Management and scheduling of swapping, charging, and discharging modes of BSS operation can be economical for both [4]. In operating stage of BSS, the decision of categorizing and distributing the batteries is according to their state of charge (SOC) [5]. Connection of BSS to MG creates opportunity for BSS to provide auxiliary services through battery to grid (B2G) [6]. Further participation of BSS in energy and reserve market can reduce the operation cost of MG and increase the profit of BSS [7, 8].

Earlier research on BSS for public transportation vehicles resulted in BSS proving as more financially suitable service provider than charging stations since public vehicle's travel routes are predictable in network [9]. However, research on BSS for private vehicles is still fragmented. For any type of vehicle, energy consumption of BSS can be estimated by charging start time, charging duration, EV station visits [10].

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Evaluation and Cost Analysis of Methods of Power Supply for Irrigation Pumps

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Abstract The electrical loads in rural areas are mostly dominated by induction motor-driven water irrigation pumps. These loads are fed from a low-voltage distribution system (LVDS) which consists of an 11 kV/433 Volts three-phase distribution transformer followed by a long low-tension (L.T.) line. The low-voltage line carries a very high current and results in high power loss, low voltage profile, and poor quality of supply to the end consumers. To overcome these drawbacks of LVDS, different strategies have been tried in the literature which include capacitor bank installation at the load end, high-voltage distribution system (HVDS), and off-grid solar photovoltaic (SPV) pumps. This paper presents a techno-commercial analysis of the HVDS methodology used to supply electricity to irrigation pumps. The load flow studies are conducted for LVDS and HVDS systems to find power losses in the distribution network. Moreover, annualized life cycle cost analysis (ALCC) is carried out by considering different topologies of the distribution network to study economic feasibility. The study shows that the HVDS and solar PV-based pump systems are effective methods for minimizing power losses while supplying electricity to irrigation pumps.

Keywords Annualized life cycle cost · High-voltage distribution system · Low-voltage distribution system · Load flow analysis

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Abbreviations

LVDS	Low-voltage distribution system
HVDS	High-voltage distribution system
SPV	Off-grid solar photovoltaic
ALCC	Annualized life cycle cost analysis
DTC	Distribution transformer
ABC	Aerial bundled conductors
V_i	Voltage at each node point, i
V_{BASE}	Base voltage
Z	Impedance of conductor
P_{DTC}	Distribution transformer losses
P_{NL}	No-load loss
PFL	Full-load loss
P_{LVDS}	Total power loss in LVDS
P_{LINE}	Line power loss
C_{HT}	Cost of HT line per km
C_{DT}	Cost of distribution transformer
$Cost_{DT}$	Cost of DT
P_{DTC}	Power loss in distribution transformer
$P_{LVDS(c)}$	Total loss in LVDS with capacitor
L	LT length
P_{HVDS}	Total reduction in losses due to capacitor installation
P_R	Total reduction in losses due to HVDS
P_S	Annual energy savings
$Cost_{EN}$	Cost of energy
I_t	Electricity generated in a year
C_{EN}	Cost of energy per kWh
C_{infra}	Upfront infrastructure cost of LVDS
f	Number of farmers on the feeder
$Cost_{LT}$	Cost of LT network
C_{LT}	Cost of LT lines per Km
N	Number of DTs on the feeder
$Cost_{HT}$	Cost of the HT network

Digital Object Identifier

Cloud Energy Storage Based Embedded Battery Technology Architecture for Residential Users Cost Minimization

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ABSTRACT This paper presents a cloud energy storage (CES) architecture for reducing energy costs for residential microgrid users. The former of this article concentrates on identifying an appropriate battery technology from various battery technologies with the aid of a simulation study. The later part addresses the economic feasibility of the storage architecture with three different scenarios namely grid connected energy storage, distributed energy storage (DES) and CES. The performance of the proposed architecture has been evaluated by considering five residential users with suitable battery technology identified from the former part of the study. For the purpose of the analysis, PV and load profiles including seasonal effects and grid price were taken from IIT Mumbai, India and IEX portal, respectively. In addition, this article also examines the impact of increased number of users with CES. The advantage of this study is that the proposed CES architecture can reduce the user electricity cost by 11.37% as compared to DES. With this, CES operator's revenue can be increased by 6.70% in summer and 16.97% in winter in the case of fixed number of users. Finally, based on the analysis and simulation results, this paper recommends CES with Li-ion battery technology for residential application.

INDEX TERMS Cloud Energy Storage, Distributed Energy Storage, Lead-acid battery, Lithium-ion battery, Sodium-sulfur Battery, Redox Flow Battery

Nomenclature

Subscript:-

i User index
 I Total number of users
 t Time Index
 T Set of time intervals

Function:-

EC_i^{grid} i^{th} user's daily electricity consumption cost (Rs/day)
 EC_i^{DES} Daily electricity cost of i^{th} prosumer with DES (Rs/year)
 EC_i^{CES} Overall daily cost to prosumer i when using CES with PV generation (Rs/year)
 O_i^{DES} DES operating cost (Rs/day)
 O^{CES} CES operating cost (Rs/day)

Variables:-

DES Side Variables

$P_{i,t}^C$ i^{th} user storage charging power for Δt time interval (kW)
 $P_{i,t}^D$ i^{th} user storage discharging power for Δt time interval (kW)

CES Side Variables

P_t^C CES charging power at t time (kW)
 P_t^D CES discharging power at t time (kW) E^{cap}

Parameters:-

θ_t Electricity selling price for excess PV generation feed to grid at t time (Rs/kWh)
 λ_t Electricity buying price from grid for t time (Rs/kWh)
 λ_D Discharging threshold price at t time (Rs/kWh)
 λ_C Charging threshold price from grid at t time (Rs/kWh)

Computation of Control Law for State Transfer Problem in Efficient Way for a Single Input

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Abstract—This article proposes a modified way to compute open loop control for the state transfer problem (STP) for a linear time-invariant system. Solving STP analytically is a cumbersome task. This is mainly due to tedious computations of state-transition matrix and controllability Gramian matrix. The proposed modified method enables to find control law easily and with less computations. This approach is applicable even for a third-order or higher order system with single input case analytically and without use of computer. Moreover, the proposed approach minimizes the use of calculator and thereby reduces the computational rounding-off errors. Finally, it is shown that for some special case with knowledge of mode vector, the STP can be solved very quickly without even calculating the state-transition matrix and controllability Gramian matrix. Furthermore, theoretical as well as experimental evaluation of control law is provided. Experimental results are used to validate the proposed method.

Index Terms—Control input, controllability Gramian, position control, state transfer problem (STP).

I. INTRODUCTION

IN RECENT years, development in sensor, computation, control, and actuators technology in industries impacted significantly on scientific and economic development in the society. Control theory has a major role in Industry 4.0 and became the mathematical backbone for various engineering disciplines. It is widely used as an analytical tool in manufacturing, operations, and control areas in industry. Especially in electrical engineering, control theory contributes in the fields like automation, electric drives, electric vehicles, power electronic circuits, etc. Most of these complex nonlinear dynamical systems are linearized to get the linear model of the plant to design the control and analyze the parameters.

For linear time-invariant (LTI) systems, the controllability Gramian plays the most vital role in control input. The LTI system is controllable iff the controllability Gramian matrix

is positive definite, and so it will be nonsingular. It is also the fundamental factor in deciding the continuous-time open loop control signal for a state transfer problem (STP) of an LTI system [1]. The eigenvalues of this matrix express the control energy required to transfer the system states in eigenvector directions. Computed control law uses the minimum amount of control energy to steer states [2], [3], and also estimation is carried out [4], [5].

Initially, the problem of state transfer was developed for an optimal sampling discrete time system. The notions of “controllable state” and “controllability,” its criterion for a single input case are coined by Kalman for continuous and discrete time systems [6], [7]. Subsequently, the authors proposed a solution of the STP and computations of state-transition matrix (STM) [8]–[13]. The use of advanced software tools in solving STPs is in practice. STP involves calculation of STM and controllability Gramian. In [12], the authors have illustrated 19 ways of computing STM. Gramian matrix is calculated by a simple repeated algorithm for a stable linear dynamical plant [14]. It is also obtained by solving the continuous-time Lyapunov equation [15].

A control objective is proposed for a two-degree-of-freedom system with rotating cylinder on a moving cart and optimization of an aircraft structural design using controllability Gramian. The results show that it is easier to control and it enhances the controllability of system [3]. Calculations of finite and infinite Gramians and sub-Gramians are carried out as well as uncertainty-based optimal control is proposed for power grid to analyze stability, which are derived from algebraic Sylvester and Lyapunov equations [16]–[18]. Also, the optimal actuator and sensor placement based on controllability is discussed in [19]. For six different orders, error comparisons of backward differentiation methods are evaluated and analyzed for calculating stiff controllability Gramian, and closed-form solutions are also calculated [20]. In order to mitigate the power oscillation and improve plant stability, the cost-effective power system stabilizers (PSSs) have been used to provide the damping. For PSS placement, full rank optimal conditions provide complete controllability [21]. Finite and infinite time Gramians and cross-Gramians [22] are expressed as bilinear [23] and quadratic matrix form in [16]. A probabilistic state transfer over a finite time instance is introduced in [24] using Hadamard product. Authors have explored on different ways of determining Gramian matrix and control law. However, from literature, it is inferred that finding the solution of states by computing controllability Gramian is essential.

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Edge Computing With Software Defined Network for Enhancement in Interoperation of Heterogeneous Internet of Things

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Abstract: Internet of Things (IoT), a near future world which will become key factor in everyone's daily life. With ubiquitous growth of Internet of Things, various IoT platforms and protocols are required to interconnect a huge number of IoT devices. Such network structure introduces heterogeneity and this high heterogeneity between such different IoT platforms and protocols decreases interoperability among IoT devices. So design and implementation of software defined networks (SDN) with this scenario is required to cope up this situation. IoT with SDN framework handles bi-directional communication and thus allows interoperation among various IoT devices supporting different application-layer network protocols. Large numbers of different sensors and heterogeneous devices are the terminals in IoT. To control infrastructure of smart word, terminals in IoT continuously generates data and exchanges messages through complex network supporting machine-to-machine communications. A technique to provide local computing for the issues as resource congestion in IoT, edge computing (EC) a new paradigm has emerged. As compared to cloud computing, a network referred as 'edge' placed near to the terminals in IoT and relocate data computation or storage to the edge network. Definitely computational overhead of centralized network is now reduces due to distributed nodes present in edge network. Also latency in message exchange is decreases which is major requirement of real time IoT applications, thus response will be fast compared cloud services. As computation and communication overhead of limited battery power node is transfer to nodes with significant power resources, increases individual nodes life. Different comprehensive surveys prove that edge computing improves the performance of IoT in terms of network latency, bandwidth occupation, energy consumption, and overhead. Researchers provide novel platforms in edge computing for heterogeneous IoT and proved with considering case study of application in IoT. In this paper, we conduct survey on such different platforms and compare performance based on results.

Keywords: Heterogeneous IoT, Software Defined Network, Edge Computing, Smart Healthcare system.

I. INTRODUCTION

A decade ago, one notion has announced as Internet of Things which includes our daily lives physical objects like wireless sensors, smart phones, RFID. It can be described as digitally connected universe of everyday physical devices. These devices are intelligent and are embedded with internet connectivity, sensors and other hardware that allow communication and control via web [1]. The concept was a ubiquitous future network where everything including live objects can be attainable, sensed, and interconnected inside the global, dynamic structure of the Internet.

As Internet of Things encompasses every physical object, it is required to interconnect more-capacity and full-functional traditional computers as well as small-size and constrained devices. It is necessary that every physical object is able to communicate with each other regardless of features that it having and therefore research work is focused on the design and implementation of IoT standards and platforms, to attain machine-to-machine communication between all types of IoT devices. In every network architecture, use of appropriate communication methods by smart devices is helpful for integration of digital information and physical objects, which offer users with new exciting applications and services. Even if moving ahead to develop robust Heterogeneous IoT applications, heterogeneous network configuration, different communication technologies and complexity of application impose many challenges for researchers.

With rising edge of Internet of Things, requires interconnection of stack of IoT devices and for that purpose, numerous IoT platforms and protocols are suggested. Thus heterogeneity in IoT enhances, and high heterogeneity between IoT standards lowers the interoperability in IoT devices. As different approaches are introduces for enhancement in interoperation of heterogeneous IoT, this paper includes work done by different researchers in HetIoT field.

For heterogeneous IoT, to enhance interoperation between various devices, recently software defined network (SDN) concept has been used. SDN confer a new networking design that focuses to centralize the network control and to separate the data and the control planes. Thus, gives benefit from SDN to extract the major management complexities present in this ubiquitous network of networks i. e. IoT [2]. IoT network structure based on SDN provides centralization of the network control with decentralization of the data management

Experimental Study of Multistage Constant Current Charging with Temperature Awareness Control Method

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ABSTRACT- Temperature and charging time are critical parameters during charging period of a battery as temperature rise affects battery life. In a particular charging method, setting high current minimizes charging time but raises temperature. In this study attention is given to multistage constant current charging approach to shorten charging time while maintaining battery temperature below preset range. Battery charging characteristics of various methods are studied, and their performance is compared. The proposed multistage charging method is compared with constant current constant voltage and traditional multistage charging method. The experimental results obtained show that, the proposed method reduces the charging time by 42.22 % and 9.3 % as compared to the constant current constant voltage and conventional multistage charging method respectively, while limiting the rise in battery's temperature to 5°C above room temperature. Further in the proposed method, battery temperature is reduced by 20% as compared to the conventional multistage method.

General Terms: Lithium-ion battery, Charging methods, control algorithm.

Keywords: Battery Wired Charging, Constant Current, Temperature, Multistage, Electric Vehicles.

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1. INTRODUCTION

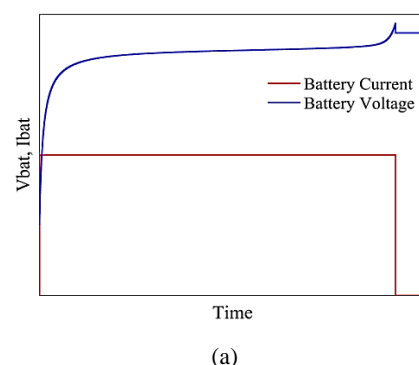
Electronics devices like digital cameras, mobile phones, laptops, electronic toys and many other uses Lithium-ion battery as a main power source due to its advantages like high durability, high energy density, low maintenance requirement etc. Due to these advantages, they are also used in electric vehicles in which very high-capacity battery is required. It takes several hours to charge the battery using traditional/onboard chargers. Lack of charging infrastructure and long charging time are major reasons for the low demand of electric vehicles. A lot of research has been underway on battery charging methods to improve the performance of battery.

Battery charging time, energy efficiency, State of Charge (SoC) and temperature are all significant parameters of the battery. Charging time of battery is a critical factor that must be minimized to overcome the problem of driving range anxiety in case of electric vehicles. Energy efficiency of the battery is the measure of amount of power delivered by the battery in a charge cycle. SoC is the measure total amount of charge present in the battery to the total charge capacity. Charging time, energy efficiency, SoC as well as temperature of the battery depends

on charging current. Pumping large current into battery has demerits like- increased battery temperature; reduced SoC; reduced energy efficiency; and reduced battery life [1]. On the contrary, low charging current maintains battery temperature under threshold value and improves charging efficiency and SoC but it prolongs charging time. Therefore, the charging current should be selected properly, so that the battery will be charged fast and safely [2].

1.1 Battery Charging Methods

The various charging methods [3] are: Constant Current (CC); Constant Voltage (CV); Constant Current Constant Voltage (CCCV); Pulse charging; and Multistage Constant Current (MSCC). Each of these methods has its merits and demerits. In CC method a constant current is applied to the battery as shown in *figure 1 (a)*. Charging time of battery can be minimized by setting high current during charging time. In constant current charging method, battery may get overcharged. Battery overcharging increases battery temperature drastically and it may damage the battery permanently.



An Adaptability of Online Engineering Education Amidst the COVID19 Pandemic

Mahadev S. Patil, Umesh A. Kamerikar

Abstract— The COVID19 pandemic has disturbed the daily lives of people, including those in the education sector. It has tested the readiness of Higher Education Institutes (HEIs) and put in question the adaptability of students and faculty in using online teaching-learning modalities. This paper describes the development of an online engineering education in the department of Electronics and Telecommunication Engineering of Rajarambapu Institute of Technology, Islampur. The authors sampled 211 engineering students and 16 faculty members from the department of Electronics and Telecommunication Engineering using online survey forms. The author highlighted the requirements of online teaching-learning, the implementation methodology, online platforms, sample ICT tools and active learning tools used for the delivery of contents and conducting examinations. From the feedback of students and faculties members, it was found out that availability of resources, institute support, skill development and engagement have significant contribution to the adaptability of faculties and students to online teaching-learning. The pandemic situation has enhanced the adaptability of online teaching-learning during the COVID19 pandemic and also students and faculties are ready if any other similar man-made or natural disruptions occur.

Keywords— Online teaching-learning, ICT Tools, online platforms, adaptability, pandemic.

I. INTRODUCTION

THE COVID19 pandemic, which started in Wuhan, China in late 2019, is one of the deadliest catastrophes of the recent time. Inevitably, the pandemic has disrupted the daily lives of people including the higher education sector. To protect the health and safety of the public, countries around the world have implemented policies. Government of India issued series of circulars to guide entire education sector to implement online delivery using different information and communications technology (ICT) tools. It is a student centric and outcome-based education approach, for which its implementation depends on the availability of technology, availability of devices, internet connectivity. The online learning is the most ideal alternative of face-to-face learning and applies only if the technology readiness is high; learners have good digital devices, fast internet speed, and motivation to adapt to changes (Nikdel Teymori, 2022; J.R.Dhage et al., 2017; Mamta Meena, 2021).

The output of the study is the identification of requirements and implementation methodology to the online engineering education while the main outcome is to find adaptability to online engineering education amongst students and faculties.

II. REQUIREMENTS

The students and faculties were motivated by conducting meetings. In the meeting, requirements and issues were gathered. For the effective delivery of online education, the requirements are devices (Smartphone/Laptop/Desktop), internet connectivity (wired/leased line/wireless/mobile data), average internet speed in Mbps, location, training, online platform, Learning Management System (LMS), social support, confidence, motivation. On the other hand, the demotivating factors were large screen time (4-5 hours a day), frequency of disruptions, lack of good internet speed, self-confidence, training, social support, lack of abilities to handle online platforms (Yadav, 2021).

III. IMPLEMENTATION METHODOLOGY

Most of the students had laptops/desktop and every student has smart phone with internet connectivity, however the speed of the internet was not sufficient especially in rural areas. To provide social support, meetings were conducted with parents. Mentors for group of students were appointed to motivate students in online mode. The students and faculties were trained to operate online platforms and most commonly used apps, time management, and perceived usefulness of online learning resources. Most commonly used platforms were Zoom, MS Teams, Google meet and Webex and apps are MS PPT, MS Excel, PDF Viewer. The ICT tools: online white board, Kahoot, Polly, Socrative, were used. Chat window was used to take feedback during live sessions of delivery and Google forms were used to take feedback at the end of completions of unit/chapter. Also online learning Massive Open Online Courses (MOOCs) and Open Educational Resources (OERs) were used (Kamerikar & Patil, 2020; Hew, 2014). Some sample ICT and active learning tools used are described here.

Kahoot quiz platform provides facility to create quiz including multiple choice questions, a true or false questions, and a single word response from each participant (Prabhavalikar & Patil, 2022). Since it displays leader board

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Assessing the influences of e-resources motives on their utilization

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Abstract— The foundation of e-learning is formalized learning delivered via electronic devices like computers, tablets, smart phone, smart gazettes, etc. This makes it possible for everyone to learn round the clock, regardless of their location or other limitations. The learning materials that are available online are known as e-resources. There are several different electronic resources available for the study, including e-books, e-journals, e-magazines, e-databases, e-newspapers, e-maps, etc. E-resource availability is always expanding. One need only sit at a console and click to access global information without any physical effort. As we can see, using online resources for a variety of objectives is necessary in today's world. Therefore, while determining their use, it is necessary to learn about the availability of different e-resources utilized by students who use online / e-learning and how it impacts them for various reasons. Using the pre-structured questionnaire, data was collected from 250 students, from the Navi Mumbai area who were using e-resources. A theoretical construct was developed based on certain assumptions to explore the relationship between utilization and reasons for using e-resources, viz., time saving, easy to use, and helping to get better grades on the test and examination. The proposed construct was examined using SPSS version- 20. The demographic profile, objectives, and hypothesis were followed while doing the data analysis. The average values of chi-square test results for the reasons (time savings, ease of use, and helping students get better grades in tests and examinations) are calculated. These are found to be 0.016, 0.015, and 0.002 for the first variable (e-learning material), 0.141, 0.016, and 0.001 for the second variable (knowledge enhancement), and 0.182, 0.096, and 0.004 for the third variable (other e-resources), respectively. The results of the data analysis shows the linkage between motives/ reasons of e-resources and its utilization. As the nature of education is predicted to become more hybrid in the future, similar research might be conducted to further identify the areas that need development in the realm of e-resources.

Keywords—E-resources, Reasons/motives, Utilization, E-learning.

JEET Category—: Technology Enhanced Learning

I. INTRODUCTION

An increasing number of individuals are choosing to learn online or electronically. The learning system substantially changed from traditional to electronic learning methods during and after the COVID-19 epidemic.

In the majority of industries, including education, we can see significant technological advances. We might state that there is a necessity in order to learn what is needed today and to adapt to changing circumstances. Today's students use online/electronic learning methods and resources, taking into account the demands of the K to PG educational system. It has been noted that e-learning is essential in the modern world since it offers a number of advantages, including time savings, ease of use, increased information, and assistance in learning new concepts for both mentors and students. In light of this necessity, the aim of our study is to determine the factors that influence how students use electronic resources. An inferential statistical method was used to develop and verify the theoretical construct in this case.

II. LITERATURE REVIEW

Electronic resources must be easily found and accessible since they are digital or digitized content that librarians have chosen, acquired, and managed for use by library users S. Johnson et al.,

E-books, e-journals, indexing and abstracting, full-text (aggregated), reference (biographies, dictionaries, directories, encyclopedias, etc.), numeric and statistical, e-images, and e-audio/visual resources are some examples of these. Similar to this, it is crucial to gauge user satisfaction in order to enhance library services and satisfy user needs.

A. K. Tamrakar and R. G. Garg

More than ninety percent (98%) of students are aware of online information sources, although few are familiar with the ones that the university offers, according to Dumebi in a study on awareness of online information sources among university students. O. Dumebi.

Bakare concentrated on the study of students' perceptions of, access to, and usability with regard to, e-resources. D. Bakare, B. Bamigboye, and M. Chiemenem.

Improving Teaching Learning with Development of Virtual Laboratory

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Abstract- The pandemic Covid-19 has brought a change in the education significantly. As we all know that Education Industry was the drastically hit industry in the service sector. The future of education completely depends upon experiential learning. Now the students can find their courses and books online where they can study as per their own schedule. In these times of need, online learning tools emerged as a boon. In this regard the department tried to design and implement a web-based simulation models under Virtual BIZ & Investment Lab for the student Learners. This paper talks about the benefits of Virtual lab and how it will expose the student learners to real world problem solving and decision making issues to make them industry ready.

Keywords- *Virtual lab, Industry Ready, Education, Teaching, Learning.*

JEET Category—Industry Ready Education,

I. INTRODUCTION

Virtual Lab is available to all students anywhere, easy to access and provide hands on experience. The Virtual Lab has exposed students to real environmental and business issues related to finance, operations, marketing, HRM and other business functions. The future of education completely depends upon experiential learning. Need of online learning tools emerged as a benefit. Virtual Lab has lots of paybacks such as portability, ease of access to software, less need for physical infrastructure, low costs and more flexibility.

A. Need of Virtual Lab

The pandemic Covid-19 has brought a change in the education significantly. As we all know that Education

Industry was the drastically hit industry in the service sector. The future of education completely depends upon experiential learning. Now the students can find their courses and books online where they can study as per their own schedule. In these times of need, online learning tools emerged as a boon. In this regard the department tried to design and implement a web-based simulation models under Virtual BIZ &

The Virtual BIZ & Investment Lab will expose students to real economic, environmental and business issues related to finance, operations, marketing, HRM and other business functions and need to integrate Virtual Laboratory in the process of teaching and learning. Virtual based e-learning is seen as an effective supportive in teaching and learning process. This method is able to create a student-centered learning. Virtual education has many benefits such as movability, ease of access, reduced need for physical infrastructure, lowered costs and greater flexibility.

The annual best practice activity initiated at the institute level through scientific approach of identifying the problems faced by the department and finding a feasible solution on it made our team to first identify the problems of the department, which was done through the brainstorming session held among the members in consultation with the Head of the department. Following problems were identified through the session; biggest challenges facing online education today.

Biz Lab: Biz Lab is a virtual business Laboratory designed for Management students to offer them hands on experience on management concepts and make them industry ready.

B. Objectives

- To provide remote-access to simulation-based labs in various management areas for easy access.
- To entuse students to conduct experiments by arousing their curiosity.
- To design complete Learning Management System for supporting learning through virtual Labs.
- To provide students hands on training on online simulation software to encourage investing behavior and develop their own strategies for their portfolio.
- To develop realistic scenarios for retraining and practice till one can master the skills.

II. VIRTUAL LAB ACTIVITIES

Improving the teaching learning the following activities were conducted.

Effective Implementation of Online Academic Delivery through Innovative Practice League (IPL) Competition

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Abstract— Covid-19 pandemic forced academic Institutes to switch from 100% offline to 100% online delivery mode in very short amount of time. Most of academic Institutes were not ready for this change in terms of required faculty training. Also many Institutes lagged essential computing hardware, software, and Internet bandwidth support for effective implementation of ICT based education. Due to pressure from apex bodies like AICTE, peer Institutes, students and parents almost all academic Institutes started implementation of the online academic delivery in hurry. However, this unprepared start caused increased level of frustration among students and faculty community. Very soon a need of effective implementation of online academic delivery was recognized by the different Institutes.

The paper presents how our Institute implemented and ensured effective implementation of online academic delivery using Innovative Practice League (IPL) competition. The paper explains methodology adopted by the Institute in details for improving quality of online academic delivery. The Institute undertook various initiatives at faculty-level, department-level, and Institute-level for the same; the paper discusses the same in details. The paper also presents details of IPL competition and discusses how IPL helped to have awareness of quality issues related with online academic delivery.

