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Compiled by Institute Research Advisory Council (IRAC)

Principal's Message



Dr Satish K P Principal Government Engineering College Thrissur is forging ahead in the field of research activities undertaken by various faculty and students of the institution. All the research activities carried out by the institution are helping industry and society at large and are contributing towards a sustainable development.

The 6th volume, 1st edition of our research bulletin has come out successfully which completely showcases the research activities completed and which are in progress in our institution. We have three members of our institution who successfully completed their PhD. I use this opportunity to congratulate each one of them in their achievement.

ICETEST 2023 was successfully organised by our institution during April 19-21, and it was a grand success in terms of participation as well as presentation of cutting-edge research activities. I hereby also congratulate the coordinators, and various committee of ICETEST 2023, who had put in tremendous efforts for making it a grand success. ICETEST 2023 witnessed excellent presentations from various researchers spread across the international level. I hereby also congratulate all these contributors for enriching this international conference.

I am also extremely happy to note that in the last six months we have added another six MoUs with reputed organisations. This will go a long way as far as collaborative research with industry is concerned, wherein our institution is establishing a mutually beneficial relationship with industry.

I am also glad to note that we have excellent intellectual faculty resources who are capable grabbing funded research and I encourage them for achieving their research objectives by taking up funded research projects. Special initiatives for augmenting the research activities in our institution need to be formulated and implemented. I urge all our faculty members to take initiatives for bringing more research funding from various funding sources, which is the need of the hour. Let our motto be strengthening research activities and building industry institute linkages.

I hereby also congratulate the editorial team of this research bulletin under the leadership of Dr. Vinod P Raphael, for bringing out this excellent edition with rich contents.





Dr Prasanth P



Dr Laly M J



Dr Sherjah P Yusuf Ali

The Research Advisory Council of GEC Thrissur is delighted to congratulate our esteemed faculty members: Prof. Prasanth P from the Physics department, Prof. Laly M J from the EEE department, and Smt. Sherjah P Yusuf Ali (CE dept.), on their successful completion of their Ph.D. degrees.

Details of Ph.D Awardees

CONGRATULATIONS!

Sl. No	Name of Ph. D Awardee	Dept.	Name of Supervisor	Title of the Work	Date of Award & University
1	Prasanth P	Physics	Dr. K. M. Udayanandan	Studies of statistical mechanics for chaotic systems	10 th May 2023, Kannur University
2	M. J. Laly	EEE	Dr. Sunitha R & Dr. Elizabeth P Cheriyan	Optimal and Stable Operation of Hybrid Power Systems Integrated with Bulk Renewable Energy Sources and Storage Systems	13 th March 2023, NIT Calicut
3	Sherjah P. Yusuf Ali	CE	Dr. N. Sajikumar & Dr. P.T. Nowshaja	Water Quality Monitoring of Lakes using Sentinel 2 Multispectral Imagery	29 th May 2023, APJ Abdul Kalam Technological University

Ph D Abstracts

Optimal and Stable Operation of Hybrid Power Systems Integrated with Bulk Renewable Energy Sources and Storage Systems

Dr. Laly M J

The optimal power flow (OPF) problem is a tool in the planning and operating stages of a power system. Increasing penetration of renewable energy significantly alters the network power flow in terms of direction as well as magnitude. The intermittent and uncertain nature of renewable inputs is a major concern since the power flow in the system is affected considerably. Hence to support bulk integration of renewable energy in the power system, bulk or distributed energy storage systems can be implemented. The energy storage system is utilized to absorb the excess power and meet the demand to avoid violation of system constraints. A multi-period ac optimal power flow (OPF) problem with energy storage systems (ESSs) is formulated and a set of candidate buses for ESS installation are identified based on economic criterion. A novel hybrid approach of conventional cum heuristic method, newton raphson based particle swarm optimization (NRPSO) method is proposed to optimize the allocation problem. The integration of various types of renewable energy sources and storage systems into power system increases the complexity of the conventional power system. The proposed methodology optimizes the power flow of a complex, nonlinear hybrid power system to fulfill several objectives, viz., line loss minimization, cost minimization, and profit maximization under varying environmental conditions and system attributes. Another major concern is the stability of the power system. Small signal stability (SSS) of the system is its ability to return to a stable operating stage after small disturbances such as load variation, generation variations, etc. In this study, the conventional Nyquist plot method and modern heuristic search algorithms, say cuckoo search optimization (CSO) algorithm, fire fly (FF) algorithm, and particle swarm optimization (PSO) algorithm, are applied for the design of the controller parameters and the performance of the system is analyzed and compared for varying system condition. By performing the loadability test, flexible AC transmission system (FACTS) controller is implemented in the system to improve the voltage profile. Coordinated design of controller parameters is done and verified the system performance for different conditions. Better performance is obtained with a coordinated controller design.

Studies of statistical mechanics for chaotic systems

GECT RESEARCH

Dr. Prasanth P.

In this wor, we strengthened the concept that statistical mechanics can be applied to a nonlinear system when it is chaotic, through our studies. We used four different types of nonlinear oscillators and showed the regions where they transform to chaotic systems. Using statistical mechanics we tried to explain the temperature and internal energy of some systems. In Statistical Mechanics many authors were using two equations for obtaining temperature. From our studies, we investigated and concluded that Gibbs's definition of entropy and related temperature is more suitable than Boltzmann's definition of entropy and temperature. We obtained general expressions for the equipartition theorem which can be applied to any type of Hamiltonian. We differentiated Virial Theorem from Virial Relation. Found general expression for Virial relation applicable for complex type potentials. Finally we showed that fractals, the beautiful patterns in nature, are related to chaotic systems and that all the nonlinear oscillators we studied have a good fractal dimension.

Water Quality Monitoring of Lakes using Sentinel 2 Multispectral Imagery

Dr. Sherjah P. Yusuf Ali

The objective of the present study was to derive/identify simple tools for mapping the trophic status of lakes by using satellite imagery. Trophic State Index (TSI) is generally accepted as an indicator of the trophic status of inland water bodies. This study explored the possibility of using both the bottom of atmosphere reflectance (R_{rs}) and the inherent optical properties (IOP) for developing models for estimating TSI. The band ratios (BR) and normalised difference (ND) indices of R_{rs} and IOP proved to be dependable tools for mapping the TSI of lakes by their ability to estimate TSI with a mean absolute percentage error (MAPE) less than 12%. The indices when applied to S2 imagery helped in identifying severe hypereutrophic areas of the water body. The feasibility of using these indices on the Google Earth Engine (GEE) platform was also studied. The capability of the models as a rapid water quality monitoring tool is demonstrated by displaying the temporal and spatial variation of water quality across Vembanad Lake and Milford Lake for the period 2018-2021. These tools can be beneficial to the government authorities for regularly monitoring the quality of water bodies using the freely available S2 imagery.



IRAC congratulates the entire team for the release of the souvenir, "TBI Chronicle," for commemorating the remarkable journey of entrepreneurship development under the umbrella of the Technology Business Incubator (TBI) and the Swavalamban Chair for MSME Solutions an initiative by Small Industries Development Bank of India (SIDBI).

The "TBI Chronicle" serves as a comprehensive record showcasing the entrepreneurial journey fostered by TBI and the Swavalamban Chair for MSME Solutions. It highlights the myriad of workshops, seminars, mentoring sessions, and successful startup stories that have emerged as a result of our collective efforts. It is a