Keywords— Covid-19; Pandemic; Online teaching learning; effective implementation; Online tools for activity-based learning; Active learning; Innovative Practice League (IPL).

JEET Category—Research paper

I. INTRODUCTION

Covid-19 pandemic emerged as major threat for human life since March 2019. Due to this pandemic entire world got shaken as life of every individual was impacted due to the same. The governments imposed strict lock-downs restricting free movements of people from one place to another place. This adversely impacted functioning of many different types of businesses and organizations. So, there was a severe and urgent need to find out ‘new normal’ of doing things in different organizations. The academic institutes also severely impacted by all these things. So there was an urgent need to change way of functioning of academic institutes so as to adjust themselves to minimize damage caused by the pandemic.

Prior to Covid-19 pandemic academic institutes were using online academic delivery on rare occasions. Due to guidelines from apex bodies like AICTE, pressure from parents and students’ communities, and peer pressure the academic

Institutes started their working in online mode. The institutes were forced to switch from 100% offline to 100% online mode in very short time. However, many Institutes were not ready for the same in terms of required hardware, software, internet-bandwidth and most important faculty training.

At beginning student community accepted online delivery mode as it was new excitement for them. But very soon different limitations of this methods started getting identified. The faculty members were frustrated due to need to spend a lot of time and efforts for requirements which are not related with actual Course. This change was really a big challenge for those faculty members who were not conversant with ICT (Information and Communication Technologies). The students started exploiting loopholes in the online academic deliveries. All these issues raised an urgent need to initiate various steps to have effective implementation of online academic delivery. Such initiatives are very much required to ensure effective delivery of the content and students’ participation during the academic delivery.

Taking into consideration the entire scenario our institute prepared plan for improving quality of online academic delivery. This research paper discusses this plan and observations during the implementation. As part of this plan following issues were addressed:

1. Training of faculty members for software’s used in online academic delivery.
2. Making good quality computing hardware and equipment’s available to faculty members. Also upgrading Internet bandwidth and expanding wireless access of the Internet throughout the campus.
3. Identification of precise parameters for measuring quality of online academic delivery and creating awareness of the same amongst faculty members.
4. Periodically monitoring online academic delivery made by the faculty members and if required offering mentoring by senior faculty members.
5. Using various online tools for active engagement of students during classroom delivery.
6. Organizing Innovative Practice League (IPL) competition to motivate faculty members for effective delivery of content in online mode and awarding best performing faculty members. As part of this competition every individual faculty member and each academic department evaluated for their performance in terms of online academic delivery.

Effectiveness of Online Teaching in Language and Communication Classes in Engineering

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Abstract—Language and communication classes are more effective with the use of direct methods that are also known as natural methods. With use of active learning techniques a language teacher can bring the learners at the centre of the teaching learning process. This study reviews second language teaching approaches and active learning methods. We identified active learning techniques useful in language and communication class. Blended use of selected active learning techniques with computerized teaching learning tools may help in making these classes effective towards fulfillment of specific topic outcomes. Engaging language and communication class in online mode has some hurdles as well as limitations. The present study is an attempt to identify these problems of content delivery in online language and communication classes. The study recommends modified active learning methods for effective online language and communication lectures. Further, we suggest possible academic and professional implications of active learning techniques in online mode.

Keywords—Active learning; ICT; Second language teaching approaches.

I. INTRODUCTION

Teachers always have freedom to be flexible in selecting teaching methods and choosing resources adequate in teaching learning process of a specific course. Teachers always have flexibility in molding and blending existing teaching methods to meet classroom requirements. That is helpful in making language teaching and learning simple and natural.

The languages were studied earlier for interpretation and translation of classical literature. In colonized countries like India English was taught as a second language to serve various administrative purposes of the rulers. Nowadays, teaching learning of first language i.e. mother tongue (L1) or second/foreign language (L2) is done to address academic and professional requirements from a language. People increasingly prefer learning L2 to serve their professional needs. Bose (1989) quoted Jack Richards and Theodore Rodgers who made concluding remarks that “both from a contemporary and historical perspective, bilingualism or multilingualism is the norm rather than the exception”(P. 96).

Professional education institutions introduced second/foreign

language courses in the curriculum or certificate training programs to their students so that more number of multinational avenues will be open for these students.

Use of direct methods that are also known as natural methods in second language and communication classes is most preferred for effectiveness and to achieve learning outcomes. In this method exclusive verbal one on one dialogue using target language is expected. Additionally, creative use of active learning techniques by a language teacher in these classes makes it more participatory for students and helps to boost the learning process. Blended use of selected active learning techniques with computerized teaching learning tools may help to increase level of student engagement in language and communication classes that ultimately resulting in improved attainment of course outcomes. These outcomes are the measurable statements on result of student’s learning. Teaching of language and communication in online mode has a lot of hurdles as well as limitations. A language teacher at present is expected to have understanding of functionalities of technology and basic technological skills in addition to appropriate pedagogical skills.

The present study implements selected active learning techniques in online language and communication lectures. This helps to identify problems in online delivery of second language and communication skills content. In order to overcome these problems, feasible technological solutions are identified and applied. This provides a foundation to recommend modified active learning methods for effective online language and communication lectures.

II. ICT IN INDIAN EDUCATION SYSTEM

Most of the language and communication teachers in general prefer to follow set methods of classroom delivery to meet the teaching learning objectives and course outcomes. Indian Institutes of Technology (IITs) and Indian Institute of Science (IIS), Bangalore collaboratively started the National Programme on Technology Enhanced Learning (NPTEL) in 2003. This is the first formal platform of its type in India that provides online certification courses. It sets standards for Information and Communication Technology (ICT) based education in general and online certificate courses in particular

Incorporating Visualization Tools and Active Learning Approach for Programming Courses

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Abstract— Programming languages are a vital domain for Computer and Information Technology engineering. The programming languages like C, C++, Java, Python, Mobile Application Development, and Web Technologies are important programming courses in CSE and IT curriculum. Understanding the programming courses includes a basic understanding of the syntax of programming language, logical & critical thinking to solve the problem, use of various editors to write and execute the program. Effective delivery of the programming course creates a great deal of influence on student's interest in programming and software development. The students lose their interest in programming due to the inefficient delivery of these courses which leads to a gap in technical competency required by the IT sector.

The current Covid 19 pandemic exposed the limitation of traditional teaching methods for programming courses. Teaching such programming courses on online mode becomes a big challenge for faculty by considering the skillset required to inculcate amongst the students for learning programming courses. The primary objective of this paper is to overcome these challenges by the effective use of a pedagogical approach for teaching programming courses. The various active learning methods and tools are discussed in this paper that was used to teach the programming language. The result shows that by implementation of such methods & tools you can retain the interest of students in programming courses and thus increase their performance and improve the skillset required in IT industry.

Keywords— Computer Programming, Activity-based learning, Visualization tools, logic building, Critical thinking, Continuous Assessment.

I. INTRODUCTION

Software developer, Application analyst, Software tester, System analyst, Web designer are various job profiles in the IT sector. Programming courses in CSE and IT curriculum plays important role in developing the technical competency required for such job profiles. From the learner's point of view understanding programming language concepts and syntax is a challenging task. In physical mode, we have a direct connection to students, therefore we have a better understanding of the problems that students come across while learning programming.

Teaching programming in online mode has become a challenging task for a teacher to ensure a joyful learning environment.

Programming language knowledge requires problem analysis, logical thinking, employing the use of algorithms & flowcharts to solve the problem, assembling the program using the proper syntax of programming language, program debugging skills to remove syntax & logical errors, and executing the program to get the desired output. Also, students should have program analysis skills to predict the output of the given program.

Only traditional teaching is not sufficient for programming courses to inculcate the above skills among the students.

While learning to program, students have several difficulties such as understanding how memory can be allocated to variables, how values of variables go on changing during execution, how to recognize and resolve the syntax & logical errors if any. To overcome these difficulties, it is essential to make a change in the teaching methodology and increase the use of many interactive tools for better delivery of programming courses.

While solving the problem using programming language, if students have the model on how programming problems can be solved then it will benefit them [1]. So it is important to incorporate the visual demonstration to the students about how the program works, how we can solve the problem using a programming language. The main goal of programming courses is to develop the ability of coding and debugging among students [9].

Concerning figure 1 of the learning pyramid/ cone of learning by the National Training Laboratory; it is clear that 75% of concepts get retained if students can practice it by doing and nearly 90% get retained if they teach others.

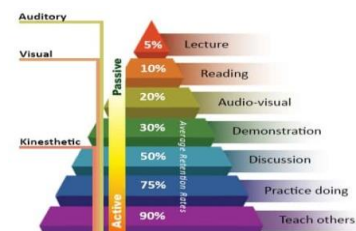


Fig. 1: Learning Pyramid



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Optimizing large scale bin packing problem with hybrid harmony search algorithm

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ABSTRACT

Bin packing problem (BPP) is a combinatorial optimization problem with a wide range of applications in fields such as financial budgeting, load balancing, project management, supply chain management. Harmony search algorithm (HSA) is widely used for various real-world and engineering problems due to its simplicity and efficient problem solving capability. Literature shows that basic HSA needs improvement in search capability as the performance of the algorithm degrades with increase in the problem complexity. This paper presents HSA with improved exploration and exploitation capability coupled with local iterative search based on random swap operator for solving BPP. The study uses the despotism based approach presented by Yadav et al. (2012) [Yadav P., Kumar R., Panda S.K., Chang, C. S. (2012). An intelligent tuned harmony search algorithm for optimisation. *Information Sciences*, 196, 47-72.] to divide Harmony memory (HM) into two categories which helps to maintain balance between exploration and exploitation. Secondly, local iterative search explores multiple neighborhoods by exponentially swapping components of solution vectors. A problem specific HM representation, HM re-initialization strategy and two adaptive PAR strategies are tested. The performance of proposed HSA is evaluated on 180 benchmark instances which consists of 100, 200 and 500 objects. Evaluation metrics such as best, mean, success rate, acceleration rate and improvement measures are used to compare HSA variations. The performance of the HSA with iterative local search outperforms other two variations of HSA.

1. Introduction

The Bin Packing Problem (BPP) is an NP-hard problem and it is considered as one of the most important optimization problems in computer science. The objective of BPP is to allocate every item to a bin in such a way that the combined weight of all the items in a bin is not more than bin's capacity and the minimum number of bins are used. There are numerous applications of bin packing in the real world. Industries that are involved in cutting wood, glass and paper (Hopper & Turton, 1999). Perboli et al. (2014) showed the application of bin packing problem in packing and routing. Song et al. (2013) used bin packing problem to solve resource provisioning in the cloud. Coffman et al. (1978) solved multiprocessor scheduling using bin packing. De Cauwer et al. (2016) applied bin packing for managing workloads in data centers. Leinberger et al. (1999) provided packing algorithms for multi-resource allocation and scheduling solutions. Paquay et al. (2016) solved multiple bin size bin packing problem from air transportation. The BPP problem formulation is well known and presented in many papers (Fleszar & Hindi, 2002; Alvim et al., 2004). The mathematical problem formulation of 1D BPP can be modelled in the following manner. Given a set of x items $k = k_1, k_2, \dots, k_x$ and y bins $b = b_1, b_2, \dots, b_y$ with capacity $c \in \forall y$ the objective is to find an optimal assignment that minimizes the number of bins to be used. For every b_i the assignment should

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Analyzing the Adoption of Recent IT Technologies in Undergraduate Engineering Project Course

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Abstract: Outcome-based professional education processes are a new standard for all stakeholders and knowledge economy. Majority of the time the IT services/consulting industry demands graduates who shall be billable from day one of joining the enterprise. According to the National Employability Report Engineers 2019, only 3% of engineers possess new-age skills in areas such as AI, data analytics and mobile technologies. Academic project works shall be seen in the light of aforesaid observations and therefore suggests treating this as an opportunity to initiate undergraduates to more hands-on experiential learning considering the advancements in technology and market need. The objective of this paper is to identify the gap between the needs of the market/job trends and undergraduate CS/IT student projects areas. The second objective is to identify the factors affecting the project selection process.

Our empirical study in general spanning over seven Engineering Institutes in western Maharashtra. The statistical data is collected from a controlled group of 4000 students. The data consists of project topics completed by students in the last nine years (from the year 2011 to the year 2019). Two indicators are used to understand the IT market. First, Gartner strategic technologies present the worldwide trend of technologies. Second, student project areas are compared with job trends in India. The student's feedback on technology adoption theory presents the challenges in adoption of recent IT technologies in academic projects. 62% of students have reported unavailability of resources at the institute to encourage the adoption of the recent technologies. The student's perception about the adoption of recent technologies needs to change.

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However, 85% of students agree that online resources can overcome the problem of availability of expert and guidance.

Keywords: CS/IT academic project selection, Gartner strategic technologies, CS/IT job/market trend.

1. Introduction

The current pandemic situation proved the significance of information and communication technology adoption in different sectors. According to IDC forecast cloud computing, mobile technologies, analytics and IoT are contributing significantly for enterprise growth. In the next few years robotics, artificial intelligence and AR/VR will reach 25% of ICT spending (IDC - Global ICT Spending: Forecast 2020 - 2023, 2020). Government of India has taken different initiatives for technology adoption in educational institutes. MHRD and AICTE have started different faculty development programs for improving the faculty competencies in different thrust areas such as artificial intelligence, data analytics, robotics, blockchain. AICTE promoted different new programs in recent technologies of artificial intelligence, machine learning, blockchain, data analytics, cybersecurity, Internet of things etc. IIT Mumbai, IIT Chennai, IIT Delhi and many more have taken initiative in this direction.

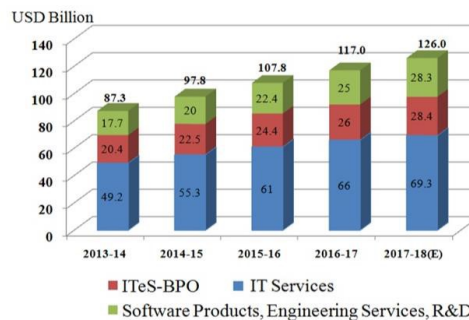


Fig.1 Top job roles in CS/IT in India (Ernst and Young, 2017)

Figure 1 shows the top job roles in the Indian information technology sector. From 2013-14 the jobs in IT services are increasing. The product development, engineering services and R&D increased rapidly. It creates the need for efficient manpower in recent IT technologies (Ernst & Young, 2017). Aspiring Minds conducted and published an annual employability survey in 2019. According to the report, 80% of Indian engineering graduates are not fit for a job in the current knowledge economy. This report shows that the small changes in the education system will not address the

Comparative Study of Supervised Algorithms for Prediction of Students' Performance

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Abstract: Predicting academic performance of the student is crucial task as it depends on various factors. To perform such predictions the machine learning and data mining algorithms are useful. This paper presents investigation of application of C5.0, J48, CART, Naïve Bayes (NB), K-Nearest Neighbour (KNN), Random Forest and Support Vector Machine for prediction of students' performance. Three datasets from school level, college level and e-learning platform with varying input parameters are considered for comparison between C5.0, NB, J48, Multilayer Perceptron (MLP), PART, Random Forest, BayesNet, and Artificial Neural Network (ANN). Paper presents comparative results of C5.0, J48, CART, NB, KNN, Random forest and SVM on changing tuning parameters. The performance of these techniques is tested on three different datasets. Results show that the performances of Random forest and C5.0 are better than J48, CART, NB, KNN, and SVM.

Index Terms: Educational data mining, Machine learning, Random forest, C5.0.

1. Introduction

It is essential for every educational organization to facilitate high quality education to their students. Performance of student in academic is major concern for every institute as it linked to job opportunities and reputation of institution. One of field related to dealing with processing and analyzing of all educational data is educational data mining (EDM). EDM develops methods to understand student and their environment of learning [1]. It also helps to predict patterns that can be helpful to improvement of student performance. Prediction of student's academic performance is a difficult task because it depends on various demographic, socio-economic and past-academic factors. In this paper, the attributes responsible for affecting the academic performance of the student and the students' grades for three different datasets are determined.

In literature, different data mining (DM) algorithms and machine learning (ML) algorithms have experimented for this problem. Machine learning algorithms as said 'learn' from given data, discover hidden patterns and provide predictions, which allow engineers, researchers and scientists to make a reliable decision. Machine learning is broadly divided as supervised, unsupervised, and reinforcement learning. In supervised learning is done using training data which is analyses and builds model to perform predictions for training set. Classes or target variable is labelled in this case. DM and ML techniques are widely applied in field of analytics and predictions. The research work in [2-8] make use of such algorithms which are Logistic Regression, J48, Decision Tree, Support Vector Machine (SVM), NB, Random Tree, ANN, K-Nearest Neighbour (KNN), MLP, and Random Forest. In few cases, other algorithms are also used such as association rules [9], and clustering [10]. NB Tree is used in [11] for predicting status of student, length of study and GPA. Techniques such as REP Tree, PART, Decision Table, Decision Stump, and JRip [12-13] are used for student performance prediction. Results show that the algorithms that perform well for predicting grades are Random Forest, J48, CART, NB, KNN and SVM. To the best of our knowledge, the experimentations are not conducted on C5.0, which is an advanced version of C4.5 (also called as J48) for predicting grades of students. Hence, these seven algorithms are used for grade prediction.

Attribute selection is critical task in every DM and ML algorithm. Performance of algorithm depends on type of data it consists. Adding and removing of certain attributes can also change the performance of algorithm. For

Improved Undergraduate Software Capstone Project Development with Adoption of Industry Practices

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Abstract: To improve cost-effectiveness, the software development processes in the IT industries are changing rapidly. There is a gap in different processes in IT industries and engineering institutes due to a mismatch in industry expectations and academic practices. According to different survey reports, this gap is increasing significantly due to lack of domain knowledge, inabilities of adopting recent technologies, old curriculum contents, poor assessment methodologies, and old project development practices, etc. To make students industry-ready, it is necessary to inculcate recent software development processes in academics. Academic project is one of the important courses in an undergraduate program which inculcates industry required skills among the students to bridge the gap to a greater extent. In this work, the gap in academic software project development practices is identified through feedback from industry experts, alumni, and previous three years' student projects. This paper presents Industry Oriented Software Engineering Practices (IOSEP) methodology to adopt the recent industry practices in academics for improving students' project quality. The proposed methodology is implemented for the third-year mini project and a

final year capstone project for academic year 2018-19. The IOSEP methodology incorporates an agile model, industry coding practices, GitHub platform, modern tools and technologies, testing tools, real-time deployment and, LaTeX for documentation. To analyse the effectiveness of the proposed methodology, a new skill-based assessment method and rubrics are designed. K-means clustering is used to analyse students' performance. The Elbow method and silhouette analysis are used to select the number of clusters. Results show that optimal cluster values are three and more than 38% of students are in excellent cluster. The post feedback analysis from faculties and students show that project quality improved compared to previous years on development time, coding practices, technology use, and technical report writing. Industry-sponsored projects, participation in project competitions, student paper publications, and placement statistics are improved than the previous three years.

Keywords: Software development, Agile model, GitHub, LaTeX, Employability skills.

1. Introduction

According to Aspiring Minds (National Employability Report Engineers, 2019) report, 80 % of Indian engineering graduates are not fit for a job in the current knowledge economy. This report shows that the small changes in the education system will not address the actual problem. Prashant R. Nair (2020) discussed the statistics of National Association of

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Malware Classification with Improved Convolutional Neural Network Model

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Abstract: Malware is a threat to people in the cyber world. It steals personal information and harms computer systems. Various developers and information security specialists around the globe continuously work on strategies for detecting malware. From the last few years, machine learning has been investigated by many researchers for malware classification. The existing solutions require more computing resources and are not efficient for datasets with large numbers of samples. Using existing feature extractors for extracting features of images consumes more resources. This paper presents a Convolutional Neural Network model with pre-processing and augmentation techniques for the classification of malware gray-scale images. An investigation is conducted on the Maling dataset, which contains 9339 gray-scale images. The dataset created from binaries of malware belongs to 25 different families. To create a precise approach and considering the success of deep learning techniques for the classification of raising the volume of newly created malware, we proposed CNN and Hybrid CNN+SVM model. The CNN is used as an automatic feature extractor that uses less resource and time as compared to the existing methods. Proposed CNN model shows (98.03%) accuracy which is better than other existing CNN models namely VGG16 (96.96%), ResNet50 (97.11%), InceptionV3 (97.22%), Xception (97.56%). The execution time of the proposed CNN model is significantly reduced than other existing CNN models. The proposed CNN model is hybridized with a support vector machine. Instead of using Softmax as activation function, SVM performs the task of classifying the malware based on features extracted by the CNN model. The proposed fine-tuned model of CNN produces a well-selected features vector of 256 Neurons with the FC layer, which is input to SVM. Linear SVC kernel transforms the binary SVM classifier into multi-class SVM, which classifies the malware samples using the one-against-one method and delivers the accuracy of 99.59%.

Index Terms: Malware classification, image classification, convolutional neural network, support vector machine.

1. Introduction

Malicious code is a code that is a part of the software, system, or scripts, causing harm to the system. In the last few years, growth in Internet usage has grown significantly. With more Internet usage, there is a rise in criminal activities and hacking code injections. For doing such activities, criminals are using malicious codes to perform illegal activities on devices connected to the Internet. Creating malicious codes with online available automated tools is easy for attackers. According to Symantec's report of the year 2019, every month, on average, attackers inject malicious codes into 4800+ retailer's websites to get credit card details [1]. Malwarebyte's research [2] reported that malware attacks on Windows operating systems increased by 18% in the year 2019.

Malicious codes are divided into several classes considering their working, namely virus, worms, logic bombs, trojans, keyloggers, and backdoors. These classes again further divided into different families of malware. FireEye [3] stated that in 2019, they discovered 500 new families of malicious code. With fast technological progress, malicious code analysis, detection, and classification malware became more critical from the computer and network security point of view. Performing newly arrived malware detection and classifying them to their respective families involves feature vectors that represent the essential features of malicious codes. There are two fundamental techniques for analyzing malware with the help of feature vectors, namely static analysis, and dynamic analysis. Static analysis examines the behavior of malicious code without executing them. The sequence of code or instructions is cross-checked to understand the purpose of it [4].

On the other hand, dynamic analysis involves the execution of the malware under strictly remote or virtual sandbox devices to understand the working of it [5]. Paper [6] shows how these traditional methods fail to deliver

Roadmap to inculcate complex problem-solving skills in CS/IT students

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Abstract: IT industries expect critical & analytical thinking, programming skills, domain & technology knowledge and soft skills from CS/IT graduates. There is a need for investigation of outcome-based methods to inculcate complex problem-solving skills among graduates. This paper presents a roadmap for designing student learning outcomes, assessment methods, curriculum and active teaching-learning activities for CS/IT programme. The proposed roadmap incorporates project-based, problem-based and case study based teaching-learning and assessment strategies to address higher Bloom's level. The proposed roadmap of implemented for the 2015-19 batch of CS&IT department, Rajarambapu Institute of Technology. The case study presents identified 13 student learning outcomes (SLOs) in line with program outcomes and current IT industry expectations. To achieve the SLOs, problem and project-based assessment methods and teaching-learning methods are designed. To calculate the success of the proposed roadmap, students' performance of 2015-19 batch is compared with ancestor batch 2014-18. The effectiveness of the proposed roadmap for inculcating complex problem solving is measured with percentage of higher levels of Bloom's addressed in assessment, attainment of student learning outcomes, attainment of students'

employability skills and student's feedback. For all courses, performance of students of batch 2015-19 is better than batch 2014-18. The better performance is shown with highest and median marks. Batch 2015-19 shows better student learning outcomes and employability scores than batch 2014-18. The proposed roadmap is found better on all mentioned measures for inculcating complex problem-solving skills.

Keywords: Problem-solving roadmap, project-based learning, problem-based learning, outcome-based education.

1. Introduction

National Employability report 2019 published a survey conducted for 170,000 students from 750 engineering colleges in India. According to this report, more than 90% students are weak in problem-solving skills such as algorithmic knowledge, programming, analytical skills, etc. Research in Education System has reported the limitation of traditional teaching-learning and evaluation methods. Lack of patience in young generation drives the need for active teaching-learning methods. So, it's time to update and improve the teaching & assessment process through activity-based learning and active learning techniques.

In literature different active learning techniques are investigated for student's engagement. Few popular active teaching-learning methods are project-based learning, think pair share, case study based

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Master-Slave TLBO Algorithm for Constrained Global Optimization Problems

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Abstract

INTRODUCTION: The teaching-learning based optimization (TLBO) algorithm is a recently developed algorithm. The proposed work presents a design of a master-slave TLBO algorithm.

OBJECTIVES: This research aims to design a master-slave TLBO algorithm to improve its performance and system utilization for CEC2006 single-objective benchmark functions.

METHODS: The proposed approach implemented using OpenMP and CUDA C, a hybrid programming approach to enhance the utilization of the system's computational resources. The device utilization and performance of the proposed approach evaluated using CEC2006 benchmark functions.

RESULTS: The proposed approach obtains best results in significantly reduced time for CEC2006 benchmark functions. The maximum speed-up achieved is 30.14X. The average GPGPU utilization is 90% and the average utilization of logical processors is more than 90%.

CONCLUSION: The master-slave TLBO algorithm improves the utilization of computational resources significantly and obtains the best results for CEC2006 benchmark functions.

Keywords: Master-slave TLBO algorithm, Parallel Evolutionary Algorithms, GPGPU, Constrained benchmark functions, Optimization problems.

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1. Introduction

Optimization is defined as “Finding an alternative with the most cost effective or highest achievable performance, by maximizing desired factors and minimizing undesired ones” [1]. Optimization functions are discrete/continuous and constrained/unconstrained types. The optimization problems found in engineering and other domains are constrained and unconstrained in nature. The constrained optimization problems are optimized concerning certain restrictions. The restrictions exist on different things like resources

availability, time, etc. The unconstrained optimization problems are free from such restrictions. These problems are optimized with respect to design variables and their range as well as dimensionality. The constrained and unconstrained optimization problems are of single and multi-objective optimizations [2-5].

In literature, different classical methods used to solve the constrained and unconstrained optimization problems. These methods have their own merits and demerits. Researchers have developed nature-inspired approaches to solving complex engineering design and optimization problems [2]. When an algorithm is proposed newly, validation and efficiency of the algorithm need to be evaluated. Therefore,

Improving Problem Solving Ability of Student Through Cooperative Learning

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Abstract: Traditional teaching learning methodologies are not that much efficient in today's teaching age. The demand of present age group of teaching learning with an innovative strategy is huge one [1]. The main focus of this paper is about the collective efforts needed to be taken to improve the ability of students in problem solving with the innovative teaching learning method for cooperative learning. This mentioned methodology was applied to teach the course Digital Systems and Microprocessors for the second year B.Tech computer science and information technology students at Rajarambapu Institute of Technology, Sakharale. The objective of this activity has to analyse the students' problem-solving ability through cooperative learning. The evaluation of the results demonstrates that collaborative learning enhances the students' confidence and their involvement in the learning process.

Keywords: Problem solving ability, Cooperative learning, Discussion Forum, thought process

1. INTRODUCTION

Engineering education in the 21st century has created various learning platforms such as critical thinking, problem solving, Communication and Collaboration Skill, and the concept of engineering itself. Problem solving is amongst the main motive of the 21st century's slow learning students to advance including in engineering learning.[2] To teach digital system and microprocessor course is somehow challenging because it contains lots of numerical as well as designing problems. Since problem solving is a tricky method of finding the correct way which finds a solution, so it is difficult. Problem resolution is a technique that involves using certain measures (heuristics), often referred to as a model or problem-solving steps to find a solution Heuristics are the common guidelines or steps used to help in solving problems. These policies, however, do not ensure the success of the individual in solving the issue. [3] Collaborative problem-solving skills are therefore a significant to meet cognitive

ability. Students learned more efficiently if they are active rather than passive during the teaching phase (i.e., deep learning rather than superficial learning). In general, learning through doing is more efficient than learning through listening or reading, and when learning is through doing (using data to fix a issue), students are more likely to remember what they have learned, and The information they receive is also more likely to be processed and reflected on how they learned, especially if there are incentives to do so.

Table 1: Difficulties with Problem Solving

1. Student has many problems with problem solving
2. Afraid to make decisions
3. Student goes through one or more steps inadequately
4. Problem solving process is not easy
5. Problem solving individually limit the thought process.

2. COOPERATIVE LEARNING

It is a teaching and learning approach that involves groups of students working together to finish a job, solve a problem or generate a product with unique requirements [5] Collaborative learning is based on the idea that learning is a natural social act in which members talk to each other. It is based on values as follows:

- I. Learning is an effective method through which learners assimilate the data and connect the fresh understanding to a previous knowledge structure.
- II. Learning needs a challenge that needs students to actively participate with their colleagues

2.1 Why use it?

Documented results shows the

- Improved academic performance.

GPGPU based Multi-hive ABC Algorithm for Constrained Global Optimization Problems

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Abstract

INTRODUCTION: The artificial bee colony (ABC) algorithm is a nature-inspired technique used for solving different optimization problems. This paper presents a multi-hive ABC algorithm for solving constrained benchmark functions of CEC2006. The CEC2006 data set contains the global benchmark functions with different design variables, number and type of constraints.

OBJECTIVES: The objective of the proposed work is to design and apply the GPGPU based multi-hive ABC algorithm to solve constrained optimization problems.

METHODS: The proposed approach is a multi-population coarse-grained system implemented using General Purpose Graphics Processing Unit (GPGPU). The performance of the proposed approach is compared with the serial ABC algorithm for eleven benchmark functions and results in the literature. The multi-hive ABC algorithm has multiple hives, each running separate ABC algorithm on different cores of GPGPU.

RESULTS: The proposed approach provides global best solutions in significantly reduced time for all benchmark functions. The speed-up obtained is approximately 7X to 9X. The GPGPU device utilization is approximately 57% to 91%.

CONCLUSION: The GPGPU based multi-hive ABC algorithm is a found good with respect to best results, speed up factor and GPU utilization to solve constrained optimization problems.

Keywords: Multi-hive ABC algorithm, GPGPU, Coarse-grained model, Constrained benchmark functions, Optimization problems.

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1. Introduction

There exist various optimization techniques broadly classified into traditional and non-traditional techniques. Each type of technique has its own merits and demerits. The widely used non-traditional techniques are nature-inspired. These techniques include swarm intelligence based optimization algorithms like particle swarm optimization, ant colony optimization, artificial bee colony algorithm, etc. The global collective behaviour of social insects that arises from

self-organization and division of tasks is the root of all swarm-based optimization algorithms. Ant colony optimization imitates the behaviour of ants, Particle swarm intelligence imitates the behaviour of birds and Artificial Bee Colony algorithm imitates the behaviour of honey bees [1-5]. The artificial Bee Colony (ABC) algorithm was proposed by Karaboga in 2005, for multidimensional, multimodal optimization problems. Artificial bee colony algorithm is inspired by the honey bees' behaviour of searching for food. The colony of honey bees contains three types of bees namely, employed bees, onlooker bees and scout bees. The

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Active Teaching Learning Methods for Improving Students Engagement in the Classroom

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Abstract- In today's world, traditional teaching has been losing its impact during classroom teaching. Students get lazy after 20-25 minutes in an hour lecture and it makes difficult to teacher to engage a large crowd classroom. It is the need of the time to use innovative teaching learning techniques to make lectures interactive and create interest among students. These techniques should promote independent, critical and creative thinking among students. Also, increase student's interest in lecture, motivation and performance in examination.

Keywords: *Active learning methods, Blended learning, Collaborative learning, classroom, students*

INTRODUCTION

In recent years, active teaching learning has become a counterpart to traditional teaching methods and has drawn considerable attention. In a current research it was stated that the students can be more active when active learning is compared to traditional teaching methods (such as lecture), regardless of the subject matter. Apart from that, it creates the interest among students in terms of enjoy the class more and able to persist the information for a long time. The active teaching learning methods allow students to learn in the classroom with the help of instructor and other students, rather than learning by self. In an active learning classroom, students must be proactive and problem solvers rather than passively listen to lecture [8]. Active learning techniques and strategies can be helpful to develop quick activities that engage lectures. They can also be used to completely fill the class time. Drawing the students' attention and keeping them engaged are essential points to the learning process. Active methodologies place the students at the center

of this process and make them the leaders of discovery, rather than just passive information receivers. There are different teaching strategies to create an active learning environment and to engage the students to it. Current evidences indicate that active learning improves understanding and information retention. It is also effective in developing higher-order cognitive skills. Nevertheless, the adoption of active methodologies is still low. This paper aims to emphasize the effectiveness of active teaching learning methods used in the classroom and pedagogy developed by a teacher for undergraduate students. The researchers explore the benefits of active learning strategies used in curriculum and pedagogy course [1].

To promote student's engagement in the classroom, these teaching learning methods are useful in following respects:

- Promote learn ability among students
- Create Self-awareness and evaluation of group processes
- Changing students role from passive learner to active learner
- Helping students to remember things better way
- Team work with their classmates
- Applying course content to real-world examples
- Develop their social skills i.e. to communicate better and have better relationships with classmates
- Problem solving across disciplines

Harmony search algorithm with adaptive parameter setting for solving large bin packing problems

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ABSTRACT

Bin packing problem is a constrained optimization problem with a huge search space due to large combinations. Bin packing problem has a wide range of applications in multiple fields. This paper presents harmony search algorithm with different initialization and adaptive PAR strategies for solving bin packing problem. The proposed Harmony search (HS) variations tests two partial feasible initialization strategies for bin packing problem. The paper presents adaptive PAR strategies for better exploration and exploitation of HS algorithm. The PAR values are tuned in every iteration. Improved initialization strategy, population initialization after premature convergence and adaptive PAR leads to the better exploration of harmony search algorithm for bin packing problem. The performance of variations are tested over 120 benchmark instances with 100 and 200 objects with varying complexities. The results show that improved HS performs better than basic HS with respect to best, mean, convergence rate. The performance of algorithms is tested with varying harmony memory size and harmony memory considering rate. Results show that variation in these two parameter values has less effect on performance of improved versions.

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1. Introduction

Combinatorial optimization problems are difficult to solve due to huge search space and constraints. Bin packing problem (BPP) is one of the important combinatorial optimization problems. Bin packing problem has applications in multiple domains such as transportation (Perboli et al., 2014), logistics (Aggoun et al., 2016), resource placement (Song et al., 2013; Adamuthe & Patil, 2018). The BPP problem formulation is well known and presented in many papers (Fleszar & Hindi, 2002; Schoenfeld, 2002; Alvim et al., 2004; Abdel-Basset et al., 2018). In one-dimensional bin packing problem, items with varying weights are to be packed using homogeneous/heterogeneous bins. Consider a set of 'k' bins $Bin_1, Bin_2 \dots Bin_k$ with same or different capacity and 'n' objects with different weights $W_1, W_2 \dots W_n$. The objective is to pack all the items into the bins in such a way that a minimum number of bins are required. A solution is said to be optimal if it uses a minimal number of bins.

$$\min \sum_{i=1}^k z_i \quad (1)$$

subject to

$$\sum_{j=1}^n W_j y_{ij} \leq B_i \quad \text{for all } i \quad (2)$$

$y_{ij} = 1$ if object j is put in bin i , zero, otherwise

$z_i = 1$ if bin i is used, 0, otherwise

$i \in k$ and $j \in n$

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PBL based Teaching-learning Strategy for Inculcating Research Aptitude in CS/IT Students

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Abstract: The student engagement with developing problem-solving, self-learning and research aptitude is a challenging assignment in higher education especially in engineering education. Various outcome-based teaching-learning methodologies devised by educationalist and practised by engineering teachers. The main objective of this paper is to develop problem-solving, self-learning and research aptitude among students using problem-based learning (PBL). To achieve the objectives, the backward design process is used. Paper presents the PBL process from finalizing objectives, assessment methods, curriculum and instructional activities for inculcating research aptitude. Paper presents the activities for two selected courses, advanced algorithm and soft computing. Course outcomes of selected courses address the higher level of Bloom's taxonomy. Paper elaborates the teaching activities, evaluation mechanism and attainment of outcomes of courses. Higher attainment of course outcomes reflects the improvement in student's academic performance. Students' feedback reflects the satisfaction for course conduction and PBL activities.

Keywords: Problem based learning (PBL), active learning methods, research aptitude, outcome-based education.

1. Introduction

The higher education, especially the engineering education system is now in the transition phase. Engaging students for the complete course or a single session of a course is a big challenge in front of engineering teachers. The new entrant as a teacher in engineering education is not well prepared to engage and teach engineering students (Collaco, 2017). Today to teach any course, merely subject matter expert is not sufficient, effective teaching strategies are also important. The traditional teaching methods do not promote the active participation of learners. The traditional teaching-learning process is ineffective to promote thought and change the attitude of learners. It also deficit to teach behavioural skills to students (Gentelli, 2015). As opposed to traditional teaching-learning methods, the active learning tools help to increase learners focus and attention towards learning, it promotes learner engagement, critical thinking and joy of learning.

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Different learning resources are available through various means. There exist various active teaching-learning techniques such as project-based learning, problem-based learning, Jigsaw, think pair share, brainstorming. Problem-based learning is a promising technique implemented from school levels to higher education (Butler, 1998). The primary goal of PBL is to enhance learning by requiring learners to solve problems. It gives learner real-world experience. Problem-based learning makes use of complex real-world problems to improve the learning of different concepts. The problem solving is important for learners to become effective problem solvers in their profession, and for later career success (Mazumder, 2014). Problem-based learning is focusing on problems in which learners can construct their own knowledge, develop inquiry and thinking skills to a higher level.

The main objective of this study is to use problem-based learning to develop problem-solving, self-learning abilities and research aptitude among students. To achieve this objective backward design process is used. In the backward design process, goals are finalized before assessment techniques and curriculum.

Step 1: Set objectives

The main objective is divided into sub-divided as follows:

- Objective 1: Analyse complex engineering/real-life problems using fundamental mathematics and algorithms.
- Objective 2: Design efficient solutions to solve complex problems considering the given constraints.
- Objective 3: To adapt recent techniques, algorithms, data structures for efficiently solving problems.
- Objective 4: To undertake original research in the computing domain.

Step 2: Assessment methods

- Problem-based method
- Presentation of case study
- Written exam
- Online discussion forum

Step 3: Curriculum and instructional methods



Technology forecasting: A case study of computational technologies

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ABSTRACT

This research presents trend projection and technology maturity curve of six computational technologies including three disruptive technologies namely mainframes, minicomputers and cloud computing. This investigation is beneficial to sensitize different stakeholders for making effective strategic policies and decisions. Time series data of patent and paper from U.S. patent office, European patent office, IEEE and ScienceDirect is used for forecasting. Use of two technology indicators from four sources made the forecasting results more reliable for decision makers. Six functions are tested to identify the best-fitted trend line. Results indicate that most of the technologies are better fitted to polynomial trend line of 2nd order. All computational technologies except cloud computing have undergone both upward and downward trends. Cloud computing shows a very high upward trend. Maturity curve is forecasted using the best-fitted growth curve method. Gompertz growth curve is better fitted than the logistic curve for many instances. Majority of the technologies follows introduction, growth, maturity and decline pattern. The life cycle pattern and growth rate of each technology is different. Growth pattern of mainframes and minicomputers is similar to the S-shaped curve. Growth pattern of grid computing and autonomic computing is similar to the “S-shaped” curve for research papers dataset.

1. Introduction

Technology forecasting (TF) is a purposeful and systematic approach that anticipates and understands the potential direction, rate, characteristics and effects of technological change (Firat et al., 2008). Dr. Eric Jantz, one of the pioneers in the practice of technology forecasting, identified 150 different TF techniques. Coates et al. (2001) classified TF methods into nine categories. Technology trend analysis anticipates the direction and rate of technology change. In literature, different technology forecasting methods are used to analyze a wide range of technologies namely fuel cell, food safety, optical storage, RFID, 3D TV, programming languages, operating systems, super-computers etc. Growth pattern of technology helps to analyze the technology innovation process and the industry characteristics (Lee et al., 2011). Technology maturity curve shows how a product/technology progresses and evolves over time. Christensen reported that historical data is not available to indicate the movement of disruptive technology on the S-curve. Hence, there is a need to observe the movement of the disruptive technology as it moves along the S-curve of the sustaining technology (Christensen, 2000).

In the last two decades, the use of different computational technologies in business sectors, University campuses, homes, Government

sectors, large or medium sector companies and Defence services has increased very drastically. IT industry has witnessed the journey of computational technologies from mainframes, mini-computers, cluster computing, grid computing and cloud computing. Windell (2007) reported that personal computers and minicomputers are disruptive technologies which displaced minicomputers and mainframes respectively. Cloud computing is attracting more customers' attention due to its inherent properties of resource availability, scalability, on-demand provisioning, pay per use model etc. Cloud computing is a computational model that has incorporated characteristics of mature sub-technologies namely grid computing, virtualization, utility computing, distributed computing, service-oriented architecture etc. (Iyer and Henderson, 2010; Voorsluys et al., 2010). Today cloud computing has shown the disruptive impact on industry and society. Hence, trend and maturity forecasting of computational technologies become an important topic for investigation.

This paper investigates the growth of multiple computational technologies namely mainframes, minicomputers, cluster computing, grid computing, autonomic computing and cloud computing. In this paper, trend projections and growth curve methods are used for technology forecasting. Linear and non-linear trend lines are fitted to historical data points and then best-fitted trend line is projected for future

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Differential Evolution Algorithm for Optimizing Virtual Machine Placement Problem in Cloud Computing

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Abstract—Primary concern of any cloud provider is to improve resource utilization and minimize cost of service. Different mapping relations among virtual machines and physical machines effect on resource utilization, load balancing and cost for cloud data center. Paper addresses the virtual machine placement as optimization problem with resource constraints on CPU, memory and bandwidth. In experimentations, datasets are formed using random data generator. Paper presents random fit algorithm, best fit algorithm based on resource wastage and an evolutionary algorithm- Differential Evolution. Paper presents results of Differential Evolution algorithm with three different mutation approaches. Results show that Differential Evolution algorithm with DE/best/2 mutation operator works efficient than basic DE, best fit and random fit algorithms.

Index Terms—Differential Evolution Algorithm (DE), Virtual machine placement problem (VMP), Best fit, Random fit.

I. INTRODUCTION

Cloud computing is a technology that provides on-demand services over the internet such as computing resources, data or software. The cloud computing has four deployment models i.e. public, private, hybrid and community. Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) are the three important service models in cloud computing. Cloud providers have large computing resources in large data centers which are available to users on a per-use basis [1]. A data center is a group of physical machines or hosts. Each physical machine has computing capacity, memory, bandwidth, and storage capacity [2].

Today, cloud computing is one of the most explosively expanding technologies in the computing industry. Therefore, the number and the scale of cloud service providers greatly increased. More data centers mean more

energy supply and higher operating costs. It places a heavy burden on both environment and energy resources. Optimization is essential for cloud computing providers to provide a good value to potential customers. The placement of virtual machine in cloud infrastructure is one of the main research problems. The execution or placement of virtual machine on each physical machine of the data center is the process which is called virtual machine placement. In other words, placement of virtual machine is to choose the most appropriate host designed for the virtual machine process. The placement of virtual machine has many objectives like a minimum number of physical machines used, effective usage of power consumption and resource utilization such as CPU, memory, and bandwidth. The problem is how to accomplish utmost of these properties in a allocating of the virtual machine structure, to have extra efficient, little overhead, short cost and scalable allocates of virtual machine in the cloud data centers. However, approximately of these objectives are in conflicting with each other and wholly of them may not completely be attained in one allocating scheme [2-4].

In this paper virtual machine and physical machine is measured in three-dimensional item such as CPU size, memory size and storage size. The allocation of the virtual machines taking place physical machine is similar to the 3D bin packing problem. In three-dimensional bin packing problem, a group of 3D items is necessary to be placed inner side 3D bins. The main goal of this problem is to pack as more as possible items in the bins, so that the minimum count of bins are essential. In bin packing problem two items can be placed into bins beside each other or one on top of the other but this is impossible operation in a placement of VMs. The placement of virtual machine problem is similar to Vector Packing Problem and it is also an NP-Hard problem [5, 6].

The placement of virtual machine problem is constrained optimization problem, where the objective is to allocate virtual machine to physical machine by satisfying given constraints. The problem is 'P' problem



ADAPTIVE HARMONY SEARCH FOR OPTIMIZING CONSTRAINED RESOURCE ALLOCATION PROBLEM

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Keywords:

Harmony Search Algorithm (HS);
Bin packing problem (BPP);
Virtual machine placement problem (VMP);
Meta-heuristic.

Abstract: Resource Allocation problem is finding the optimal assignment of finite available resources to tasks or users. Resource allocation problems refer to a wide range of applications such as production, supply chain management, transportation, ICT technologies, etc. Resource allocation problems are NP-hard in nature where the objective is to find the optimal allocations satisfying given constraints. Harmony search (HS) algorithm is a meta-heuristic population based algorithm found good for solving different optimization problems. This paper presents adaptive harmony search (AHS) for solving one-dimensional bin packing problem (BPP) and multi-objective virtual machine placement problem (VMP). The proposed real coded solution representation supports partial constraint satisfaction. Adaptive pitch adjustment rate (PAR) based on population diversity improves the performance of harmony search algorithm. Results show that proposed HS gives optimal solution for 50 BPP instances with 100 % success rate. The performance reduced for large instances of BPP. The proposed weighted AHS for multi objective VMP problem gives better results than genetic algorithm.

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1. INTRODUCTION

Resource allocation problems are NP-hard problems in which the objective is optimal allocation of limited resources by satisfying constraints. Resources can be manpower, assets, raw material or anything that has limited supply which can be used to achieve goals and the goals can be minimizing the cost or maximizing the profit depending on the problem [1]. It has a wide range of applications in project management, economics, storage management, scheduling, etc. The bin packing problem is an NP-hard resource allocation problem in which objects of different sizes are to be packed into bins of homogenous or heterogeneous size in such a way that minimum bins are required. The constraint needs to be satisfied in such a way that the sum of weights of objects in a bin must be no more than its maximum capacity. Bin packing problem is a well-known constraint satisfaction problem because of its wide real-life applications such as timetabling problems, scheduling problems.

Cloud computing is one of the fast-growing technology. One of the most important uses of cloud computing is that, it provides scalable/elastic resources for the application hosted on it as well as it makes full utilization of the available resources. In order to do so, a good virtual machine allocation/provisioning strategy is needed. In virtual machine management whenever a user requests a machine, an instance of virtual machine is created and is delivered to the customer. This task of creating VMs and assigning it with maximum profit and minimal wastage is known as virtual machine management.

Different resource allocation problems when solved using traditional algorithms get trapped in local maxima/minima and hence it is difficult to solve complex problems. Many researchers experimented GPU parallelization to accelerate the performance of these algorithms [2]. Most of the traditional algorithms are problem specific, which is one of the important limitations, whereas, meta-heuristic algorithms can be applied to a wide range

E-Learning for Engineering Education During Covid 19 and Impact Assessment

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Abstract- Covid 19 pandemic has affected engineering education significantly. Especially the major stakeholders of it i.e., faculty and students. Various benefits and drawbacks of e-learning were observed. This paper analyses online education during the pandemic and its impact assessment on faculties. An online survey of 150 engineering faculties of various branches in Shivaji University was conducted about the various issues of e-learning. The faculty response was analyzed and significant findings are obtained. The analysis involves Principal Component Analysis (PCA) method. The findings and lessons learned through this work will be useful for the engineering faculties to further enhance the e-learning platform and address the various questions. The work addresses the educational, personal and social impacts of online education on faculties and provides valuable suggestions for the long-term implementation of the offline-online mode.

Keywords- Engineering Education; e-learning; Covid 19 impact on faculty; e-learning guidelines; e-learning benefits;

JEET Category- Research,

I. INTRODUCTION

THE COVID-19 has brought about a lot of changes in the education system. Many universities/schools worldwide have changed from traditional undergraduate classrooms to virtual online education and blended learning environment. The instructors use diverse digital learning resources which are flexible by adopting new learning approaches in Engineering Education (Asgari S et al., 2021). The pandemic affected not only educational activities but also people's health and mental health. Many faculties and students got suffered from stress and anxiety. These psychological problems affected the teaching quality of faculty and students are also got affected while getting an online education. Various active learning techniques online quizzes, one-minute questions, flipped classrooms, true-false questions and case studies can be introduced in online education. COVID-19 has introduced one of the online education options all around the world. These lessons of online

education can be useful for our future (Chakraborty, P. et al., 2021).

In online teaching certain approaches like pre-recorded lectures; active question-answer sessions; quizzes, are more suitable and preferred by faculty and students. In online mode offering laboratory online is a challenge but virtual labs or live digital and remote labs can be the possible solutions. (Grodzki, J, et al.,2020). The virtual lab needs to improve by using software or online applications that could represent the real labs (Alkabaa, A. S., 2022). Many faculty faced a lack of hardware, software and tools for the online delivery of content. The absence of a whiteboard/ blackboard, lead to a lack of online writing tool (Asgari, S., et al., 2021).

Effective online teaching depends on various factors such as encouraging contact between faculty and students, collaborative learning, active learning, feedback, learning diversification, and application of technology (Coman, C., et al., 2020). The lack of proper internet connectivity, relatively higher workload prevented students from elevated performance while adapting to online education. The students were bored, frustrated and anxious about their study issues and future career (Aristovnik, A., et al., 2020). Thus, the pandemic has allowed students to acquire new knowledge and skills useful for their careers and future development (American Society for Engineering Education, 2020).

During the pandemic, many Engineering colleges shifted to web Based/mobile-based teaching-learning for their students. The changeover compelled them to create interest in faculty and students regarding online education. Slowly this created a strong and effective use of web-based teaching-learning systems with innovations by the faculties. The designing of teaching-learning strategies should consider the learner's and instructor's, perceptions and learning support systems (Jung, Y & Lee, J., 2018).

Several advantages are there with e-learning. Easy Accessibility, affordable in nature, flexible options, and life-long learning are some of the benefits of online pedagogy. Online learning is accessible easily to everyone with easy availability in rural and remote parts of the country. It is a relatively cheaper option for education in terms of transportation costs, accommodation, and overall cost of learning. Time flexibility is one of the best aspects of online teaching-learning (Dhawan S., 2020). Global online education

Assessing the influences of e-resources motives on their utilization

Manisha Waghmode, Manisha Shukla, Jayashree Awati, Seema Desai

Abstract— The foundation of e-learning is formalized learning delivered via electronic devices like computers, tablets, smart phone, smart gazettes, etc. This makes it possible for everyone to learn round the clock, regardless of their location or other limitations. The learning materials that are available online are known as e-resources. There are several different electronic resources available for the study, including e-books, e-journals, e-magazines, e-databases, e-newspapers, e-maps, etc. E-resource availability is always expanding. One need only sit at a console and click to access global information without any physical effort. As we can see, using online resources for a variety of objectives is necessary in today's world. Therefore, while determining their use, it is necessary to learn about the availability of different e-resources utilized by students who use online / e-learning and how it impacts them for various reasons. Using the pre-structured questionnaire, data was collected from 250 students, from the Navi Mumbai area who were using e-resources. A theoretical construct was developed based on certain assumptions to explore the relationship between utilization and reasons for using e-resources, viz., time saving, easy to use, and helping to get better grades on the test and examination. The proposed construct was examined using SPSS version- 20. The demographic profile, objectives, and hypothesis were followed while doing the data analysis. The average values of chi-square test results for the reasons (time savings, ease of use, and helping students get better grades in tests and examinations) are calculated. These are found to be 0.016, 0.015, and 0.002 for the first variable (e-learning material), 0.141, 0.016, and 0.001 for the second variable (knowledge enhancement), and 0.182, 0.096, and 0.004 for the third variable (other e-resources), respectively. The results of the data analysis shows the linkage between motives/ reasons of e-resources and its utilization. As the nature of education is predicted to become more hybrid in the future, similar research might be conducted to further identify the areas that need development in the realm of e-resources.

Keywords—E-resources, Reasons/motives, Utilization, E-learning.

JEET Category—: Technology Enhanced Learning

I. INTRODUCTION

An increasing number of individuals are choosing to learn online or electronically. The learning system substantially changed from traditional to electronic learning methods during and after the COVID-19 epidemic.

In the majority of industries, including education, we can see significant technological advances. We might state that there is

a necessity in order to learn what is needed today and to adapt to changing circumstances. Today's students use online/electronic learning methods and resources, taking into account the demands of the K to PG educational system. It has been noted that e-learning is essential in the modern world since it offers a number of advantages, including time savings, ease of use, increased information, and assistance in learning new concepts for both mentors and students. In light of this necessity, the aim of our study is to determine the factors that influence how students use electronic resources. An inferential statistical method was used to develop and verify the theoretical construct in this case.

II. LITERATURE REVIEW

Electronic resources must be easily found and accessible since they are digital or digitized content that librarians have chosen, acquired, and managed for use by library users S. Johnson et al.,

E-books, e-journals, indexing and abstracting, full-text (aggregated), reference (biographies, dictionaries, directories, encyclopedias, etc.), numeric and statistical, e-images, and e-audio/visual resources are some examples of these. Similar to this, it is crucial to gauge user satisfaction in order to enhance library services and satisfy user needs.

A. K. Tamrakar and R. G. Garg

More than ninety percent (98%) of students are aware of online information sources, although few are familiar with the ones that the university offers, according to Dumebi in a study on awareness of online information sources among university students. O. Dumebi.

Bakare concentrated on the study of students' perceptions of, access to, and usability with regard to, e-resources. D. Bakare, B. Bamigboye, and M. Chiemenem.

(Manisha, Shukla, & Shaikh) In this study, researchers investigated and looked at a range of reasons and purposes for student use of electronic resources. According to the researcher's comparative analysis, the key benefits of adopting e-resources are time savings, ease of use, more informational value, lower cost, and better usefulness. The researcher proposed a hypothetical framework of online resources and students' reading preferences. Researchers shed light on earlier literature reviews regarding the motivations and goals of using

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Improving Teaching Learning with Development of Virtual Laboratory

Seema Desai, Jayashree Awati, Manisha Waghmode

Abstract- The pandemic Covid-19 has brought a change in the education significantly. As we all know that Education Industry was the drastically hit industry in the service sector. The future of education completely depends upon experiential learning. Now the students can find their courses and books online where they can study as per their own schedule. In these times of need, online learning tools emerged as a boon. In this regard the department tried to design and implement a web-based simulation models under Virtual BIZ & Investment Lab for the student Learners. This paper talks about the benefits of Virtual lab and how it will expose the student learners to real world problem solving and decision making issues to make them industry ready.

Keywords- *Virtual lab, Industry Ready, Education, Teaching, Learning.*

JEET Category—Industry Ready Education,

I. INTRODUCTION

Virtual Lab is available to all students anywhere, easy to access and provide hands on experience. The Virtual Lab has exposed students to real environmental and business issues related to finance, operations, marketing, HRM and other business functions. The future of education completely depends upon experiential learning. Need of online learning tools emerged as a benefit. Virtual Lab has lots of paybacks such as portability, ease of access to software, less need for physical infrastructure, low costs and more flexibility.

A. Need of Virtual Lab

The pandemic Covid-19 has brought a change in the education significantly. As we all know that Education Industry was the drastically hit industry in the service sector. The future of education completely depends upon experiential learning. Now the students can find their courses and books online where they can study as per their own schedule. In these times of need, online learning tools emerged as a boon. In this regard the department tried to design and implement a web-based simulation models under Virtual BIZ & Investment Lab for the student Learners.

The Virtual BIZ & Investment Lab will expose students to real economic, environmental and business issues related to finance, operations, marketing, HRM and other business

functions and need to integrate Virtual Laboratory in the process of teaching and learning. Virtual based e-learning is seen as an effective supportive in teaching and learning process. This method is able to create a student-centered learning. Virtual education has many benefits such as movability, ease of access, reduced need for physical infrastructure, lowered costs and greater flexibility.

The annual best practice activity initiated at the institute level through scientific approach of identifying the problems faced by the department and finding a feasible solution on it made our team to first identify the problems of the department, which was done through the brainstorming session held among the members in consultation with the Head of the department. Following problems were identified through the session; biggest challenges facing online education today.

Biz Lab: Biz Lab is a virtual business Laboratory designed for Management students to offer them hands on experience on management concepts and make them industry ready.

B. Objectives

- To provide remote-access to simulation-based labs in various management areas for easy access.
- To entuse students to conduct experiments by arousing their curiosity.
- To design complete Learning Management System for supporting learning through virtual Labs.
- To provide students hands on training on online simulation software to encourage investing behavior and develop their own strategies for their portfolio.
- To develop realistic scenarios for retraining and practice till one can master the skills.

II. VIRTUAL LAB ACTIVITIES

Improving the teaching learning the following activities were conducted.

1. Expert training sessions for students on every Saturday.
2. Online Trading Platform (OTP) demonstration & hands on training.
3. Create Investment awareness through different online simulation platforms like trading view.com, optraoption.com, angel one's brokers platform, moneycontrol.com

This paper was submitted for review on August 30, 2022. It was accepted on November, 16, 2022.

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SCRAMBLED VS. CORE MERCHANDISING PRACTICES IN UTENSILS- A COMPARATIVE STUDY

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Abstract

Increasing competition in the unorganized retail landscape has threatened every retailer and utensils retailers are no exception to it. In order to survive and prosper retailers are finding ways, working out new strategies, models and practices. Core retailing and Scrambled retailing are two of business models in retailing. How these two retail models (retail formats) function to accomplish profitability primarily, in addition to accomplishing non-primary business goals is the foundation of this research work. This research work closely investigates the role and intricacies of financial and non-financial aspects in creating and delivering value.

Key words: core retailing, scrambled merchandising, financial aspects, non-financial aspects...

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RETAIL MODELS AND COMPETITIVE LANDSCAPE IN UTENSILS SHOPS- A COMPARATIVE STUDY

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Abstract:

Increasing competition in the unorganized retail landscape has threatened every retailer and utensils retailers are no exception to it. In order to survive and prosper retailers are finding ways, working out new strategies, models and practices. Core retailing and Scrambled retailing are two of business models in retailing. How these two retail models (retail formats) function to accomplish profitability primarily, in addition to accomplishing non-primary business goals is the foundation of this research work. This research work closely investigates the role and intricacies of financial and non-financial aspects in creating and delivering value.

Key words: core retailing, scrambled merchandising, financial aspects, non-financial aspects...

1. Introduction:

The retail sector in India has grown rapidly in the last few decades. Such growth in retail sector will remain same in near future and if the growth rate is low due to certain reasons like global economic slowdown, the retail market is not just one entity among other sectors. It consists many divisions such as the food and grocery retail segment, apparels, jewellery, book, pharmacy, entertainment, accessory, utensils retail and many more.

Scrambled merchandising: Today many retailers trying to maintain rather focusing on increasing their revenue by offering variety of products; such practices are called as scrambled merchandising.

Working definitions

Scrambled merchandising in Utensils shops: This is a retail practice followed by utensils retailers in order to increase the traffic inside the store and benefit from (earning profits) selling variety of product categories which are not in any way related to one another and promoters original business of utensils.

Financial and non-financial aspects: This study emphasizes three non-financial aspects: human resource management, sales, marketing management, and store management. This study stresses the significance of three financial aspects of retail business: procurement of funds, utilization of funds, and working capital management.

Core retailing in utensils shops: The present study has broadly compared two kinds of retail practices in utensils i.e. core retailing and scrambled retailing (scrambled merchandising). Core retailing means the retailer's original business in which he sells only those products related to each other. These shops hold a specific product line or a few limited product lines consistent in some way. For instance, selected products such as garden tools are available at specialty garden supply or hardware shops. Core retailers of utensils shops sell tools for cooking and baking. They are usually temperature-resistant materials, such as metal, wood, or high-grade plastic, like silicone. Consumers often employ utensils to prepare, handle, or serve food.



A review on surface coating techniques on Mg based bio-degradable implants

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ABSTRACT

Cobalt-chromium alloys, Stainless steel and alloys of titanium are the traditional implant materials used in orthopaedic applications. However, these implants induce stress shielding effect and release harmful ions in the human body. Also, on the completion of bone healing, these must be removed by performing additional surgery. Magnesium (Mg), being biocompatible and biodegradable, can be a potential replacement for these traditional implants. But, Mg is having low corrosion resistance in the physiological environment. Surface coating proves to be an elixir to ameliorate the corrosion resistance of Mg. Biocompatibility and biodegradability are the paramount requirements of the coating material. Therefore, Hydroxyapatite (HA) is preferential material for coating. This review is intended to study the microstructure, characteristics and degradation behaviour of HA-coats deposited on Mg-based implants by electrochemical methods. The beneficiaries of this study will have a guideline for selecting particular compatible process and parameters to maximise the performance of implants.

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1. Introduction

Magnesium (Mg), being biodegradable and biocompatible, can be a promising candidate to replace traditional implant materials. It has the natural ability to degrade when placed within a physiological environment. The degradation of Mg in the physiological environment releases Mg²⁺ ions, which cause no harm to the human body. Thus the requirement of additional surgery is eliminated. But the degradation of Mg in physiological environment is rapid. Therefore the Mg-based implant may lose its integrity before accomplishment of the bone healing process. Therefore, improvement in corrosion performance of these biodegradable alloys is strongly needed. One of the valuable methods is a surface coating to slow down the corrosion rate of Mg alloys. These coats will not act as perfect inhibitors for corrosion but will decelerate the implant's initial corrosion rate. Along with implants, coatings will also degrade in the body gradually. The HA coating and its

degraded product are non-toxic, biocompatible and biodegradable [1]. Hence, HA is extensively used for coating the Mg-alloyed substrate. This review is mainly intended to understand the degradation behaviour of HA coated Mg-based implants where the HA is deposited by various electrochemical methods.

2. Mg as orthopaedic biomaterial

In Comparison with traditional implants, the yield strength, modulus of elasticity, as well as the density of Mg-alloys are lower and nearer to human bone. This closeness of Mg's properties with natural bone, limits the stress shielding effect, which is commonly observed in the traditional implant. Table 1 illustrates that Mg's mechanical properties are closer to the bone. The prime biological functions such as enzymatic reactions, normal heart rhythm, muscle contraction, synthesis of protein, DNA and RNA involve Mg [2]. In the human body, Mg is available mainly in teeth and bones. It has a vital role in remodelling of bone. The Mg²⁺ ions augment the process of bone healing by encouraging deposition of calcium. Almost no shreds of evidence that highlight the ill-effects of Mg are

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Inculcating Design Thinking Methodology in the Minds of First Year Engineering Students: A Step Towards Entrepreneurial Thinking

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Abstract—Every economy needs entrepreneurs to fill gaps and promote innovative products with the necessary expertise and hard work. An entrepreneurial culture hastens a nation's overall development because it promotes nurturing a greater number of venture capitalists which eventually boosts nation's economy. Rajarambapu Institute of Technology (RIT) Rajaramnagar, an Autonomous Institute has adopted choice-based curriculum system (CBCS) in 2017-18 which included Entrepreneurship development (ED) as one of the four tracks with the objective to transform students into entrepreneurs. It was observed that, there is dire need to initiate entrepreneurial thinking course in first year engineering curriculum to acquaint students with problem solving and creative thinking skills, communication skills and teamwork which are very important for an entrepreneur. Hence, the course 'Creativity, Design Thinking and Entrepreneurial Mindset' was commenced as an open elective for first year engineering students from the academic year 2018-19. In this paper, course details are presented along with course outcomes and In-Semester evaluation (ISE) plan. Design thinking methodology is illustrated phase wise with help of students' project case study. Innovative active learning tools and techniques were developed to map the required skills for an entrepreneur. Due to this strategically developed active learning tools, course CO attainment has improved from the year 2018-19 to 2021-22; CO1 has improved by 37.09 %, CO2 increased by 47.54%, CO3 by 40.30 % and CO4 improved by 28.98 %. Moreover, number of prototypes developed by the students were 4 in the year 2018-19, which elevated to 15 (increased by 275 %) in the year 2021-22. Furthermore, there was improvement in final year ED track students of 2021-22 as compared to 2020-21; 25 students entered ED track during the year 2020-21, out of which 6 students (24 % students) converted their ideas into startups, while during the year 2021-22, 28 students opted for ED track, from which 13 (46.4 % students) established their startups. Lastly, ED track mentors survey results are reported for the year 2020-21 and 2021-22, which clearly illustrate that ED track students' entrepreneurial knowledge and abilities, students' attitude towards entrepreneurship as a career option and students' entrepreneurial self-efficacy has improved than the previous years.

Keywords— Design Thinking; Entrepreneurial culture; Startup Ecosystem; Active learning.

I. INTRODUCTION

Entrepreneurs play a vital role in building nation's economy. They help in solving customers' pain points and thus lead to the development of new product, technology or service which eventually creates an employment. As a result, government place a high priority on promoting entrepreneurial activities because they are correlated with a nation's level of economic growth (Bosma, Hill & Ionescu-Somers, 2020). India, which has the second-highest population in the world and aims to have the third-largest economy by 2030, is making significant efforts to cultivate an entrepreneurial culture in this environment (Hassan, Anwar, Saleem, Islam & Hussain, 2021). However, there are many challenges involved in penetrating this Entrepreneurial culture in the society (Irfan, Rajamallaiah & Ahmad, 2018). The majority of engineering students concentrate primarily on MNC jobs because they believe these positions have a bright future (Lynch, Kamovich, Longva & Steinert, 2021). Therefore, there is a tremendous need to instill an Entrepreneurial culture in students' brains, which will help few of them become successful Startup founders. Rajarambapu Institute of Technology (RIT), Rajaramnagar has implemented choice-based curriculum system (CBCS) since 2017-18. According to this system, final year students can opt for any one choice between Undergraduate research experience (URE), Industry internship and projects (IIP) and Entrepreneurship development (ED) (Suryawanshi, Patil & Kulkarni, 2021). However, it was observed that ED track students are lagging in some prerequisites required for becoming successful startup owners. As a result, we determined which skill sets should be covered in a foundation course during the first year of engineering. Problem solving, creative thinking, communication skills and teamwork are very crucial primary stages of entrepreneurship journey (Jonassen, Strobel & Lee, 2006; Passow & Passow, 2017). Secondly, young entrepreneurs must also comprehend how technology can be successfully commercialized and brought into the market (Barr, Baker, Markham & Kingon, 2009; Bilén, Kisenwether, Rzasas & Wise, 2005). In addition, students have myths about creativity, innovation and feel that creativity is not methodical. Hence there was overall need to develop students' entrepreneurial mindset which gave rise to foundation course entitled

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PAPER

Assessment of surface integrity and hole quality in graphene-based NMQL Micro-drilling of ceramic-coated Nimonic 90 for gas turbine applications

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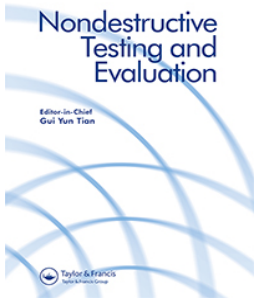
Keywords: micro-drill, nimonic 90 superalloy, gas turbine, biodegradable, acid oil, thermal barrier coated, graphene nanofluid

Abstract

Nickel-based superalloys have superior strength properties at higher temperature ranges and thus have become increasingly important in manufacturing gas turbine components for aerospace industry. However, the desire for a larger thrust-weight ratio has raised the typical operating temperature in a gas turbine; thus, thermal barrier coatings are essential. The present work compares the micro-drilling performance of ceramic-coated Nimonic 90 nickel superalloy under dry, flood and 0.5% graphene-based NMQL conditions. The biodegradable acid oil was used as a base oil, and the assessment comprised surface integrity in terms of surface roughness inside the hole and micro-crack formation and hole quality based on the diametrical overcut and taper ratio. Spindle speed (1000, 2000 and 3000 rpm) and feed rate (3, 6, and 9 $\mu\text{m}/\text{rev}$) were changed in three levels, and Taguchi L9 array was applied for the design and analysis of the experiments. Ti-Al-N coated tungsten carbide drill of diameter 700 μm was used, and Analysis of variance (ANOVA) revealed that spindle speed was the utmost important parameter impacting surface roughness, while speed and feed rate both influenced overcut and taper ratio. 0.5% Graphene-based NMQL lubrication condition significantly diminished the surface roughness by 52.67%, overcut by 46.86% and the taper ratio by 48.87% as compared to dry condition. Furthermore, in the NMQL condition, micro-crack development and ceramic layer damage were minimized, resulting in better surface integrity. In addition, burr development was minimized at the hole periphery, and tool wandering was not seen in the NMQL condition. Hence the hole quality was superior in NMQL conditions as compared to the dry and flood lubrication.

1. Introduction

Superalloys exhibit excellent mechanical properties at elevated temperatures. They have superior creep properties, making them sustainable for a prolonged time at a temperature near their melting point [1]. In addition, superalloys have high oxidation and corrosion resistance, making them possible candidates for specific applications [2, 3]. There are various types of superalloys like Iron-based, Cobalt-based or Nickel-based. However, Nickel-based superalloys possess high strength at elevated temperatures. They thus are widely preferred in the manufacturing of aero-engine (gas turbine) components such as combustor cans, afterburners, casing, turbine blades etc [4–6]. Nickel superalloys account for more than 40% of the weight of an aero-engine [7]. The thrust-weight ratio of an aero-engine is directly proportional to the inlet temperature of a turbine [8]. However, high temperature increases the stresses and oxidation which decreases the service life of the engine components [9]. Hence thermal barrier coatings (TBCs) are extensively used to prevent the engine components from high heat, and thus thrust-weight ratio can be maintained [10]. TBCs generally consist of a base material on which the bond coat is applied, and a ceramic layer is sprayed, generally 150–200 μm , which has low thermal conductivity [11]. In addition, closely spaced micro holes are required to be drilled on engine components which



Empirical-based DA and ANN to diagnose misalignment in rotor-bearing system

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An Attempt to Enhance the Visualization, Imagination and Drawing Skill of Freshman Engineering Students through Problem Based Learning Approach

Sachin N. Sawant, Pankaj S. Ghatage, Sachin K. Patil

Abstract— The Engineering Drawing is one of the important and compulsory course for all the engineering students in first year engineering. This course improves the visualization, imagination and drawing skill of the students which are helpful them to draw their ideas clearly and rapidly, to read the drawing drawn by others and to create successful design. Engineering Drawing course includes projection, section and development of solids in which students are expected to imagine, visualize and develop the drawing as per given conditions also it includes orthographic projections in which 3D objects are required to convert in 2D drawing. The students of first year engineering find this task difficult due to no prior basic knowledge of technical drawing, poor imagination and visualization skill. Hence the attainment of the course learning outcome related to these topics is recorded low. To overcome this problem, a problem based learning approach implemented along with classroom teaching in order to enhance the, visualization, imagination and technical drawing skill of first year engineering students. In this article, the author has presented the efforts taken to improve the visualization, imagination and drawing skill through active engagement of students for learning in the classroom and outside of classroom. Due to systematic implementation of problem based learning (PBL), student's engagement towards learning, attainment of the course outcomes (COs) and overall exam result of the course have been improved.

Keywords— Course Learning Outcome, Engineering Graphics, Engineering Drawing, Problem Based Learning

JEET Category—Engineering Education for sustainable development

I. INTRODUCTION

Engineering drawing is a universal technical language of an Engineers which is globally accepted technical language to communicate between engineering professionals. Based on Engineering drawing skill Engineers can able to create designs, represents them on drawing sheet and finally prepare blue print before the manufacturing (Murthy et al., 2015). The ability to understand important topics in engineering drawing such as orthographic projection, isometric drawing, hidden views, and sectional views are very critical as it represents the fundamentals of engineering drawing education (Serdar and De

Vries ,2020). Engineering drawing is the compulsory course in first year engineering class to improve the drawing and imagination skill of the students, however due to lack of prior basic knowledge of technical drawing, poor imagination skill of the students and time restrictions in the classroom teaching, it is challenging for the faculty members to train the students for good drawing skill with conventional teaching methodology. Hence many faculty members implemented innovative teaching methodologies. Murthy et al. (2015) implemented Augmented Reality (AR) as a tool for teaching Engineering Drawing and improved 3D visualization of the students. Chen et al. (2011) developed tangible and AR models for Engineering Drawing course to increase the learning interest of students and to improve the visualization of the students. Pucha and Utschig (2012) implemented learning-centered strategies like case studies and real-world problems for freshman engineering students while teaching Engineering Drawing course. Authors have presented the impact of the learning-centered strategies on students learning, engagement and performance. Soundattikar and Naik (2016) conducted case study while teaching Total Quality Management course. They found that case study is effective tool for engaging students with different learning styles. Perumaal (2018) created effective learning environment for the course Engineering graphics through different active learning activities to improve the spatial visualization of students. Govil (2021) introduced sketching as an iterative tool in engineering education to improve visual communication skill of the students. Shreeshail et al. (2021) implemented problem-based learning technique to impart engineering drawing standards. Zemke (2018) discussed case study on efforts taken to teach Engineering Graphics for blind students. The author has presented the progress of blind students while learning orthographic and isometric projections. Moyano et al. (2009) presented the case study on Engineering Graphics learning, author evaluated the prior knowledge and background of the freshman engineering students. Author concluded that the rate of students' cognitive development does not follow the efforts taken by faculty member during teaching learning process, hence new suitable methodology could be developed to improve the cognitive abilities of the students. Potter and

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Original Article

Effect of copper, tungsten copper and tungsten carbide tools on micro-electric discharge drilling of Ti–6Al–4V alloy



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ABSTRACT

Achieving microholes with dimensionally higher accuracy on the Ti–6Al–4V alloy using traditional machining techniques is challenging. Micro-electric discharge drilling (μEDD) has become a prominent machining technique in fabricating microholes. Though there are extensive applications of μEDD in producing microholes in difficult-to-cut materials, the appropriate tool materials and process parameters determine the process characteristics and accuracy. Because of the uneven machining and inadequate debris flushing, the technique is less productive and results in high overcut (OC) and hole taper (HT) for the microholes as well as poor material removal rate (MRR). Additionally, the rate of electrode wear affects hole precision. To address these issues, a rotating tool electrode set-up was used to drill microholes in Ti–6Al–4V alloy. The impact of three distinct electrode materials, copper (Cu), tungsten copper (WCu), and tungsten carbide (WC), as well as various process parameters, was investigated. The μEDD was accomplished by changing input process parameters, viz. voltage (V), capacitance (C) and tool rotation speed (TRS) and using Cu, WCu and WC tool electrodes to examine their influence on the process response variables such as MRR, TWR, OC, and HT. The experiments for each electrode were designed using a Taguchi-based L9 array, and the results were examined using Analysis of Variance (ANOVA). Capacitance was found to be the most significant electrical parameter in the μEDD of the titanium alloy. At 10,000 pF capacitance, the WCu electrode showed the highest MRR 0.009247 mm³/min, which was 6.11% and 21.92% higher than the Cu and WC electrodes. In contrast, the WCu electrode had the lowest tool wear rate (TWR) of 0.002033 mm³/min, which was 280.61% and 61.61% less than the Cu and WC electrodes, respectively. The WC electrode exhibited more accuracy by reducing the OC and HT compared to the Cu and WCu electrodes. The Cu tool electrode owing to its lower melting point and high thermal conductivity ensued in higher TWR than the WCu and WC

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Circular supply chain implementation performance measurement framework: a comparative case analysis

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ABSTRACT

Circular supply chain (CSC) has gained traction amongst academicians, practitioners, and policymakers across the world due to its wide range of sustainable benefits to business organizations. CSC amalgamates the circular economy (CE) thinking into supply chain operations of industry and improves the three sustainability dimensions of the organizational performance. However, manufacturing organizations in developing economies are finding difficult to measure the impact of CSC adoption on organizational performance. Therefore, this research aims to explore the CSC performance measures and to develop a performance measurement framework for assessing the impact of CSC implementation on business organizational performance. This research proposes a modified balanced scorecard (BSC) based hybrid framework of Pythagorean fuzzy analytic hierarchy process (PF-AHP) and Pythagorean fuzzy weighted aggregated sum product assessment (PF-WASPAS) methods. The effectiveness of the proposed framework is validated through an empirical case study of an Indian manufacturing company. Further, the proposed framework is tested with other three Indian manufacturing companies and their results are compared with the case company. The finding reveals that the overall performance of empirical case company is 62.88% based on define set of performance measures and performance of other three companies are 64.51, 56.47, and 52.43%, respectively. The outcomes of this study shows that the proposed research framework is more reliable, consistent, and robust with circular perspectives and it also offers an effective way to measure and benchmark the impact of CSC adoption on organizational performance. This research contributes to the knowledge of CSC management for achieving sustainability in the business environment.

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KEYWORDS

Circular economy; circular supply chain; performance measures; modified BSC; PF-AHP; PF-WASPAS

1. Introduction

In the present dynamic and cutthroat business environment, each manufacturing organizations want to have their production network more feasible towards three elements of sustainability (Abbasi et al. 2022; Lahane, Kant, and Shankar 2020). Many of the business organizations across the globe are facing the various issues of unsustainability, such as climate change, global warming, waste generations, resource paucity, and environmental deprivation (Das, Konietzko, and Bocken 2022; Bressanelli et al. 2021). Thus, to deal with these issues and threats of unsustainability, organizations need to adopt innovative and sustainable initiatives into their supply chain practice. Lately, the term circular supply chain (CSC) has received much more interest from academicians, practitioners, and managers of a business organization (Lahane and Kant 2022b; Bag et al. 2022). CSC acts as a one of the most effective and sustainable strategies for the waste management in a manufacturing organization. CSC assimilates the circular economy (CE) principles into supply chain operations. It is considered as an alternative approach to linear

economic model (i.e. extract-produce-use-dump), where products are dumped into landfill after end-of-use phase (de Souza et al. 2022; Batista et al. 2018; Jain, Jain, and Metri 2018).

CSC maintains the materials, products, components in circular loop as long as possible till the maximum value can be obtained from it (Angelis, Howard, and Miemczyk 2018). CSC focuses on the CE 6Rs principles. CSC network is design based on recuperative aspects of CE (Bressanelli et al. 2021). CSC emphasizes on value gain aspects of CE (Pinheiro et al. 2022; Mhatre et al. 2021). It also deals with the triple bottom line concept of sustainability (Goyal, Chauhan, and Mishra 2021). The businesses organizations can attain numerous benefits, such as reduces emissions, reduce resource scarcity issues, improves competitiveness, reduces energy usage, improves end-of-life strategy, improves product design, improves material and resource efficiency, improves social and economic efficiency, improves sustainability and productivity, etc. by adopting CE in supply chain of an industries (Farooque et al. 2022; Mhatre et al. 2021; Farooque et al.

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Vibration Analysis of Deep Groove Ball Bearing Using Finite Element Analysis and Dimension Analysis

Condition monitoring of rotor dynamic is recognized as an advanced preventative maintenance technique for fault-free operation. Faulty bearings in rotating machines may cause severe problems and even untimely breakdowns. This work demonstrates the power of the finite element analysis (FEA) model and dimension analysis technique (DAT) to analyze the effect of the depth and slope angle of surface faults on the bearing contact characteristic. Experimentation is performed to investigate the vibration characteristics of ball bearings. The FEA, DAT, and experimentation show that vibration amplitude is a vital function of surface fault size. The current approach of FEA with DAT reflects their reliability and accuracy for the diagnosis of rotor systems. The present method was found effective in predicting vibration amplitude and defect frequency within acceptable error.

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Keywords: vibration, fault diagnosis, finite element analysis (FEA), dimension analysis technique (DAT), rolling element bearings

1 Introduction

Rolling element bearings, like a ball, cylindrical, or conical rolling bearing, are majorly used in power generation industries, process industries, machine tools, and automobiles. The rolling bearing is repeatedly invoked as antifriction bearings. When preferred and appropriately tested, they can operate effectively over a lengthy duration of time. Due to fatigue behavior, the life span of a rolling element bearing is definite. Ball bearings implicate a point association between the races and the balls, which produces high stress at the contact. Failure of bearings causes malfunctioning of the machinery and shut down, which impacts the final product's price and quality. It is estimated that 30% of the machinery faults are attributed to antifriction bearings. Therefore, condition monitoring of the bearings in rotating machinery is crucial. A new regulating instrument for the shift from reactive to proactive is condition-based monitoring in industries. Premature failures can be identified and analyzed with the help of conditional monitoring, which reduces downtime and costs.

Different fault diagnosis techniques are developed and utilized efficiently to forecast imminent machine failures at their current stage. Some include vibration analysis, oil debris analysis, non-destructive testing, thermal, noise, and motor current analysis. It is among the most common methods for analyzing vibration. By analyzing vibration signatures, one can predict the condition of the rotor-bearing systems in rotating machinery using experimentation or model-based techniques. The model-based technique can convert complex engineering problems into simplified mathematical models. The model-based theoretical approach builds the circumstances for the effectiveness of experiments and evaluation of mathematical models with experimental results. Therefore, the model-based vibration conditioning monitoring techniques have been to pick up in-depth study throughout the earlier decades. Using dimensional analysis and signal processing techniques makes it feasible to attain significant characteristic frequency

from the vibration signals. The present work uses the innovative technique of model-based study to determine the effect of speed, load, surface defects size, and other physical parameters on bearing failure.

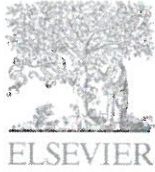
Trevor and Farshid [1] investigated crack induction and spall evolution in the rolling element employing a finite element model subject to rolling contact fatigue. This model uses the continuum deterioration method to seize the induction and reproduction of fatigue fracture, which eventually shows the creation of a surface spall. Wang et al. [2] proposed tacho-less order tracing technique centered on order spectrogram conception. The ridge eradication method is needed to assess the spontaneous frequency of a revolving harmonic. The order spectrogram is constructed, and rotating speed fluctuation is suppressed by non-stationary interference. With this technique, fault orders are disclosed, and the type of bearing fault is determined.

Neisi et al. [3] illustrated a simulated model to examine the stresses of touch-down with a crack bearing. The finite element analysis (FEA) is used to model the rotor, and friction contacts are determined between touch-down bearing and rotor. Hertzian contact stresses of rolling elements and stress intensity factors for crack initiation are studied, showing an increment in dynamic friction coefficient and air gap growth upsurges Hertzian contact stresses. Mishra et al. [4] studied a simulation model for ball bearing with a higher degree of complexity. The bearing kinetics based on the motion model in MATLAB deprived of traction and contact dynamics with bond graph also considered spatial multi-body model using ADAMS software. Shi et al. [5] suggested an FEA model elaborating the influences of fracture on contact characteristics in the bearing. The dynamic model with crack is investigated for bearing vibration.

Bonneau and Absi [6] presented a numerical technique for grooves in journal bearings. Reynolds equations are determined using the finite element (FE) approach and Newton-Raphson for nonlinearity discretized equations. Narrow-groove theory (NGT) is analyzed with the smooth bearings with various configurations. Bonneau et al. [7] developed the Reynolds equation for gas thrust bearing and grooved gas face seal established on the FE. Integration by parts reduces the complexity of uneven thickness, and the upwind technique is used for solving oscillating solutions. Iseli et al. [8] analyzed dynamic characteristics of spiral grooved gas

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Fault identification in a nonlinear rotating system using Dimensional Analysis (DA) and central composite rotatable design (CCRD)

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ABSTRACT

This paper investigates the effect of bearing clearance and external defects on the vibrational behavior of rolling element bearing. An integrated nonlinear model is developed using the Buckingham pi theorem to detect imminent bearing faults. Vibration responses acquainted experimentally by varying speed, clearance, and external defect on the rotor-bearing system are processed using fast Fourier techniques (FFT). Result analysis reveals the dominance of clearance and external defects on the dynamic stability of the rotor-bearing system. The maximum vibration amplitude among the all trials performed was 2.201 mm/sec at 1300 rpm shaft speed, 75 gm unbalance mass, and 0.025 mm bearing clearance. A close agreement of experimentation with model prediction assures accuracy and reliability. Central composite rotatable design (CCRD) shows its effectiveness in performing the design of experiments with understanding procedures. The current approach highlight's fault identification and interactions with less than 9% error that satisfy the demands of current condition monitoring or diagnosis of industrial rotor-bearing systems.

1. Introduction

The rotating component's dynamic properties mainly determine the performance of rotary equipment with rolling element bearings. In regular operation, rolling bearings typically have local flaws, radial clearance, and Hertzian contact, which result in load distribution, fatigue life, and vibrational issues. Bearing failure is the most common cause of rotary machinery failure, which necessitates continuous status monitoring to priorities complicated dynamics, thereby avoiding costly damage and production loss. As a result, researchers have concentrated their efforts on diagnosis and continuous monitoring. As a result, the current study focuses on identifying and classifying clearance levels and local abnormalities. Identification and classification of faults and precise calculation of clearance level are all part of effective condition monitoring, which leads to cost-effective and appropriate corrective procedures.

Gupta et al. employs FEM to model the nonlinearity effects of the flexible rotor-bearing system. Investigation for nonlinear dynamic

response with clearance on unbalanced flexible rotor braced by a deep groove ball bearing is carried out [1]. In rotor bearing system the nonlinearity is produced due to combined effect of radial clearance and unbalance [2]. Lavanya et al. studied heterogeneous faults in IoT based Wireless Sensor Networks and implemented a novel energy-efficient heterogeneous fault management technique (IWSN). The proposed scheme employs three distinct diagnostic methods to efficiently identify heterogeneous faults. Classifying heterogeneous faults is made easier by the Tuned Support Vector Machine classifier, which uses the Hierarchy-based Grasshopper Optimization Algorithm to optimise tuning parameters. [3]. Prasanth implemented Underwater Wireless Sensor Networks (UWSN) with relatively better network survivability, the Energy-efficient Fault detection and Recovery Management (EFRM) approach was proposed. To achieve effective fault detection across the entire network, the Hidden Poisson Markov model has been integrated into EFRM [4]. This work uses the K-nearest neighbour in tandem to investigate multiple faults in a rotor-bearing system. The proposed methods produce promising results in predicting and classifying multi-fault with

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Dynamic Characterization of MR Fluid-Based Dynamic Vibration Absorber

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Abstract

A magnetorheological (MR) damper is effective and economical for miscellaneous applications in automotive, mechanical, civil, and relative fields. A parameter tuning methodology independent of manual trial-and-error has received much technical interest for controlling vibrations. The present work contributes mathematical and Simulink modeling followed by MR damper design and development for vibration optimization of the single degree of freedom system. A Simulink model of an MR damper is performed on the mathematical model for vibration control, and the MR damper's tuning parameters are experimentally investigated to control the resonance frequency. Theoretical simulated results and its experimental verification show that increasing current raises the force to control the resonance frequency in an MR damper. The present approach provides a concise and improved platform for dynamic vibration absorber in the current potential market and the highly interested control community for the development of the distinctive attributes of the MR Damper.

Keywords MR damper · Vibration control · Modeling and simulation · Dynamic vibration absorber

List of Symbols

A	Parameter to determine the hysteresis loop in the Bouc–Wen model (dimensionless)
c_0	Viscous damping at large velocities, Ns/m
c_1	Dashpot used to introduce the nonlinear roll-off observed at low velocities, Ns/m
c_2	Damper of the secondary system, Ns/m

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C_{0b}	Constant that determines C_0 , Ns/m
C_{1a}	Constant that determines C_1 , Ns/m
C_{1b}	Constant that determines C_{1b} , Ns/mV
F	Frequency of external force, Hz
F_d	Force of damper, N
F_o	Amplitude of exciting force due to eccentricity, N
e	Radial eccentricity of its cam, m
K_0	Preload stiffness, N/m
K_1	Primary (supporting) system stiffness, N/m
K_2	Secondary (absorber) system stiffness, N/m
K_3	Accumulator stiffness, N/m
m	Mass of eccentricity, kg
m_1	Primary mass, kg
m_2	Secondary (absorber) mass, kg
z, \dot{z}	Variable to depict the history dependence of applied response, Hz
X	Displacement of the damper piston, m
\dot{y}	Velocity of the damper piston, m/s
N	Wen model (dimensionless)
x_0	Initial displacement of spring k_1 associated with nominal damper force to accumulator, m
x_1, x_2	Displacement of m_1 and m_2 , m
\ddot{x}_1, \ddot{x}_2	Acceleration of m_1 and m_2 , m/s ²
A	Scaling value for Bouc–Wen model, N/m
α_a	Constant that determines α , N/m





A multi fault classification in a rotor-bearing system using machine learning approach

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Abstract

Modern condition monitoring of rotating machinery became intelligent for enhanced reliability, productivity, and safety. Signal processing has been collaboratively implemented with several machine learning approaches to increase the effectiveness of the fault diagnosis. This paper explores fundamental bearing frequencies withdrawn from a vibration response as novel extracted features. Experimentally obtained vibration data at diverse operating conditions have been analyzed and supplied to a supervised machine learning algorithm K nearest neighbor network (KNN) for fault classification. The result shows that the KNN algorithm based on the novel features provides 98.5% fault classification accuracy and feels promising for condition monitoring of industrial rotating machines.

Keywords Fault diagnosis · KNN · Bearing characteristics feature · Signal processing

Abbreviations

KNN	K-nearest neighbor
ANN	Artificial neural network
SVM	Support vector machine
LSTM	Least squares support vector machine
EMD	Empirical mode decomposition characteristics
REB	Rolling element bearing
MS	Mild steel
CNN	Convolutional neural network
GANs	Generative adversarial nets
WT	Wavelet transform

SIRCNN	Stacked inverted residual convolution neural network
HT	Hilbert transform
IMF	Intrinsic mode functions
DA	Dimensional analysis

1 Introduction

Extensively increasing automation has increased the complexity of the modern industrial system and raised the standards for precision. This has increased demand for modern, efficiently run mechanical equipment. Thus, health monitoring of complicated machinery is thus an essential but costly endeavour. Rolling element bearings (REBs) are an integral component of widely used industrial equipment and determines the equipment's service life. Over the lifespan, the equipment loses its durability and performance, and failure risk increases simultaneously. The condition-based maintenance scheme should be an integral part of any preventative maintenance plan [1]. Excessive vibration is the most common reason for a system failure, and the most common source of vibration is fault present. Local and widespread defects in the machine may lead to catastrophic failure. Bearing failure in any of the heavy rotating machines or assembly lines can result in a shutdown, affecting the overall cost and quality of the product. Recently, substantial research has been conducted on defect classification without disrupting

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A Novel Incipient Fault Detection Technique for Roller Bearing Using Deep Independent Component Analysis and Variational Modal Decomposition

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Roller bearing failure can result in downtime or the entire outage of rotating machinery. As a result, a timely incipient bearing defect must be diagnosed to ensure optimal process operation. Modern condition monitoring necessitates the use of deep independent component analysis (DICA) to diagnose incipient bearing failure. This paper presents a deep independent component analysis method based on variational modal decomposition (VMD-ICA) to diagnose incipient bearing defect. On a newly established test setup for rotor bearings, fast Fourier techniques are used to extract the vibration responses of bearings that have been artificially damaged using electro-chemical machining. VMD techniques diminish the noise of the measurement data, to decompose data processed into multiple sub-datasets for extracting incipient defect characteristics. The simplicity of the VMD-ICA model enriched the precision of diagnosis correlated to the experimental results with weak fault characteristic signal and noise interference. Moreover, deep VMD-ICA has additionally demonstrated strong performance in comparison to experimental results and is useful for monitoring the condition of industrial machinery. [DOI: 10.1115/1.4056899]

Keywords: rolling bearing, incipient defect, vibration analysis, deep independent component analysis, rolling element bearings

1 Introduction

Rolling element bearings, like a ball, cylindrical, or conical rolling bearing, are majorly used in power generation industries, process industries, machine tools, and automobiles. The rolling bearing is repeatedly invoked as anti-friction bearing. When preferred and appropriately tested, they can operate effectively over a lengthy duration of time. A rolling element bearing's average life-span is known because of fatigue behavior. Ball bearings implicate a point association betwixt the races and the balls, which produces high stress at the contact. Failure of bearings causes deficient of the machines and abandon, which impacts the final product's price and quality. Anti-friction bearings are believed to be responsible for 30% of machinery failures. As a result, bearing condition monitoring in rotating machinery is extremely crucial. A new regulating instrument for the shift from reactive to proactive is condition-based monitoring in industries. Premature failures can be identified and analyzed with the help of conditional monitoring, which reduces downtime and costs.

Different fault diagnosis techniques are developed and utilized efficiently to forecast imminent machine failures at their current stage. Some include vibration analysis, oil debris analysis, non-destructive testing, thermal, noise, motor current analysis, component error, oil flowrate, oil viscosity, and statistical features. It is among the most common methods for analyzing vibration. Using experimentation or model-based techniques, one can forecast the health status of bearings in rotating machinery's by analyzing vibration signatures. The model-based technique can convert complex

engineering problems into simplified mathematical models. The model-based theoretical approach builds the circumstances for the effectiveness of experiments and evaluation of mathematical models with experimental results. Therefore, the model-based vibration conditioning monitoring techniques have been to pick up in-depth study throughout the earlier decades. Using signal processing techniques makes it feasible to attain significant characteristic frequency from the vibration signals. The present work uses the innovative technique of model-based study to determine the effect of speed, load, surface defects size, and other physical parameters on bearing failure.

Stefatos and Hamza [1] developed Tennessee Eastman challenge technique by independent component analysis (ICA)-based methodology to identify the primary source of the fault. Fan and Wang [2] proposed kernel-dynamic independent component analysis for fault identification. Plotting of non-linear contribution with Tennessee Eastman process showed greater effectiveness. Mao et al. [3] developed deep transfer learning with a pre-trained VGG 16 model for fault identification in auxiliary bearing. Deep features with fine-tuning technique are used for training model with support vector machine.

Cai et al. [4] developed noisy independent component analysis for condition monitoring. Fourth order cumulant matrix with joint diagonalization is estimated by noisy intercluster separation algorithm. Three variable system with stirred tank reactor system detects fault by recursive independent component kurtosis. Cai and Tian [5] investigated robust independent component analysis (Robust ICA) algorithm for extracting non-Gaussian features for robust whitening and determination. Cai et al. [6] developed a model for milling chatter with energy entropy and variational mode decomposition (VMD). Number of modes with quadratic penalty is an input function to VMD for kurtosis selection with total energy absorbed by frequency band. Simulation and

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Crack Detection in A Cantilever Beam Using Correlation Model and Machine Learning Approach

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Abstract: - Crack in a structural member alters local stiffness that affects the dynamic response, such as natural frequency and mode shapes. The purpose of structural health monitoring is to diagnose and predict structural health. In this paper, a correlation model is developed to detect crack parameters, i.e., crack location and crack depth, in the beam. To evaluate the authenticity of the developed correlation model, the Artificial Intelligence-based approach is used to predict the crack parameters. Twenty-three Artificial Intelligence algorithms were used to predict the locations and depths of the crack in a cantilever beam. The developed correlation model used the first two normalized natural frequencies to predict the crack parameters. On the other hand, the first three normalized natural frequencies were used to input the machine learning models to predict the crack parameters. In this research study, V-shaped and U-shaped open edges cracks were considered on the cantilever beam. FEA software, ANSYS, is used to do the modal vibration analysis of various cracked cases of beams. The data set of V-shaped and a U-shaped cracked case obtained from finite element analysis (FEA) were used to develop the correlation model and machine learning models. The results for crack locations and crack depth obtained from the correlation model and machine learning models agree with the actual results. In the future, the proposed correlation model of crack detection can be used to detect cracks in more complicated structures.

Keywords: - Correlation model, ANN, Machine learning, Natural frequency, FEA and Crack location.

1. INTRODUCTION

Beams are used in various structural applications in the automotive, civil, and aerospace industries. The presence of crack affects the structure's stiffness and affects the mechanical response of the whole structure to a more considerable extent. Due to these changes, there is a reduction in modal frequencies and mode

shapes. Therefore, it is feasible to anticipate the crack characteristics by determining changes in the vibration parameters [1].

A fault diagnosis method based on genetic algorithms (GAs), and a model of damaged (cracked) structure is proposed. For modeling the cracked-beam structure an analytical model of a cracked cantilever beam is utilized, and natural frequencies were

Experimental and Numerical Investigation of a Cracked Cantilever Beam for Damping Factor to Access its Applicability in the Crack Detection

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Abstract

The cracks alter the physical and modal properties of the beam, i.e., stiffness, damping, natural frequency, and mode shapes, and, in turn, the dynamic response of the beam changes to a considerable extent. The condition monitoring of the beams is essential to avoid its catastrophic failure in applications. A basic criterion has been followed for modal parameters like natural frequencies, mode shapes, and stiffness for the possible crack detection. In contrast, damping as a dynamic property to represent structural damage has been limited due to the difficulties in measuring damping and analysis. Therefore, in this study, the effect of various possible crack profiles, i.e., V-shaped and U-shaped, on the applicability of using the damping criterion for determining the presence of damage in the cantilever structure was investigated. The damping loss factor for all the cracked cases of a cantilever beam was computed using ANSYS and experimental analysis. The numerical results of the damping loss factor were compared with experimental results. It was understood that the results were susceptible to the crack geometries changes.

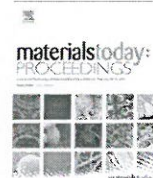
Author Keywords. Effective Mass, Dewesoft FRF, Impact Hammer, V-shaped Crack, U-shaped Crack, Structural Health Monitoring, ANSYS, Torsional Stiffness, Resonant Amplitude.

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1. Introduction

A structural health monitoring system is generally designed to monitor, inspect and test the health and performance of structures such as beams, buildings, bridges, and dams, to ensure their safety. It mainly consists of two major components: the smart sensing technologies and the damage detection algorithms. The smart sensing technologies use fiber optic sensors, piezoelectric sensors, laser Doppler vibrometers, and accelerometers to monitor various



Design and development of automotive radiator for better cooling efficiency

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ABSTRACT

Today's Automobiles are getting equipped with high powered engines. Out of total energy produced by combustion nearly 30–35% is generally used for cooling engine hot water. In such engines, heat dissipation is observed to be improper due to many reasons which cause overheating of the engine, which further leads to damage to lubricating oil film, engine parts and also wear and tear between engine parts. This excess heat can be removed with the help of the effective use of cooling water. The present work aims to identify different ways that need to be used for improving the cooling efficiency of the radiator. LMTD and NTU methods are used for the design of the heat exchanger. The cross-flow heat exchanger is completely designed for the augmentation of heat transferred from the radiator. Different tube arrangements and fin materials are used in this work which gave the effective solution to the problem stated above. The newly developed cross-flow heat exchanger is used in automobile vehicle radiators on a stationary engine in the laboratory which has further helped for reducing the fuel consumption and increasing heat transfer. The comparison is also made for cooling efficiency from the newly fabricated cross-flow heat exchanger with the previous one. The major outcome of the research work is a reduction in fuel consumption by 8.78% with the use of a designed heat exchanger and an increase in brake thermal efficiency by 23.16%. It is also seen that with the change in the tube arrangement, tube shape and fin material, the heat transfer rate is also improved by 24.37% for various dynamometer loading conditions.

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1. Introduction

The primary role of any heat exchanger is to transfer thermal energy from a relatively hot fluid to a cold fluid. The heat exchanger is widely found in applications in refrigeration, air conditioning, heating, energy generation and chemical processing industries. A Crossflow heat exchanger is widely used in a car as a radiator. In the heat exchanger, heat transfer occurs between hot water present in the heat exchanger and the flow of air circulating in an orthogonal direction to each other, so that hot flow and cold flow cross each other. A Crossflow heat exchanger provides a larger contact surface area. This paper is focused on redesigning the cross-flow heat exchanger by changing tube arrangement and fin material [1]. Arasu et al. [15] studied the thermal behaviour

of an automobile radiator. LMTD and NTU methods are used for design and performance analysis. Brave et al. [4] illustrated the design of the fan and analyse it for its strength in the structure using the Finite Element Method and the flow of air in all directions by using the Computational Fluid Dynamics approach.

Bozorgan et al. [9] in their article, used copper oxide water Nanofluid as a coolant in a radiator of a Chevrolet Suburban IC engine with given heat exchange and pumping power for CuO-water capacity. Trivedi et al. (2012) [7] illustrated the effect of tube pitch for a best-configured radiator for optimum presentation. Ibrahim et al. [2] explained the effect of using nanofluids on heat transfer performance in heat exchangers. Shah and Gururaja Rao [3] described various techniques for heat transfer enhancement from electronic devices.

Different research papers on the design and optimization of cross-flow heat exchangers [10,5,6,11,13] were referred to and observed that there is scope to work on and arrangement of tubes, the material of fins. With this gap, it is decided to use different

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A Case Study on Course Outcome & Program Outcome Mapping Levels Based on Competency & Performance Indicators.

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Abstract— This Paper gives an insight into an essential part of practicing outcome-based education (OBE). One of the crucial parts of OBE is measuring the quality and quantity of Program learning skills that student has acquired through various assessments. Course Outcome attainment heads up the learning in a specific course. However, the Program Outcome (PO) attainment needs the relation of Course Outcome & Program Outcome (CO-PO), i.e., mapping levels for calculations. The author has demonstrated the CO-PO mapping level underpinning the competency and Performance Indicators. The methodology for CO-PO Mapping has been shown in the Paper. A review on Mapping has been taken on an online feedback survey and found that mentoring is required in the CO-PO mapping level and interpreting it at hard-shell. CO-PO Mapping for a course has been demonstrated w.r.t. the process followed, and calculations to the end have been explained. There is an opportunity to take PO assessment methods further with mapping levels concentrating on defining competencies and Performance Indicators.

Keywords—Course Outcome (CO), Program Outcome (PO), CO-PO Mapping, Competency, Performance Indicators OBE.

I. INTRODUCTION

THE teaching-learning process is the heart of any educational system at a level and takes the stakes to their wisdom. Outcome-based education has emphasized the same, and the focus of learners' learning is at the center of the teacher's teaching.

In outcome-based education, the education focuses on learners' skill development at Cognitive, Psychomotor, and Attitude levels. The above skill level varies with education streams and level of education from school to higher education colleges & universities. (Spady, 1993) While implementing outcome-based education ensures a certain amount or level of measurement quality has been imparted to the learner.

Measuring of quality of education imparted to students leads to the assessment and evaluation of learning by students in examinations (Yuet Yen Wong, 2015). AICTE has been defined and guided through Examination reforms and Policies, which also support better assessment in studies, measuring outcomes at the course and program levels. Model question papers that will help in the evaluation program skills incorporated by a student.

Exam Reforms (REFORMS, 2018) this reform has guided the Assessment strategy for outcome-based Education (OBE). It suggested a two-step process bringing clarity to PO, Mapping

PO to examinations/examination tools, what skills competencies curriculum of a program develops, and performance indicators through which can assess these competencies. Examination tools that evaluate higher-order abilities and professional skills are also demonstrated (Dr. A. Kavitha, 2018).

It becomes abstruse to justify the CO-PO mapping level defined by the course teacher (Jayasree & Durga, 2018). There becomes a necessity for scientific or any statistical relevance that will rigid the CO-PO mapping level (Reddy, Karuppiyah, Asif, & Ravivarman, 2021). The Mapping of the CO-PO level concerning Competency and Performance Indicators makes it a cakewalk for the course in charge to demonstrate for a third person.

Competencies are simplified statements that focus on different abilities to be attained by the learners. These are Domain-specific and can be used to assess the student's learning ability.

Competencies are statements that showcase what students demonstrate concerning PO from the program curriculum. Each PO and Program Specific Outcome (PSO) can be implied by an ability that is needed to be shown by the program student/learner. This demonstrative ability requires assessment procedures, creating a shared understanding that students want to achieve through their respective programs. A program needs to identify what competencies and various skills can be built in students concerning each PO, these competencies will give an idea for performing indicators through which we can measure these competencies, and subsequently, the quality of PO can be measured.

Performance Indicators (PI) - Measuring tool in Assessment, Performance Indicators are the statements used to evaluate various competencies; they can be designed to find the appropriate level of Competency of each indicator so that instructors can target and students can achieve the acceptable level of proficiency


A feedback survey has been taken, and an understanding of CO-PO mapping levels and how mapping levels are justified is analyzed. The next section describes the feedback survey followed by the methodology proposed and the tool used at the Institute of the same.

A. Responses of faculties involved in OBE and teaching – Learning Practices

Online feedback is taken, and responses have been analyzed for the ten questions stated below, responses for understanding


Assigning the Test Case Priorities Using Butterfly Optimization Algorithm for Software Test

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ABSTRACT

Software maintenance is the longest process of SDLC. It continues with the distribution of applications till the software is not in operation. Software modifications are an unavoidable aspect of the life cycle of software growth. The optimization of software testing is still an important task, as the average percentage of detected failures (APFD), the average percentage of branch coverage detection (APBCD), and output of time are unsatisfactory in priority test cases. The authors also suggested in this document to give priority to test cases using butterfly algorithms optimally. They use butterfly algorithm with a fitness function specified with a similitude-distance model to optimise the ordering of test cases. Three testing suites selected from the software testing case repository experimented with three benchmarking programmes. The test case prioritization technique (TCP) was better than current works with the butterfly APFD algorithm as the output matrix. Overall, APFD results show butterfly algorithm being a successful competitor in TCP applications.

KEYWORDS

APBCD, APFD, Butterfly Algorithm, Regression Testing, Test Case Prioritization

INTRODUCTION

Software testing requires a long-running time and can be the costliest step of the software development process Reid, S. (2004). The checking of applications is understood as the least comprehensive aspect of the development process. Also, testing of applications is done over and over again, because of time limitations and resources it is often done in hurry. In light of this, the Test Case Prioritization application (TCP) has been stated to increase test viability in software tests (Rothermel et al., 1999) (Khatibsyarbini et al., 2017) (Khatibsyarbini et al., 2018) (Jiang & Chan, 2015). First stated by (Wong

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Experimental and finite element investigation of statistical energy analysis parameters for idealized subsystems

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ABSTRACT

In the field of acoustic and vibration analysis, statistical energy analysis proven to be an efficient tool for evaluation of the crucial parameters like damping loss factor (DLF), modal density and coupling loss factor of complex structures. In the present study, modal densities and DLFs of idealised subsystems i.e. rectangular plates comprised of different materials were evaluated experimentally and numerically. In addition, the effects of various boundary conditions (BCs) like free-free, simply supported and cantilever on the statistical energy parameters have been studied. The results obtained using both experimental and numerical approaches are in close agreement. In the case of comparison of all the considered materials, the highest modal density was observed for aluminium, whereas the lowest frequency was observed for graphene doped epoxy composite. The highest DLF was observed for GFR epoxy composite, whereas the lowest DLF was observed for stainless steel.

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1. Introduction

In the early 19th century, the structural parts used in the automotive and aerospace industries were made from conventional materials such as aluminium, steel, copper etc. The revolution in the area of advanced materials leads to the development of novel lightweight composite materials [1]. The properties of developed composite materials like high damping, high strength to weight ratio, excellent resistance to fatigue, high modulus, creep and corrosion leads to replacement of conventional materials [2]. In the past two decades, many researchers investigated the static as well as dynamic properties of glass fiber reinforced (GFR) composites. The properties like damping and storage modulus play a significant role in the case of design of composite structures [3–5]. The vibrational response of the composite structures has been studied using deterministic methods like finite element method (FEM), boundary element method (BEM), finite volume method (FVM) or statistical approaches i.e. statistical energy analysis (SEA) [6]. The deterministic methods are proven to be effective in lower frequency region and require a high discretization of the structure, making them

very sensitive with respect to changes in the input parameters. Whereas SEA helps to predict the vibrational characteristics in the mid and higher frequency regions effectively as it considers the smooth or ensemble average structural response and less sensitive to changes in the input parameters as it operates on statistical average [7].

The SEA parameters like input power, DLF, modal density and coupling loss factor plays a significant role in path analysis and flow of energy within the idealized subsystems. SEA parameters mainly depend on material properties, geometry, type of junctions used and tightening torque applied at junction between two coupled subsystems [8,9]. The modal density is evaluated by obtaining the ratio of the number of resonating modes per unit particular frequency bandwidth [10]. Ramachandran and Narayanan [11] evaluated the modal density of longitudinally stiffened cylindrical shell using an eigenvalue problem-based solution, based on the whole structure's strain energies and kinetic energies. Borgaonkar et al. [12,14] determined the modal density of idealized subsystems i.e. rectangular plates of different materials experimentally. Bachoo and Bridge [13] formulated mathematical expressions for modal density of GFR composite beams coupled in torsion and bending neglecting the effect of BCs. In addition, they studied the effect of discontinuity produced in the composite beam systems on the variation of modal

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Experimental analysis of energy conversion and noise suppression mechanism using polyvinylidene difluoride piezoelectric element

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Avadhut Tukaram Patil¹  and Maruti Bhagwan Mandale¹

Abstract

Energy conversion and conservation techniques are well known for different natural sources but one of the common sources of energy that stays unutilized in the environment is sound energy. The noise around us is a form of unutilized energy. The acoustic energy can be utilized to produce electrical energy. In this article, the testing of the acoustic energy conversion technique is performed. Here the acoustic low amplitude pressure waves generated by the buzzer ringer have impinged over the surface of PVDF (Polyvinylidene Difluoride) Piezoelectric element which has the capability to vibrate after sound impingement. Here the experimental results are taken in the frequency range of 400 Hz to 1300 Hz, in which the highest response occurred at a frequency of 1000 Hz and 91.9 dB, which is ± 50 mV and the maximum V_{rms} (Voltage; root mean square) is 35.35 mV by the single piezoelectric unit. The performance of an array of resonating tube chambers as an enclosure to the noise source has been observed to accomplish noise reduction. Then the array pattern arrangement of this entire system has been discussed with the predictions of the output voltage.

Keywords

acoustic energy, piezoelectric material, energy conversion, noise barrier, electromechanical

Introduction

A sound wave is a vibration that propagates through a transmission medium such as a gas, liquid or solid. These waves hold energy in the form of pressure. Such sound waves or the form of energy stays unutilized in the environment. Acoustic waves are more mechanical waves that contain some energy and this energy can be easily found in noise and other sound sources. When the sound wave is undesired, it is referred to as noise. Common noise sources include airplanes, vehicles, high-speed trains, power plants, loudspeakers, machines, and expressways. Hence every noise source has been critically understood and the estimation of different noises has been studied such as, In-cabin noise levels during commercial aircraft flights, and the quantitative analysis of the aircraft noise is done for different aircraft.¹ Even under the flight path, and flyover zone of aircraft, large sound pressure levels have been observed.² Which are significantly high, and the variations of noise is the challenging part to overcome to reduce noise. But these specific points near the continuous in-use runways can be used. Also, Traffic noise analysis is done with dynamic and experimental observations of urban areas.³ And

mechanical applications such as centrifugal pumps, simple noise, and low-frequency noise are estimated.^{4,5} To point out this problem and give a solution to this noise generation, researchers have found many approaches to control noise.

There are many applications available in the daily environment becoming the sources of noise, and this noise cannot be avoided, so there is a need for noise absorption or suppression, just for a sake of human comfort. Hence many practices have been developed to lower the intensity of noise by absorption or attenuation of waves to make it quite comfortable for human hearing.⁶⁻⁸

In the new era, the technology has increased its demand to extract unutilized energy from the environment and to convert it into a usable form such as electrical

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Review

Recent advancements in synthesis, rheological characterization, and tribological performance of vegetable oil-based lubricants enhanced with nanoparticles for sustainable lubrication

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ABSTRACT

Energy and material conservation is an important global issue. In conventional practice, lubricants were selected based on cost, performance, and life, and concern was not given to the impact of lubricants on humans, animals, plants, and the environment. Vegetable oil-based lubricants are gaining more significance in the industrial lubrication market because of their biodegradability, renewability, minimal environmental impact, excellent tribological performance, and stringent environmental regulations. This review paper highlights the most recent advancement in the synthesis, rheological characterization, and tribological performance of biolubricants under different lubrication conditions. Biolubricants are produced from edible and non-edible vegetable oils with limitations such as low thermo-oxidation stability, low hydrolytic stability, and poor low-temperature properties. It can be overcome by modifying vegetable oils chemically and by blending additives in a base oil. The review provides various aspects of biolubricants, such as the chemical composition of various vegetable oils, chemical modification methods used to synthesize biolubricant, physicochemical and rheological properties of biolubricant, tribological performance of biolubricant under various conditions, and various nanoparticles used to enhance the performance of biolubricant. Numerous studies reported that the blending of additives containing nanoparticles enhances the tribological performance of biolubricant and the results obtained from the various researchers have been observed and analyzed in the review. Nanoparticles have gained importance in engineering lubricants because of their shape, size, and other lubrication properties. The properties of biolubricant enhanced with nanoparticles, the dispersion stability of nanoparticles in various biolubricants, the effect of shape, concentration, and morphology of nanoparticles on tribological properties, nanolubrication mechanism, and surface topology and morphology analysis of rubbing surface are emphasized in the review. The research suggests that vegetable oil has a significant prospective to be used as sustainable lubricating oil with nanoparticle additives. The issues limiting the use of biolubricant have also been highlighted with feasible solutions. Additionally, this comprehensive review is highly significant, as it provides new direction and valuable insights to researchers and practitioners towards sustainable lubricants.

1. Introduction

The rapid growth in industrialization and demand for a luxurious life has increased the use of advanced machines and equipment. To achieve smooth function and maximum efficiency, the basic need of these machines and equipment is lubrication (Yeichuri et al., 2019). The demand of lubricants has increased tremendously due to the industrial revolution and growing sales of automobiles (Zulkifli et al., 2014). According to a global market survey, 36.8 MMT of lubricants were used in 2019 (Bellini

et al., 2021), increasing demand by around 2.1% every year. In 2020 the global lubricants market size was valued at 125.81 billion USD, and the market is expected to grow at a CAGR of 3.7% from 2021 to 2028. The lubricant market plays a vital role in the country's economy as rapidly depleting fossil fuels causes sudden fluctuations in lubricating prices. Tribological research reveals that one-third of mechanical energy is lost in the form of heat due to friction between rubbing surfaces. In automobile sectors, one-third of the energy losses are caused by piston assembly, transmission system, bearing, camshaft and crankshaft mechanism valve train, etc. (Sharma and Sachan, 2019). Controlling

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Investigating the Effect of Compression Ratio on Operating Characteristics of Compression Ignition Engine Fueled with Diesel—Ricebran Biodiesel—*n*-Butanol Additive Blends

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Abstract The rapid growth in industrialization, environmental pollution, and diminution of fossil fuels are the significant aspects that encourage researchers to seek alternative renewable fuels. The study aimed to examine the influence of the compression ratio on compression-ignition engine tested with rice-bran biodiesel and *n*-butanol additive. An investigation has been carried out for various compression ratios under the full load condition for fixed injection timing 30° before the top dead center. The experimental result indicates that the engine torque increases with the compression ratio for all biodiesel blends. The brake-thermal efficiency shows an increasing trend with compression ratio and blends proportion up to the B30n5 blend and a decline for the B40n5 blend. The average decrease in brake-specific fuel consumption was 14% as the compression ratio increased from 16:1 to 19:1, and brake-specific fuel consumption shows an increasing trend with blending proportion. Hydrocarbon and carbon monoxide emissions were reduced by 40% and 15%, respectively. In contrast, carbon dioxide and nitrogen oxide emissions were increased by 10% and 15%, respectively, with an increase in compression ratio from 16:1 to 19:1. High compression ratio results in high heat release and cylinder pressure. The results reveal that the rice-bran biodiesel with *n*-butanol additives provides comparable performance with diesel and can be used for a diesel engine without modification.

Keywords Performance · Combustion · Emission · Ricebran · *n*-Butanol

Abbreviations

B5n5	Diesel 90% + Rice-bran biodiesel 5% + <i>n</i> -butanol 5% by volume
B10n5	Diesel 85% + Rice-bran biodiesel 10% + <i>n</i> -butanol 5% by volume
B15n5	Diesel 80% + Rice-bran biodiesel 15% + <i>n</i> -butanol 5% by volume
B20n5	Diesel 75% + Rice-bran biodiesel 20% + <i>n</i> -butanol 5% by volume
B25n5	Diesel 70% + Rice-bran biodiesel 25% + <i>n</i> -butanol 5% by volume
B30n5	Diesel 65% + Rice-bran biodiesel 30% + <i>n</i> -butanol 5% by volume
B40n5	Diesel 55% + Rice-bran biodiesel 40% + <i>n</i> -butanol 5% by volume
B10	Diesel 90% + Biodiesel 10%
B20	Diesel 80% + Biodiesel 20%
B40	Diesel 60% + Biodiesel 40%
VCR	Variable compression ratio
CR	Compression ratio
CI	Compression-Ignition
IC	Internal combustion
m_f	Fuel flow rate (kg/h)
CV	Calorific value (kJ/kg)
Q	Integrated heat release
P	Indicated pressure in the cylinder (N/m ²)
BHP	Brake power (kW)
IHP	Indicated power (kW)
BSFC	Brake-specific fuel consumption
BMEP	Brake-mean effective pressure
BTE	Brake thermal efficiency
EGT	Exhaust gas temperature

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Adoption of Experiential Learning Approach for Validation of Perpetual Motion Machine of First Kind Concept in Engineering Thermodynamics

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Abstract— Educationalists among the globe are innovating and experimenting innovative teaching practices to the students to trigger students involvement, grasp of the concepts and performance. Engaging students in practical and challenging activities is one of the way to engage students in the learning process. The learning through inference drawn from these activities and experience is referred as an experiential learning. Experiential learning has evolved as a superior teaching-learning methodology over conventional classroom teaching. Autonomy in learning to the students and triggering creative thinking in students are the key aspects of experiential learning methodology. Educationalists have adopted experiential learning to science and technology, medical, management and engineering disciplines and is being more popular day by day. This article presents experiential learning model applied to engineering thermodynamics course (subject) for validation of basic thermodynamic concepts. Student validated working of a machine without any work input by reproducing the machine claimed in the videos uploaded on video sharing platforms. Flexible learning system helped students to have proper understanding of basic concepts, laws of thermodynamics and understanding and to improve academic performance. The activity conducted resulted in the improvement in the overall CO attainment by 14.12% along with improvement in the average marks of the students for UT1, UT2 and ESE assessment collectively by more than 55%.

Keywords— Experiential learning; learning by doing; engineering thermodynamics; flexible learning framework.

I. INTRODUCTION

EXPERIENTIAL learning is an active learning strategy that involves learning through experience gained through activities like experiments, field observations, hands on experience etc. It enables students to learn by doing by their own. It helps students, trainee and learners to inculcate new set of skills, viewpoint by involving in an experiential task and analysis and synthesis about the experience. The critical analysis and synthesis, initiative and decision making opportunities for students, becoming accountable, intellectual, social and physical involvement of students and learning opportunities to students are key elements of experiential learning.

It is evident that the conventional classroom teaching-

learning involving ‘chalk and talk’ approach proves unproductive for science and engineering education (Freeman et al., 2014; Waldrop, 2015). In order to improve students learning, active learning techniques like group problem solving and demonstrative examples have become essential part of classroom teaching (Kober, 2015). In addition to this, active learning approaches like ‘peer learning’ and ‘think-pair-share’ are becoming more popular amongst educationalist in recent year to improve learning of students (Lom, 2012). Learning experience in science and technology can be enhanced by including hands on exercises like laboratory session (Freeman et al., 2014). At present, many laboratory exercises have fixed learning framework with fixed set of instructions (Handelsman et. al., 2004). By implementing creative and flexible learning framework that gives more learning freedom to students, considerable utilization of practical sessions can be done (Handelsman et. al., 2004).

Inference drawn from the research carried out in a Spanish business school shows that adopting experiential learning activities helps students’ grasp of theoretical concepts and improves academic performance (Rodriguez and Morant, 2019). Patil and Meena implemented experiential learning to computer engineering undergraduate students at a private engineering college in India (Patil and Meena, 2018). Powar and Patil employed 3D printing as a learning tool for undergraduate mechanical engineering students developed a technology-enhanced project based learning (TEPBL) model (Powar and Patil, 2022). It was found that utilizing experiential learning activities enhances the employability of engineering students (Patil and Meena, 2018). Gadola and Chindamo presented a case study of Motostudent event, Europe and Formula SAE competition (Gadola and Chindamo, 2017). It was concluded that, engineering student competitions involves students in experiential learning to an open-ended multidisciplinary problem and triggers students’ creativity and innovation (Gadola and Chindamo, 2017).

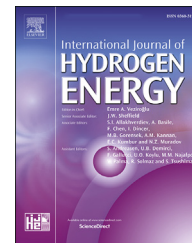
Engineering thermodynamics course is a part of undergraduate mechanical engineering programme at Rajarambapu Institute of Technology (RIT), Rajaramnagar, India. Course content of engineering thermodynamics includes basic thermodynamic concepts like system, boundary, surroundings, first and second law of thermodynamics, entropy, exergy, properties of gases and properties of steam. The



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Performance analysis of sodium alanate hydride reactor with different nanofluids

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HIGHLIGHTS

- Developed and validated mathematical model of sodium alanate based hydride reactor.
- Used nanofluid as a heat exchange fluid.
- Presented performance for $\text{Al}_2\text{O}_3/\text{HTF}$, CuO/HTF and MgO/HTF Nanofluids.
- Absorption time is improved by 14% for given conditions.
- Reported up to 10% enhancement in the heat exchange rate for CuO/HTF nanofluid.

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ABSTRACT

The thermal management of the hydride based hydrogen storage reactor is the key factor to realize the complete storing potential of hydrides. In this regards a hydride reactor filled with sodium alanate in multiple tubes is numerically analyzed for absorption process. Based on various governing equations, a mathematical model of hydride reactor is developed and validated with the help of ANSYS Fluent. The hydride reactor uses mainly water or oil for heat exchange during hydrogen sorption. In the present study conventional heat transfer fluid (HTF) is replaced with the nanofluid since it has a greater heat exchange properties. The CuO/HTF , $\text{Al}_2\text{O}_3/\text{HTF}$ and MgO/HTF nanofluids are selected based on previous studies and results of numerical experiment are recorded. The outcomes are attained for various parameters such as material and concentration of nanoparticles, supply pressure of hydrogen and inlet temperature of heat exchange fluid. The CuO/HTF nanofluid with concentration of 5 vol% exhibited better rate of absorption in comparison with other vol% concentrations and other selected nanofluids. It shows improvement in hydrogen absorption time up to 14% under selected conditions. Additionally, it is observed that CuO/HTF nanofluid with 5 vol% concentration is thermodynamically superior to other selected nanofluids; as a result it enhances the rate of the heat exchange up to 10% for hydride reactor. It is realized that the performance of CuO/HTF nanofluid with 5 vol% concentration is superior among picked nanofluids. Therefore for the hydride reactor the use the nanofluid is advantageous.

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DESIGN AND SIMULATION OF AUTOMOTIVE RADAR FOR AUTONOMOUS VEHICLES

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Abstract

Modern automobile technology is pushing towards maximizing road safety, connected vehicles, autonomous vehicles, etc. Automotive RADAR is core sensor technology used for ADAS (Advanced Driver Assistance Technology), ACC (Adaptive Cruise Control), AEB (Automatic Emergency Braking System), traffic assistance, parking aid, and obstacle/pedestrian detection. Despite being inexpensive, RADAR technology provides robust results in harsh conditions such as harsh weather, extreme temperature, darkness, etc. However, the performance of these systems depends on the position of the RADAR and its characteristics like frequency, beamwidth, and bandwidths. Moreover, the characterization of varied materials like layers of paint, polish, primer, or layer of rainwater needs to be analyzed. This performance can be predicted through real-time simulation using advanced FEM software like Altair FEKO&WinProp. These simulations can provide valuable insight into the performance of the system, allowing engineers to optimize the system for specific use cases. For example, simulation can be used to determine the optimal parameters of the RADAR system for a given application. This information can then be used to design and build a physical model or prototype that is optimized for the desired performance. These simulations play a prominent role in determining appropriate data collection and sensor fusion, which reduces the cost and time required for the development of a physical model or prototype. The continued growth and demand for advanced safety features in vehicles further highlight the importance of RADAR technology in modern automobile technology. By accurately characterizing the environment and simulating the

Performance Testing of Multicylinder Compressed Ignition Engine with Dual Fuel Mode of CNG with Biodiesel and Diesel

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ABSTRACT:

The experimental investigation was performed on a multicylinder CI engine used for off-road applications with dual fuel modes of CNG-biodiesel, CNG-diesel and CNG-biodiesel-diesel. The study aims to identify the maximum possible replacement of liquid fuel by CNG and investigate the engine's performance and emission characteristics under dual fuel mode. Biodiesel used for the study is prepared from waste cooking oil using the transesterification method. Engine performance and emission characteristics are tested for D100, B100 and B60 fuels with CNG supplied in various quantities up to the engine can take at respective operating conditions. The test was conducted at a constant speed of 1500 rpm and varying loads of 10%, 25%, 50%, 75% and 100% of full load. The liquid fuel replacement by CNG is obtained in the range of 54% at low loads and 84% at high loads. The brake thermal efficiency is decreased for dual fuel mode at low loads but improved at high loads. A substantial reduction in the smoke and NO_x emissions and an increase in CO and HC emissions were observed for the dual-fuel mode. The biodiesel-CNG dual fuel mode significantly reduces greenhouse gas emissions.

KEYWORDS:

Dual fuel mode with CNG; WCO Biodiesel; Diesel; Engine performance; Emission characteristics

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NOMENCLATURE:

BMEP	Brake Mean Effective Pressure
BSEC	Brake Specific Energy Consumption
BTDC	Before Top Dead Centre
BTE	Brake Thermal Efficiency
CA	Crank Angle
CI	Compression Ignition
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CR	Compression Ratio
CO ₂	Carbon Dioxide
DI	Direct Injection
HC	Hydrocarbon
LPM	Litres per minute
NO _x	Oxides of Nitrogen
NTP	Normal Temperature and Pressure
PM	Particulate Matter
RTD	Resistance Temperature Detector
SI	Spark Ignition
TDC	Top Dead Centre

2050. The rising energy demand and continuous destruction of fossil fuels lead to the energy crisis. The energy developed in the industries and transportation sectors primarily from mineral oil and coal. Specifically for the automobile sector, almost all the fuel required for the IC engine is derived from petroleum oil, which is a non-renewable source of energy and will deplete in the near future [3, 4]. Simultaneously more concern is given to environmental issues such as emission, acid precipitation, stratospheric ozone depletion and global climate change. The use of clean and green energy is becoming a growing concern for the transport sector and industry. Therefore, it motivates the researcher to search for renewable and alternative fuels that will minimize or replace the use of fossil fuels [5].

Biodiesel is a good alternative renewable energy source for use in IC engines [6, 7]. To sustain the energy crisis and consider the concern over pollution, a substitute for petroleum fuel needs to be identified. A tremendous amount of petroleum fuel is imported from foreign countries, which is another reason for the development of alternative fuels. The alternative fuel should be developed from a renewable source of energy and give less emission [8, 9]. As the Compression Ignition (CI) engine is widely used in the industry and transport sector, searching for alternative fuels for CI engines is essential. The dual-fuel CI engine uses gaseous fuels in

1. Introduction

In the last decade, substantial growth has been observed in India's economy, which ultimately increased energy demand and greenhouse gas emissions [1, 2]. As per the energy, environment and sustainable report, the energy demand is expected to increase by 1.5 to 3 times up to

NEED OF HYBRID ELECTRIC TWO WHEELERS ON INDIAN ROADS TO SUSTAIN GREEN ENVIRONMENT

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ABSTRACT

This paper provides a comprehensive study of the recent work of Hybrid Electric Two Wheeler (HEVs). The paper describes the development and the need of HEVs. Over the decade, we have observed various kinds of research in the area of Electric and hybrid electric vehicles but till now there is no such expected number of vehicles on Indian and abroad roads. All we know that the major issues in pollution are from the emissions from the vehicles. Through this paper, we are trying to put a basic comprehensive study of why we have to rethink the need of hybrid electric vehicles? Up to the fulfillment stage of availability of the required facilities and infrastructure for the on-road electric vehicles we have to use or develop reliable hybrid electric vehicles, which will be propelled by the existing I. C. engine and battery power. And simultaneously, it is required to develop the revolution facilities and infrastructure for the pure battery powered or say Electric Two Wheelers (EVs).

KEYWORDS: Hybrid Electric Vehicles (HEVs), Electric Vehicles (EVs), Internet of EVs, Revolution Requirement.

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INTRODUCTION

In today's fast moving world, having a vehicle is very common thing. But till problems related to pollution and vehicle emission is not much controllable yet. New environment friendly and affordable power systems like Electric and Hybrid Electric Two Wheelers has become very important and thus, they are needed to be installed urgently. In India, continuing since 2010, the Government of India and State Governments have announced and are helping through many sources like start-up support, subsidies on the vehicles and the parts, free registration, some models were allowed to drive without Driving License, No Toll etc. The benefits are announced and given for the users and manufacturers of Electric Vehicles, Hybrid Electric Vehicles and Solar Powered vehicles.

But till now, the electric vehicles are not spread or popular as expected by the manufacturers and government. We are not observing numbers of electric vehicles and models on roads. Else, we have observed that numbers of dealers have closed their business.

Even the MNCs or OEMs like Hero or TVS have not got such success in this business. Obviously they are adopting the latest technology, latest research and development. But they could not getsuccess. The end customers / end users are not reliable on the Electric Two Wheelers. The companies and the technical people are trying to spread the technology. We might reliable on battery performance development, life and maintenance, new arrival of Lithium-Ion batteries. But till the end customers are not ready to use the electric two wheelers. All we know, the use should be increased. But it will happen when we are able to develop reliable vehicles which will be preferred by the end users. Based on these observations, we are hereby putting together this study. To develop awareness, we are



PAPER

Investigation of the damping behavior of shape memory alloy-nitinol reinforced composite

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E-mail: ranjit6044@gmail.com, s_rane@spce.ac.in and samir.kumbhar@ritindia.edu**Keywords:** damping behavior, vibration control, shape memory alloys, elastomer, nitinol reinforced composite, damping factor, damping model

Abstract

The use of Shape Memory Alloy (SMA) recently increased in smart structures. It is essential to investigate the impact of viscoelastic material, and transformation temperatures of SMA on dynamic behavior, especially the damping capability of the SMA reinforced composite. In this paper, the damping constants of SMA and viscoelastic material are evaluated experimentally, and a damping model based on experimental results is proposed for the composite. The effect of SMA wires in combination and selective activation has been studied using the proposed model and validated experimentally. It has been observed that damping predicted by the model is close to damping calculated by experimentation. Also, damping varies with the transformation temperatures of SMA. Thus, dynamic control of the SMA reinforced composite is feasible by controlling transformation temperature. The composite studied in this work can shift the damping by 9.58% by activating all nitinol wires.

1. Introduction

Smart materials like shape memory alloy (SMA), piezoelectric materials, Magneto rheological elastomers (MRE), Magneto-rheological fluids (MRF), electro rheological fluids (ERF) play a vital role in vibration attenuation and controls due to their inherent ability to change the mechanical properties with respect to external stimuli [1–12]. Nowadays, many researchers are using these smart materials in combinations to increase their effectiveness in vibration control [13–15]. Recently, the use of SMA has been increased in smart structures to make them more adaptive and alter the dynamic performance of the structure [16–21]. The SMA has a unique ability to change its modulus, consequently, stiffness with respect to external stimuli like heat and magnetic field. Hence it is the best candidate for stiffness tuning [13, 22–32]. In vibration control, along with stiffness tuning, vibration damping is also essential; hence, it is required to explore. Materials like silicon rubber having viscoelastic properties effectively increase the vibration-damping ability of the structure [33–35]. Viscoelastic materials have significant hysteresis damping and can be combined with SMA material to have the dual advantages of stiffness tuning and structural damping. Many researchers explored the capability of such combinations in vibration control by constructing composites, testing those in a laboratory, and using simulation software [36–51].

In this work, the SMA-reinforced viscoelastic composite has been investigated for its damping ability by tuning the properties of SMA through temperature change and activating a number of wires selectively. In this process, the damping properties of individual SMA wires have been experimentally evaluated for different temperatures. Also, the damping properties of viscoelastic material have been evaluated. Nitinol SMA and silicon rubber as viscoelastic materials have been used for fabricating the composite. The effect of wire combination and selective activation on damping behavior has been studied mathematically by taking inputs

Article

Experimental Investigation and Optimization of AZ31 Mg Alloy during Warm Incremental Sheet Forming to Study Fracture and Forming Behaviour

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Abstract: The main purpose of this research work is to study the forming limit and fracture behaviour of the AZ31 magnesium alloy, as well as to improve the formability and surface roughness of parts formed using the warm incremental sheet forming (ISF) process. For the ISF process, AZ31 Mg alloy sheets were used. Initially, Taguchi orthogonal L27 arrays were used to design experiments, and a framed multi-objective optimization problem was solved using the grey-fuzzy method. The strain-based forming fracture limit diagrams (FFLD) were plotted after a variable wall angle test. The grey-fuzzy reasoning grade (GFRG) is calculated in this study by combining grey relational analysis (GRA) and fuzzy rationale. For the AZ31 Mg alloy, the maximum GFRG value was obtained for the following forming combinations: step depth 0.3 mm, feed rate 500 mm/min, spindle speed 700 rpm, and tool diameter 10 mm. Then, ANOVA was used to determine the importance of parameters on the responses, and it was discovered that the step depth has the greatest influence (68.78%) on GFRG value, followed by the feed rate (16.56%). The fracture behaviour of the Mg alloy was studied using fractographs. Later, FE simulation was used to validate the strain value obtained from experimentation and to investigate the effect of process parameters on responses.



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Keywords: magnesium alloy; incremental sheet forming; grey-fuzzy optimization; variable wall angle; warm forming; optimization

1. Introduction

For regular sheet metal forming, specialised equipment, such as dies and punches, and metal cutting and bending machines, are required to form the required part. As a result, the time and cost associated with the traditional sheet metal forming process are greater for customised products. Furthermore, any minor change in the part design may turn it into a herculean task because all of the requirements will be altered. Consumer demands are becoming more specific and personalised, rendering the traditional metal forming process obsolete. For these reasons, highly flexible forming methods with high dimensional precision are required. As a result, an additional efficient and adaptable forming process, namely incremental sheet metal forming (ISF), has evolved.

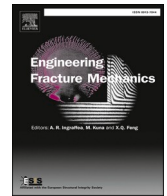
The ISF meets a unique set of requirements, including forming on standard CNC machines, die and punchless forming, low stress generation, rapid modification capability, higher material formability, and a superior surface finish at a low cost. Because of these characteristics, the ISF process is well suited for rapid prototyping in small- and medium-sized batch manufacturing [1]. Hence, determining the forming limit in the ISF process is very important. Pandivelan et al. [2] examined the formability of the sheet during the ISF process using a straight groove test and found that the formability was greatest in the rolling direction. Numerous researchers have investigated the strain-based forming limit for steel and its alloy sheets. Yoganjaneyulu et al. [3] observed that the formation of dimples, cracks, voids, and pits from a fractured surface disrupts the forming limit of



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Development of Virtual Internal Bond method based material model for Carbon fiber and its application to Carbon fiber reinforced epoxy system

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ABSTRACT

The present work contributes to the current state of art in fracture modeling of carbon fiber through development of virtual internal bond (VIB) model based on Tersoff-Brenner potential for carbon fiber. The underlying VIB method is multiscale in nature and the stress-strain relation which while retaining the microscopic attributes handles crack initiation and propagation without addition criterion. A variant of VIB method viz. multi-dimensional virtual internal bond (MVIB) method is employed to model epoxy resin, wherein the stiffness involved in the interaction potential is penalized based on the strain levels to capture damage. Following calibration based on elastic properties and tensile strength, the potential of the current work is demonstrated through simulation of damage in two-dimensional assemblage of carbon and epoxy under the action of bi-axial loading characterized via bi-axiality ratio.

1. Introduction

The excellent mechanical properties viz. high specific strength, specific modulus, fracture toughness and corrosion resistance exhibited by carbon fiber reinforced polymer (CFRP) composite are usually attributed to the layout and proportion of carbon fibers relative to the polymer and are leading a transformation from the conventional metal-based to polymer-based structures in areas as diverse as naval, aviation, automobile [3,48,49]. The carbon fiber reinforced polymer composite (CFRP) consists of two parts: the carbon fiber as the reinforcement and polymer resin (e.g. epoxy) as the matrix. The former provides strength and the latter binds the reinforcement together [2]. The primary element of CFRP is a carbon filament produced from the precursor polymer such as polyacrylonitrile (PAN), rayon or petroleum pitch [3]. CFRP composite parts can be manufactured by using methods like molding, vacuum bagging, compression molding and filament winding [4]. A large quantum of experimental and modeling research centered around CFRP has simultaneously emerged [e.g. 2–3, 5, 6–9] and researchers have either attempted to enrich the mechanical properties or predict the fracture process and its dependent parameters via damage models. The concerned experiments demand state-of-art instrumentation and setups making them quite expensive and niche. Hence although insightful, experiments are always limited in number and variety. On the other hand, computer simulations can cover up for the limited experiments, provided the model captures the multiscale effects ranging from micro-structural phenomenon like interaction amongst fibers, interaction of fiber with adjoining

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Enhancement in Student Employability by Providing Internship and Project Track

Ajinkya K. Patil, Pruthviraj C. Chavan, S.V. Chatanya, Sharad D Patil.

Abstract—In order to strengthen its final year engineering students' worldwide competency, our institute decided to launch four choice-based project tracks in 2017-18. According to this method, students can select one option from traditional capstone project (CP), undergraduate research experience (URE), entrepreneurship development (ED), and industry internship & projects (IIP). The current work focuses on industry internship & projects (IIP), how it affects students' careers, employability chances assessment techniques perceived by students and the institute, and the significant steps done to address such challenges. Students and their evaluators were surveyed to analyze the results of the four track project method. Students who choose the IIP track were found to have improved their skills. Self-learning capacity, self-assurance, and critical thinking all showed satisfactory growth. The pupils' resumes were aided by this. In order to improve students technical understanding Institute again decided to change in four track structure into three track in 2020-21 by making CP track compulsory to each students which will start in second semester of third year and ends after first semester of final year. Students that undergo compulsory the CP track in their third year were successful in gaining abilities like teamwork, creative problem-solving, and time management. Which can helpful to them for better survival in Industry during Internship. Overall, it has been noted that the institute's placement percentage increased from 78.68 to 82.32 and average package have been increased from 2.60 LPA to 3.71 LPA.

Keywords—placement; internship; projects; employability
JEET Category—Industry and Academia Collaboration

I. INTRODUCTION

In today's competitive environment, employers look for engineering school graduates who are prepared for the workforce. In India, there are over 4282 engineering institutes. Every year, more than 30 Lakh students from diverse courses graduate from these institutions. Engineering students in this situation must contend with intense competition while looking for a job that suits their preferences. Consequently, the growth of engineering students is greatly influenced by teaching and learning approaches. According to the engineering education curriculum, final year students are required to complete a significant project. Additionally, students must complete a group project on a specific issue related to their chosen

engineering field. Students are not exposed to real-world job situations, even though this practice is helpful for developing skills like critical thinking, analysis, teamwork, project management, etc. (Waychal, 2016). Entrepreneurship education is seen as complimentary to the current engineering education system. Some students want to launch startups after graduation, but they don't acquire the necessary skills and expertise before they graduate. To improve students' chances of success in the actual world of employment, the curriculum needs to move its emphasis more toward experiential learning methods. Cooperative education, internships, service learning, research, study abroad, fieldwork, and other educational and professional experiences like entrepreneurial development are all included in the experiential approach (Gashaw, 2019). All of these experiences serve as a bridge between what is taught in the classroom and job expectations. Institutions and employers collaborate in cooperative education so that students can apply what they learn in class to the workplace. This improves decision-making skills and working experience (Jung and Lee, 2017). Students also receive limited-term work experience via internships. Paid internships under a professional's supervision are available. The main distinction between cooperative education and an internship is that cooperative students are paid for their work and are treated like full- or part-time employees. In the case of internships, students get paid nothing or little. According to a literature review, the majority of institutions favor internship programmes lasting four to six weeks within the four-year degree programme. Internships and cooperative education can help students embrace new ideas, generate possibilities, and become more conscious of concerns affecting their communities (Gol et al., 2001). A fruitful internship might provide important information for choosing the course of future education or job. An internship is a chance to apply and advance knowledge and abilities connected to a particular industry, as well as integrating internships into regular courses can be difficult for many universities (Parishani, Khoroshii, 2016). (Renganathan et al., 2012). Although the advantages of internships have been the subject of several studies, few students and academic institutions actually implement these programmes. The planning of internships should start with assigning the industries, allowing enough time for the internship, providing adequate supervision and assistance, and providing financial support for the interns (Gashaw, 2019). Otherwise, institutions and students may encounter a variety of difficulties. Our institute opted to advance an experiential learning paradigm after considering the existing state of the world. The institute started off by surveying 500 pupils. After graduation, 65% of students expressed a desire to work for

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Design Thinking with ICT Tools: An Approach to Enhance Engagement in Design Problem and Practical Exposure

Pruthviraj C. Chavan, Ajinkya K. Patil, Ganesh R. Chate and Vinayak R. Malik

Abstract—These instructions give you guidelines for preparing **Abstract**— Students were unable to gain exposure to think practically, solve real-world problems, and think critically in recent years following pandemic situations, so design thinking is a rapid change in engineering education strategies to increase students' engagement in imparting knowledge and skills remotely to the students. The traditional approach to teaching-learning strategies has given way to some advanced methods utilizing various modern approaches such as design thinking. The engagement of students actively and learning collaboratively with thinking ability is the major challenge in the learning of courses like metrology. The paper is a report on the author's use of the design thinking approach for the learning and active participation of third-year mechanical engineering students at Rajarambapu Institute of Technology in Rajaramnagar. This paper describes the use of the design thinking approach for the metrology course and summaries of students' active participation and improvement in terms of students' "Learning Coefficient (LC)" based on the responses collected. The learning coefficient is represented by a number ranging from 0 to 1, with 0 indicating fewer interactive sessions and 1 indicating extremely interactive sessions. These coefficients reveal how much learning is taking place. Furthermore, the impact assessment shows that course results and course outcome attainment were significantly improved. The students' feedback indicates that they had a great time and appreciated the opportunity to learn.

Keywords— Collaborative learning; Course outcomes; Design thinking; Learning coefficient; Students' feedback.

I. INTRODUCTION

Teaching-learning of courses is not only limited to, delivery in the classrooms, physical performance, and recording observations. It combines new active learning strategies for interactive learning, critical design thinking, and practical experience. Students' presence is not limited to physical attendance; it also allows instructors to consider how students will be engaged, involved, learn, and think in a planned manner. Interaction among students as well as faculty and students during metrology course learning has become an important aspect of successful teaching-learning of courses. The culture must be such that students can actively participate, debate among themselves, and gain shop floor experience while

learning. To create an active learning environment and increase students' skills during sessions, the regular class culture must be such that all can think, engage actively, share their views, and evaluate. The lecture delivery techniques create a link between students for easier learning and understanding, as well as ensuring that positive solutions are provided by the students.

Many instructors now use design thinking as their approach. Given the needs of engineering education, instructors have begun to use these modern approaches to teaching and learning in engineering education.

A. Inspiration for the Study

Because of a lack of active participation, attention to learning, and revision during the teaching-learning process, students are unable to comprehend everything that the teacher teaches. If these actions are taken and these corners are modified, it is hoped that the teaching-learning process will produce significant results. The author was inspired by the interactive learning of the students and the thing in this way to use modern approaches with ICT tools to improve the effectiveness of the teaching-learning process.

II. LITERATURE REVIEW

This section explains the overview of the research articles and recognizes the gap in the use of modern approaches in the teaching-learning process.

Design thinking was discussed by Judy Matthews and Cara Wrigley (2017) as an approach used in higher education. The researchers used various design thinking approaches to create a preliminary map of some of the higher education business programs. Stanislav Avsec (2021) investigated design thinking as a transformative learning approach and found that design thinking, when supported by transformative learning theory, can be conducive to the development of higher order thinking skills and meaningful learning experiences that influence a pedagogical shift and perspective of pre-service teachers from a variety of majors. Teaching design thinking to students, according to Jacqueline E. McLaughlin et al. (2019), is a skill-based tool to prepare students for problem-solving in complex healthcare environments and to create, implement, and refine health professions curricula and training programs. Aparna

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Application Of Neural Network For The Detection Of Covid-19 Or Viral Pneumonia

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Abstract

A bacterial infection in the lungs can cause viral pneumonia, a disease. Later the middle of December 2019, there have been multiple episodes of pneumonia in Wuhan City, China, with no known cause; it has since been discovered that this pneumonia is actually a new respiratory condition brought on by coronavirus infection. Humans who have lung abnormalities are more likely to develop high-risk conditions; this risk can be decreased with much quicker and more effective therapy. The symptoms of Covid-19 pneumonia are similar to those of viral pneumonia; they are not distinctive. X-ray or Computed Tomography (CT) scan images are used to identify lung abnormalities. Even for a skilled radiologist, it might be challenging to identify Covid-19/Viral pneumonia by looking at the X-ray images. For prompt and effective treatment, accurate diagnosis is essential. In this epidemic condition, delayed diagnosis can cause the number of cases to double, hence a suitable tool is required is necessary for the early identification of Covid-19. This paper highlights various AI techniques as a part of our contribution to swift identification and curie Covid-19 to front-line corona. The safety of Covid-19 people who have viral pneumonia is a concern. Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN), two AI technologies from Deep Learning (DL), were utilized to identify Covid-19/Viral pneumonia. The Algorithm is taught utilizing non-public local hospitals or Covid-19 wards, as well as X-ray images of healthy lungs, fake lungs from viral pneumonia, and ostentatious lungs from Covid-19 that are all publicly available. The model is also validated over a lengthy period of time using the transfer learning technique. The results correspond with clinically tested positive Covid-19 patients who underwent Swap testing conducted by medical professionals, giving us an accuracy of 78 to 82 percent. We discovered that each DL model has a unique expertise after testing the various models.

Keywords: Covid-19, Viral pneumonia, Deep Learning (DL), Convolutional Neural Network (CNN), Recurrent Neural Network (RNN).

I. Introduction:

Recently, numerous causes of pneumonia were discovered in Wuhan, China, with causes that are unknown. It was believed to be a minor respiratory condition brought on by a coronavirus up until February 12, 2020, when the International Committee on Taxonomy of Viruses formally designated a new coronavirus, severe acute respiratory syndrome coronavirus 2. (SARS-CoV-2) [1,2,3]. The serious increase in mortality rates around the globe has been deemed a global pandemic by the WHO. This has led to the worldwide healthcare systems collapsing, necessitating an immediate response to recognize and reduce the escalating number of COVID cases [4]. The symptoms of COVID-19 found in patients are extremely diverse, including pneumonia, ARDS (acute respiratory distress syndrome), fever, dry cough, sore throats, and other conditions that are comparable to viral pneumonia symptoms. [5]. Since a significant risk to humanity has been established by the discovery of a novel COVID-19 mutation in the UK [6]. Reverse transcription-polymerase chain reaction (RT-PCR) and SWAB are the two diagnostic tests for



Multi-objective optimization of micro EDM using TOPSIS method with Tungsten carbide electrode

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Abstract. The titanium alloy specimens are generally utilized in many manufacturing applications due to their higher corrosion resistance and lower density. Since it is highly tedious to machine such materials using conventional machining processes, it can be easily machined using micro Electrical Discharge Machining (EDM). In the present study, an attempt was made to optimize the process parameters on machining titanium alloy specimens with tungsten carbide in micro EDM process. Taguchi-Topsis method was used to derive better process factors such as voltage, capacitance and Electrode rotational speed. Depth of machining, Overcut and tool wear were considered as quality measures to evaluate the machining characteristics. It was found that 160 V of voltage could produce better machinability with the capacitance of 10 nF and electrode speed of 400 rpm. It was also found that the parameters can produce a better surface finish with better machining accuracy. The only fewer agglomeration of tool electrodes was observed over the machined titanium specimen.

Keywords. Micro EDM; titanium; TOPSIS; tungsten carbide; voltage; electrical discharge machining (EDM).

1. Introduction

In Micro electrical discharge machining (μ -EDM) process, the electrode is significantly affected by the thermal energy of the sparks owing to its smaller size and lower heat transfer of the electrode. Due to this phenomenon, the tool electrode will wear continuously throughout the machining process. It affects the machining accuracy and machining cost. The different electrode materials have different ability to work in EDM and μ -EDM [1]. The performance of different tool electrodes such as tungsten (W), copper (Cu) and copper-tungsten(Cu-W) electrodes in μ -EDM was compared for machining SS316L [2]. The higher material removal rate (MRR), tool wear rate (TWR), overcut (OC) and Taper angle (TA) were observed with Cu tool electrode. The electrode materials with high electrical conductivity, and the higher melting temperatures will contribute to reducing the thermal erosion of the electrode [3]. It will contribute to improving

the machining efficiency in μ -EDM. However, the new electrode material will have a very significant effect on the μ -EDM machining process. Therefore, it is necessary to study and optimize the technological parameters in μ -EDM using new electrode materials. It will contribute to promoting the applicability of this technical solution in production practice.

The principle and mechanism of machining in μ -EDM is complicated. It will cause to reduce the processing efficiency. The technological parameters including electrical parameters, non-electrical parameters are changed. It will lead to a very strong change in the physical process in machining. Since the number and level of technological parameters is larger, the process of optimizing such factors in μ -EDM is very complicated. The techniques for designing empirical matrices and solving optimization problems by traditional solutions often lead to very high costs. In μ -EDM, the rotational speed of the electrode has a significant effect on productivity, electrode wear, machining accuracy and post-machined surface quality. If the rotational speed of the electrode is too high or too

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Multi-objects optimization in μ -EDM using AlCrNi-coated tungsten carbide electrode for Ti-6Al-4 V

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Abstract

Titanium alloy (Ti-6Al-4 V) is widely used in a number of fields such as medical, aeronautical, and nuclear fields. Since the surface finish should be enhanced as much possible in efficient way, the micro EDM process can be used for machining such materials. The process mechanism can be enhanced by utilizing the coated electrode in the process. In the present study, an effort was made to investigate the effects of process parameters on drilling titanium alloy with aluminum chromium nitride (AlCrNi)-coated aluminum electrode in micro EDM process. An optimization approach was also implemented using Taguchi-DEAR approach. From the experimental interpretation, the conclusions were made as follows. The AlCrNi-coated aluminum electrode can enhance the machinability of micro EDM process. The optimal combination of voltage (140 V), capacitance (10000pF), and spindle rotation (200 rpm) could provide better quality measures among the chosen variables. The moderate voltage and capacitance can remove the material effectively with lower overcut, since the electrical conductivity can effectively enhance the conductivity of the plasma energy column. The coated electrode can create the tiny craters with uniform energy distribution.



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Investigating the circular supply chain implementation challenges using Pythagorean Fuzzy AHP approach

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ABSTRACT

The business organizations across the globe are comes under the severe threats of unsustainability. The unsustainability issues are arises due to environmental unease such as climate change, global warming, resource scarceness, and ecological degradation. Circular Supply chain (CSC) has gained momentum in the last few years and acts as one of the sustainable and innovative approach for the manufacturing industry. CSC adoption enhances the social, economical, and ecological aspects of the production and supply chain system. However, very less research has been done on the identification and exploration of numerous challenges to CSC implementation in developing nations, particularly, in India. Thus, this research objective is to explore and evaluate the challenges to CSC implementation in the perspectives of Indian manufacturing sector. Total 24 CSC challenges are recognized through literature review and experts input. This research proposes the Pythagorean fuzzy analytic hierarchy process (PF-AHP) technique. This technique is used to prioritize the challenges of CSC adoption based on their relative importance. The empirical example of an Indian case organization is considered for demonstration of the applicability of proposed method. The result reveals that lack of top management support is the most crucial challenge to CSC adoption. This research outcome acts as a stepping stone for industrial practitioners to adopt CSC efficiently, and effectively.

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1. Introduction

Due to dynamic and rapid growth of industrial activity causes the various issues of unsustainability that directly affects the overall performance of manufacturing organizations. Thus, business sectors across the globe are started to adopt innovative and sustainable strategy in to their manufacturing environment in terms of circular supply chain (CSC) implementation. CSC combines the principles of circular economy in supply chain system. It mainly focuses on sustainability-three dimensions. It is dominant solution to traditional supply chain system. The enormous wastes are generated though it's unsustainable practice that causes the issues of global warming, pollutions, scarcity of raw materials, environmental degradation, etc. In contrast to this, CSC concentrates on product recovery mechanism of circular economy. It uses circular economy 6Rs principles such as reduce, reuse, redesign, repair,

recycling, and remanufacturing. CSC maintains the materials, components, and products in closed loop for longer time for value gain purpose. It is considered as restorative and regenerative system of production by its circular design. This concept linked the several subjects of sustainability such as life cycle assessments, product life cycle management, industry 4.0, process integration, product service system, eco-innovation, reverse logistics, etc. The benefits such as resource and material efficiency, improves product design, improves social and economic efficiency, enhances environmental sustainability, competitiveness, and production strategies the manufacturing organizations can be achieved by adopting CSC. The most of the European nations has adopted CSC from last 2–3 decades. They have stringent norms, laws, regulation policies towards CSC implementation. However, the developing economy, especially India is still facing the challenges to adopt CSC effectively, and efficiently. It is at beginning stage in most of the emerging nations like India. India placed second in globe based on population, and fifth in producing large amount of electronic waste in world. Several wastes are generating though its business prac-

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A Novel Method to Classify Rolling Element Bearing Faults Using K -Nearest Neighbor Machine Learning Algorithm

A novel method is proposed in this work for the classification of fault in the ball bearings. Applications of K -nearest neighbor (KNN) techniques are increasing, which redefines the state-of-the-art technology for defect diagnosis and classification. Vibration characteristics of deep groove ball bearing with different defects are studied in this paper. Experimentation is conducted at different loads and speeds with artificially created defects, and vibration data are processed using kurtosis to find frequency band of interest and amplitude demodulation (Envelope spectrum analysis). Bearing fault amplitudes are extracted from the filtered signal spectrum at bearing characteristic frequency. The decision of fault classification is made using a KNN machine learning classifier by training feature data. The training features are created using characteristics amplitude at different fault and bearing conditions. The results showed that the KNN's accuracies are 100% and 97.3% when applied to two different experimental databases. The quantitative results of the KNN classifier are applied as the guidance for investigating the type of defects of bearing. The KNN Classifier method proved to be an effective method to quantify defects and significantly improve classification efficiency. [DOI: 10.1115/1.4053760]

Keywords: bearing, defects, KNN, features

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A novel way to designing the undergraduate mechanical engineering curriculum using active stakeholder participation

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Abstract— Curriculums that are adaptable to the demands of the communities they serve are the most effective. Whether you intend to modify an existing curriculum or develop one from scratch, you must first undertake an evaluation. This article outlines the creative method utilised to develop the new curriculum in accordance with AICTE requirements. The first stage in formulating a plan is to determine the industries where graduates will find work and the skill sets they will require to be successful in those professions. The strategy emphasizes the need of including important stakeholders in curriculum development at an early stage. According to the findings of a survey given to a diverse group of stakeholders, there are issues with the current curriculum as it is assessed. This paper presents a case study of the development of the mechanical engineering curriculum at Tier-I institution from western Maharashtra for undergraduate (UG) students.

Keywords— Curriculum Design; stakeholders' involvement; active participation; Mechanical Engineering.

JEET Category— Practice paper

I. INTRODUCTION

CONCERNS have been raised all over the globe about the market potential of graduates from educational programmes in technical fields like engineering. According to the findings of a study conducted in 2021 on the subject of talent shortages the countries with the most severe talent shortages are Taiwan (88%) and Portugal (85%). Near to 90% of the companies polled in Singapore (84%), china (83) India (83%), said that talent shortages restrict them from recruiting candidates with the required expertise. This issue is pervasive across Asia Pacific. Global average of talent shortage is about 75% [1].

Today's industrial workplace is characterised by a high-performance work ethic, intense competition, a greater emphasis on quality or value addition, a greater range of

products and services, and an increase in automation. The business world demands college grads who are job-ready, meaning they have the necessary skills and are able to immediately begin working on whatever projects or responsibilities have been delegated to them. Not only are technical knowledge and abilities included on the list of anticipated competences for graduates, but also the capacity to collaborate effectively in groups, leadership, interpersonal skills, communication, creative thinking, and flexibility. Due to the shortage of professionally trained people in the industry, businesses will need to invest time, money, and resources into training workers so that they are ready to work. Due to the situation, there must be more contact and collaboration between the different engineering institutes and the industry. Even if a lot of subcomponents of the technical education system require improvement, the curriculum and teaching techniques are the two subcomponents that require immediate attention in order to produce graduates who are industry-ready [3].

A crucial part of every curriculum is ensuring that student learning is directly applicable to real-world contexts. The primary issue with curriculum is that it eventually becomes irrelevant and cannot fulfill external demand. The distractions will make it hard for students to learn. A lack of motivation to learn will slow a student's progress. Not doing so is not in the student's best interest.

To address this issue, the curriculum must be evaluated on a regular basis. The faculty has a unique opportunity to keep track of the curriculum he/she is presenting and give adjustment ideas as he/she goes. Thus, an attempt was made for design and development of UG mechanical engineering curriculum at tier-I institution of western Maharashtra with an innovative approach. Section 2 contains the details about the methodology adopted. Section 3 describes the implementation of proposed methodology and procedure of involvement of various stakeholder in curriculum design & development. Section 4 discusses the result and analysis of feedback survey from stakeholders.



A multi fault classification in a rotor-bearing system using machine learning approach

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Abstract

Modern condition monitoring of rotating machinery became intelligent for enhanced reliability, productivity, and safety. Signal processing has been collaboratively implemented with several machine learning approaches to increase the effectiveness of the fault diagnosis. This paper explores fundamental bearing frequencies withdrawn from a vibration response as novel extracted features. Experimentally obtained vibration data at diverse operating conditions have been analyzed and supplied to a supervised machine learning algorithm K nearest neighbor network (KNN) for fault classification. The result shows that the KNN algorithm based on the novel features provides 98.5% fault classification accuracy and feels promising for condition monitoring of industrial rotating machines.

Keywords Fault diagnosis · KNN · Bearing characteristics feature · Signal processing

Abbreviations

KNN	K-nearest neighbor
ANN	Artificial neural network
SVM	Support vector machine
LSTM	Least squares support vector machine
EMD	Empirical mode decomposition characteristics
REB	Rolling element bearing
MS	Mild steel
CNN	Convolutional neural network
GANs	Generative adversarial nets
WT	Wavelet transform

SIRCNN	Stacked inverted residual convolution neural network
HT	Hilbert transform
IMF	Intrinsic mode functions
DA	Dimensional analysis

1 Introduction

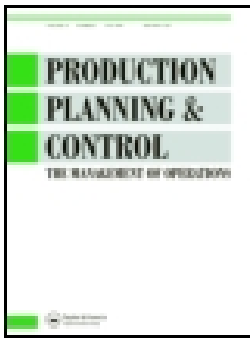
Extensively increasing automation has increased the complexity of the modern industrial system and raised the standards for precision. This has increased demand for modern, efficiently run mechanical equipment. Thus, health monitoring of complicated machinery is thus an essential but costly endeavour. Rolling element bearings (REBs) are an integral component of widely used industrial equipment and determines the equipment's service life. Over the lifespan, the equipment loses its durability and performance, and failure risk increases simultaneously. The condition-based maintenance scheme should be an integral part of any preventative maintenance plan [1]. Excessive vibration is the most common reason for a system failure, and the most common source of vibration is fault present. Local and widespread defects in the machine may lead to catastrophic failure. Bearing failure in any of the heavy rotating machines or assembly lines can result in a shutdown, affecting the overall cost and quality of the product. Recently, substantial research has been conducted on defect classification without disrupting

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Circular supply chain implementation performance measurement framework: a comparative case analysis

Swapnil Lahane, Ravi Kant, Ravi Shankar & Sachin K. Patil


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Simultaneous improvement of Z-coordinate and overcut in EDM of titanium grade 5 alloy using a carbon-coated micro-tool electrode

Phan Nguyen Huu, Toan Nguyen Duc , and Shailesh Shirguppikar

<https://doi.org/10.1142/S0217984923400043>

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Abstract

Depth of machining and dimensional accuracy are important parameters in assessing the quality of microelectrical discharge machining (EDM); therefore, enhancement of these two entities is highly essential. The optimal process parameters in microEDM are significantly influenced by the electrode material, which directly affects the machining quality. In this study, depth of machining (Z co-ordinate) and overcut (OVC) in microEDM with carbon-coated electrode were selected; and capacitance (C), voltage (V), and rotary tool (RT) were the process parameters. The experimental work was performed on a titanium alloy (Ti-6 Al-4 V) with a thin film-coated microtool electrode. The surface of the tungsten carbide microtool electrode was coated with carbon and the thickness of the coating was approximately five microns. The results show that the Taguchi–multi-objective optimization based on ratioanalysis (MOORA) — analytic hierarchy process (AHP) is the best combination for performing a simple and concise calculation in the machining process; and $U = 140$ V results in higher machining efficiency with $C = 10000$ pF and $RT = 200$ rpm. Our results show that the quality of the machined surface and machining accuracy in microEDM using coated electrode at optimal parameters are good.

Keywords: Microelectrical discharge machining (EDM) • Taguchi • multi-objective optimization based on ratio analysis (MOORA) • analytic hierarchy process (AHP) • coated electrode

Performance measurement framework of green supply chain implementation in the context of Indian manufacturing organizations

Performance measurement framework

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Abstract

Purpose – This research aims to explore the various green supply chain management (GSCM) performance measures and develop the efficient performance measurement framework for evaluation of influence of GSCM adoption on organizational performance.

Design/methodology/approach – This research proposes a hybrid framework of Pythagorean fuzzy analytic hierarchy process and Pythagorean fuzzy weighted aggregated sum product assessment technique. The usefulness of proposed framework is validated using empirical case example of Indian manufacturing organization.

Findings – The finding reveals that the overall performance of case organization is 67.03% based on define set of performance measures. Further, the proposed framework has been validated with other three Indian automobile manufacturing organizations. The results obtained were confirmed with selected empirical case company. The proposed hybrid framework provides the effective path to measure and benchmark the impact of each performance measures on system performance.

Research limitations/implications – This research is limited to automobile sector of India; hence the results obtained in this study may not be comprehensively used to other sectors due to different product and process fields.

Originality/value – This research aids the industrial practitioners to effectively implement the green supply chain management (GSCM) and helps them to boost the overall performance of business organizations in three dimensions of sustainability.

Keywords Green supply chain management, Performance of GSCM, Sustainability, PF-AHP, PF-WASPAS, India

Paper type Research paper

Abbreviations

GSC	Green supply chain
GSCM	Green supply chain management
BSC	Balanced scorecard
AHP	Analytic hierarchy process
WASPAS	Weighted aggregated sum product assessment
PF-AHP	Pythagorean fuzzy analytic hierarchy process



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*Micro-EDM, coated electrode,
optimization*

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THE OPTIMIZATION OF MICRO-EDM MACHINING PROCESS WHEN USING CARBON COATED MICRO ELECTRODE AS A TOOL

The amount of electrode wear in micro-EDM has a direct effect on the dimensional accuracy of the machined hole. Therefore, improving the corrosion resistance of electrodes in micro-EDM is still of great interest. The effective coating of thin film for the micro tool electrodes in the case of micro-EDM can lead to minimize the electrode wear which eventually improve the productivity and machining quality. In the present study, experiments were performed on micro-EDM using carbon coated tool electrode and optimized using Taguchi-Topsis to investigate optimum levels of Depth of cut (Z) and overcut (OVC). It was concluded that optimum conditions had improved significantly using carbon coated micro tool electrode. Optimal levels of technological parameters include $V = 160$ V, $C = 10000$ pF, $RPM = 600$ rpm, and $Z_{opt} = 2.525$ mm, $OVC_{opt} = 65.257$ μ m. The quality of the machined surface with the coated electrode at optimal conditions is analysed and evaluated. The Topsis method is a suitable solution to this problem, and the steps to perform the calculation in this technique are simple.

1. INTRODUCTION

A crucial component in engineering sectors like aerospace and implant biomedicine is titanium alloy (Ti-6Al-4V). The most used technique for machining titanium alloys (Ti-6Al-4V) is EDM, specifically micro-EDM. In micro-EDM machining, productivity and dimensional accuracy are crucial quality factors technical specialists are very interested in the simultaneous development of these quality metrics. Coated electrode micro-EDM is a fairly new method, and it shows great promise for increasing micro-EDM machining efficiency. However, various materials have distinct impacts on the machining quality parameters when utilised to cover the electrode surface in micro-EDM. Currently, the number of studies of micro-EDM with coated electrode is very small. Therefore, research results in micro-EDM with coated electrode are published, and it will contribute to clarifying the influence of coating material on the micro-EDM machining process.

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Influence of carbon coated WC electrode on drilling measures of Ti–6Al–4V alloy in μ - EDM process

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Sādhanā **48**, Article number: 108 (2023) | [Cite this article](#)

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Abstract

Even though titanium alloy specimens are being used in many engineering applications, it is highly tedious to machine such materials using conventional machining process. It is very essential to enhance the process mechanism in micro electrical discharge machining (μ -EDM) process. In the present work, an effort was made to analyze the effects of carbon coating in tungsten carbide tool electrode. The influence of process parameters was also investigated on performance measures such as depth of cut, tool wear rate and overcut while machining titanium alloy specimens in μ -EDM process. Since the discharge energy is influenced by the capacitance, it can have most influence on depth of cut and tool wear rate. Due to the importance of voltage across the machining zone on determining side cut in the process, it can have most influence on overcut. From the surface morphology analysis, the less burrs of the orifice surface of the hole were observed with the coated electrode than uncoated electrode.

Research Article

Dong Pham Van, Shailesh Shirguppikar, Phan Nguyen Huu*, Muthuramalingam Thangaraj, Thanh Le Thi Phuong, Ly Nguyen Trong and Vaibhav Ganachari

Influence of graphene coating in electrical discharge machining with an aluminum electrode

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Abstract: Since the cost of electrodes in electrical discharge machining (EDM) is usually too high, it leads to a significant increase in the production cost. Hence, it is important to conduct research aimed at reducing the manufacturing cost of electrodes. Currently, coated electrodes are a new process solution in EDM. It can improve the economic and technical efficiency of this technology. In this article, the efficiency of the graphene-coated aluminum (Al) electrode in the EDM for Ti-6Al-4V was analyzed and evaluated. Material removal rate and tool wear rate were used as quality indicators in this work. The research results have shown a significant improvement in quality characteristics in EDM with coated electrodes compared to EDM with uncoated electrodes. The surface quality of the specimen with coated electrodes in EDM was also improved.

Keywords: EDM, coated electrode, graphene, aluminum, MRR, TWR

1 Introduction

Titanium alloy (Ti-6Al-4V) is widely applied in many important industrial fields such as aerospace, biomedical,

nuclear, *etc.* Processing and manufacturing products with Ti-6Al-4V often face many difficulties, especially products with complex surfaces and small sizes [1]. At present, electrical discharge machining (EDM) is still a processing method capable of bringing high economic and technical efficiency in manufacturing titanium alloy materials. Besides the outstanding advantages of EDM compared to traditional machining methods and some other non-traditional machining methods, EDM also has some limitations such as low machining productivity and surface quality, and the electrode is worn continuously. These have led to a significant reduction in the application efficiency of EDM in practice. Therefore, this research provides process solutions to improve machining efficiency by EDM, and it is still attracting the attention of experts in this field of machining [2]. Many new process solutions were introduced such as EDM with vibration, optimization in EDM, EDM with powder mixed in dielectric, *etc.* EDM with coated electrodes is a process solution that is still relatively new, and it can be economically and technically viable in this area. However, different coating materials can affect the quality characteristics in EDM very differently, and research results in EDM with coated electrodes are few. Therefore, the results of studies aimed at clarifying this field still need to be further explored.

Some recent research results have shown that using copper (Cu)-coated aluminum (Al) electrodes in EDM has contributed to reducing the cost of electrode materials [3]. The production cost of the product with EDM with Cu-coated Al electrodes has been reduced by approximately 35% compared to the uncoated Cu electrodes [4]. The stiffness of the electrode fixture system of EDM with Cu-coated Al electrodes is also significantly increased because the mass of the coated electrode was only approximately two-thirds of that of the uncoated electrode [5]. The coating of the material on the electrode surface in EDM has resulted in larger machining productivity with reduced electrode wear and better surface quality. Using tin-coated electrodes in the EDM for EN24 steel has resulted in significantly reduced machining times and improved surface quality and dimensional accuracy [6]. The influence of process

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Magnetic and structural characterization of Sn doped cobalt ferrites; A visible light-driven photocatalysts for degradation of rhodamine-B and modeling the process by artificial intelligence tools



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ABSTRACT

Tin (Sn) substituted cobalt ferrites $\text{Co}_{1-x}\text{Sn}_x\text{Fe}_2\text{O}_4$ with composition ($x = 0.0, 0.1, 0.2, 0.3, 0.4$ and 0.5) were synthesized utilizing sol-gel auto combustion method. All synthesized powders were characterized for their structural, magnetic and optical characterization after calcination. The single phase spinel with good crystallisation and a decreasing crystallite size with Sn substitution is confirmed by the powder X-ray diffraction (XRD) pattern. The magnetic measurements were carried out at room temperature where saturation magnetization values show sufficient magnetic nature of calcinated ferrites. The bandgap values for pure cobalt and Sn-substituted cobalt ferrites were closer to the experimental value. The visible light photocatalytic degradation of Rhodamine B was carried out in presence of Sn substituted cobalt ferrites that shows good catalytic activity up to 87% degradation for $\text{Co}_{0.5}\text{Sn}_{0.5}\text{Fe}_2\text{O}_4$ catalyst. Additionally, this study used Artificial Neural Network (ANN) and Adaptive Neuro-Fuzzy Interface System (ANFIS) models to simulate degradation efficiency with inputs including time, pH, and catalyst dosage. The results revealed that the 3-2-2-1 structure ANN4 model outperformed the other ANN and ANFIS models in the testing phase (RMSE = 6.90% and NSE = 0.92). According to the findings of this study, artificial intelligence models are capable of precisely predicting Rhodamine B degradation.

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1. Introduction

Spinel ferrites garnered a lot of attention due to their inexpensive cost, excellent chemical stability, moderate saturation magnetization, high surface area, robust wear resistance, low density, low thermal expansion coefficient, and negligible toxicity to both human health and the environment [1,2]. Due to their distinctive magnetic characteristics and crystalline structure, which are caused by minute variations in the particle size, composition, presence of surface effects, they have attracted researcher's attention in a number of fields [3,4].

The modern era of ceramic research contains the synthesis and study of spinel ferrites with general formula $\text{M}^{2+}(\text{Fe}^{3+})_2\text{O}_4$ (where

$\text{M}^{2+} = \text{Co, Mg, Zn and Ni}$) because of their exceptional chemical and physical properties [5]. Cobalt ferrite a kind of spinel ferrite is gaining popularity because it can be easily modified for use as an adsorbent [6,7]. In order to synthesize ultra-fine ferrite particles, a number of synthetic techniques have been developed, including chemical co-precipitation [8,9], solid state [10], sol-gel [11,12], micro-emulsion [13], hydrothermal [14], cetyl trimethyl ammonium (CTAB) assisted hydrothermal [15], and chemical reduction [16]. As a result, the sol-gel auto combustion method is regarded as a simple, approachable, perfectly composition-controlled, and remarkably reproducible procedure. Low processing time and very low external energy usage are requirements for this method [17]. The material can also be doped with various ions in a range of concentrations to modify its structural [18], optical [19], electrical [20], and magnetic [21] characteristics. Variations in the structure and crystallinity of ferrites are caused by the distribution of various elements between the tetrahedral (A) and octahedral (B) sites. Ferrites nanoparticles

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Subclass of Harmonic Univalent Functions Associated with the Differential Operator

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Abstract. In the present paper, we study a new subclasses of harmonic univalent functions by using differential operator in the unit disc $\mathbb{U} = \{z \in \mathbb{C} : |z| < 1\}$. Also we obtain the coefficient bounds, convex combination, extreme points and convolution conditions.


Keywords: Harmonic functions; Univalent functions; Differential operator.

1. Introduction

Let \mathcal{A} denote the class of analytic functions $f(z)$ of the form

$$f(z) = z + \sum_{l=2}^{\infty} a_l z^l \quad (1)$$

A REVIEW OF ^{137}Cs TRANSFER FACTOR STUDIES FOR INDIAN ENVIRONS

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In recent years there have been conscious efforts put by researchers in India to generate the soil-to-plant ^{137}Cs transfer factor values. This review study is aimed at providing a comprehensive background of ^{137}Cs transfer rates around the environs of a few nuclear power plant sites of India. As a part of this, the study looked into ^{137}Cs transfer rates from soil to various plant species. The effort was made to quantify the transfer rates of ^{137}Cs and various parameters affecting the movement of ^{137}Cs in the terrestrial environment. The past and current knowledge on ^{137}Cs transfer factors available in the literature were reviewed thoroughly and highlighted the need for incorporating lesser known and overlooked aspects of radionuclide behaviour for future studies. The paper also tried to identify and highlight the gaps and inconsistencies in the reported values of ^{137}Cs transfer factors.

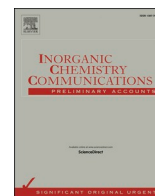
INTRODUCTION

Predominantly, the natural environmental radioactivity which contributes to external exposure mainly arises from three primordial radionuclides present in the soil such as ^{40}K , and the ^{238}U and ^{232}Th decay series^(1, 2). Besides natural radioactivity, there is anthropogenic radioactivity which is artificially generated radioactivity from weapon-testing fallout, nuclear activities and medical applications. As a result of atmospheric nuclear weapons testing carried out from 1945 until 1980 and reactor accidents, there has been a huge discharge of ^{137}Cs into the atmosphere⁽³⁾. These radionuclides reach the stratosphere, where they are widely dispersed due to stratospheric diffusion and mixing, and would have come down to this part of the earth (the Indian subcontinent) through wet and dry fallout. Normally the radioecological experimental studies are performed around the vicinity of nuclear facilities like nuclear research centers, nuclear power plants or fuel processing complexes as they might act as indicator sites for the presence of radionuclides in the environment. After nuclear accidents like Chernobyl in 1986 and Fukushima in 2011, there was renewed vigour and urgency in studying high-yielding fission products like ^{137}Cs and ^{90}Sr due to their affinity with nutrient counterparts K and Ca. Among caesium's numerous radioactive isotopes, ^{137}Cs is of utmost importance from a human radiological protection point of view, because (a) it is both β ($E_{\text{max}} = 512 \text{ keV}$) and γ (662 keV) radiation emitter; (b) it has a very

long half-life of 30 y and (c) of its great mobility in the biosphere and its affinity with biological systems^(4, 5). Unlike in other parts of the world, as India did not witness nuclear mishaps of such a scale, the need for extensive study across the nation was not felt. However, the review of literature revealed that in India many researchers carried out detailed baseline investigative studies from time to time around various nuclear facilities to gain information and quantify the influence of weapon-testing fallout radioactivity vis-a-vis natural background radiation. Hence, for India, such studies were mostly carried out around nuclear power plants as a part of routine regulatory and monitoring measures. As a part of this, this study is an effort to review existing literature on transfer factor (TF) studies of ^{137}Cs . The estimation of TF and transfer coefficient (TC) for a radionuclide in various pathways is essential for an accurate assessment of the long-term radiological hazard to the public residing near nuclear establishments. It is a well-known fact that the transfer rates of radionuclides are influenced by their stable and analogue element concentrations in the environmental matrix, particularly in case of those radionuclides, such as ^{137}Cs , which has analogue element (K) as an essential nutrient pair^(6, 7).

TRANSFER FACTOR

Many projects were run by the International Atomic Energy Agency (IAEA) to determine TF mainly for



Short communication

Effect of calcination time on electrochemical performance of hydrothermally grown copper cobalt sulfide nanostructures for use in electrochemical supercapacitors

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ABSTRACT

This work reports the fabrication of CuCo₂S₄ (CCS) nanostructures (NSs) by a hydrothermal method. The CCS-NSs are synthesized at 170 °C by varying calcination times. Nickel mesh (NM) is utilized as a current collector. The CCS-NSs are derived at different calcination times, such as 12 h, 14 h, and 16 h and are coated onto NM to fabricate electrochemical supercapacitors (SCs). The cyclic voltammetry and galvanostatic charge–discharge analysis of CCS-NM electrodes are performed in 1 M LiOH electrolyte. The electrodes fabricated with the CCS-NSs with a calcination time of 14 h (CCS@14h-NM) showed the maximum specific capacitance (C_{sp}) of 995.86 F g⁻¹ at a scan rate of 10 mVs⁻¹. In addition, the CCS@14h-NM electrode showed an 83 % capacitance retention rate after 10,000 cycles at a current density of 1 mA cm⁻². The excellent capacitance retention rate of CCS-NM electrodes reflects an extensive scope in fabricating efficient electrochemical SCs involving earth-abundant and environmentally benign elements. Additionally, an asymmetric supercapacitor device with CCS@14h-NM as the anode and AC-NM as the cathode produces excellent C_{sp} (103 F g⁻¹), specific energy E_{sp} (16 Wh kg⁻¹), and specific power P_{sp} (7.4 kW kg⁻¹) as well as remarkable long cycle life (retention of 81 % after 10,000 cycles).

1. Introduction

Due to a lack of efficient energy sources, the global energy crisis has gotten worse in recent years [1]. Energy storage is required to make better use of available resources. Batteries, supercapacitors (SCs), and fuel cells are among the many storage devices available today [2]. The SCs are the most appealing among these devices because of their high power density, fast charge–discharge rate, a noteworthy life cycle time and ease of fabrication with low maintenance [3].

The SCs store and release energy electrochemically. Due to their lower energy density, SCs are not commercial products despite having all of these advantages. As a result, researchers are working to increase its energy density [4–7]. The capacitive properties of a device are influenced by the electrical conductivity and electrochemical stability of the material [8]. Carbon-based materials are more appealing in light of these requirements due to their availability, low cost, and high electrical conductivity, but their lower capacitance (50–150 F g⁻¹) limits their commercial applications [9–10]. The use of low-cost pseudo-capacitive material is the most beneficial, economical, and effective way to

increase the energy density of SCs [11]. However, the cycling performance of pseudo-capacitive materials is limited due to their electrochemical stability. Therefore, various electrode materials and electrolytes are used to overcome this drawback and improve its stability [12–13].

Metal sulfide-based materials are promising electrode materials for constructing SCs. Analogues to metal oxides; metal sulfides have special benefits such as low cost, exceptional electrochemical activity, and dependable stability. Metal sulfides also exhibit greater electrical conductivity and richer redox sites. Besides, the low-density and hollow spherical structures will be advantageous to improve their electrochemical performance [14]. Therefore, there is a growing interest among researchers to design electroactive materials based on metal sulfides for electrochemical SCs [15]. Recently, Zhai et al. have prepared CuS and carbonized cloth as composite electrode materials through hydrothermal method for flexible supercapacitors. They have investigated the significant role of reaction time in improving overall performance of these electrodes [16]. Moreover, the electrodes fabricated from zinc sulfide, copper sulfide and porous carbon have delivered

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KI-Oxone catalyzed ultrasound-promoted synthesis of imidazo[1,2-a]pyridine-3-carboxylates (IPCs) and evaluation of their anti-tubercular activity

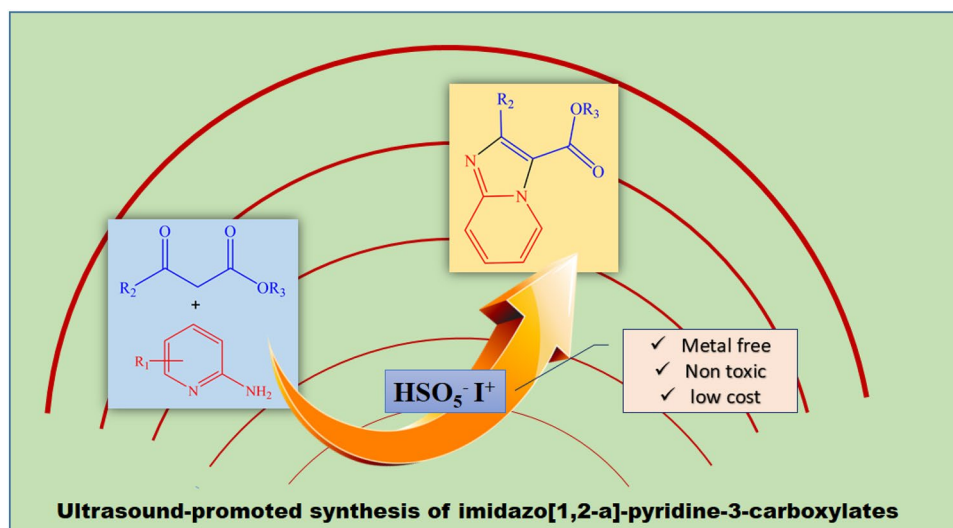
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Abstract

The present work involved ultrasound-promoted KI-Oxone mediated oxidative C–N bond formation from a reaction of β -ketoester and 2-aminopyridines leading to novel functional imidazo[1,2-a]pyridine-3-carboxylates (IPCs). The α -halogenation of β -ketoester has been easily carried out by in situ formed $I^+ OH^-$ species from the KI-Oxone system. IR, NMR, and Mass spectra characterized all derivatives. The structure of the synthesized IPCs was confirmed by X-ray crystallographic analysis. A transition metal-free protocol, one-pot synthesis, non-toxic reagents, benign reaction conditions, high yield, short reaction time, and the synthesis of highly functional IPCs are the remarkable features of the present method. The synthesized IPCs show unusual anti-tubercular activity.

Graphical abstract



Keywords 2-aminopyridine · imidazo[1,2-a]pyridines (IPY) · imidazo[1,2-a]pyridine-3-carboxylates (IPCs) · β -ketoester · KI-Oxone · Ultrasound irradiation

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RESEARCH ARTICLE

A mathematical model of blood flow in a stenosed artery with post-stenotic dilatation and a forced field

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Abstract

Arterial stenosis is a common cardiovascular disease that restricts blood flow. A stenotic blood vessel creates tangent stress pressure, which lessens the arterial side and causes an aneurysm. The primary purpose of this study is to investigate blood flowing via an inclination pipe with stricture and expansion after stricture (widening) underneath the influence of a constant incompressible Casson liquid flowing with the magnetism field. The relations for surface shearing stress, pressure drop, flow resistance, and velocity are calculated analytically by applying a mild stenosis approximation. The effect of different physical characteristics on liquid impedance to flowing, velocity, and surface shearing stress are studied. With a non-Newtonian aspect of the Casson liquid, the surface shearing stress declines, and an impedance upturn. Side resistivity and shear-stress increase with the elevations of stricture, whilst together decreasing with a dilatation height.

1. Introduction

A narrowing of an artery caused by arteriosclerotic deposition or other aberrant tissue growth is referred to as stenosis. As the growth spreads into the artery's lumen, blood flow is impeded. The hindrance could make hurt the internal cells of the divider, bringing about stenosis movement. The advancement of stricture and the streaming of blood across the corridor are consequently coupled given that all influence the other. The movement of vein stenosis will have genuine outcomes and disturb the customary working of the vessel plot.

The investigation of blood streaming through stricture arteries is one among the first significant zones of examination because plate shape problems reason additional than 30% of all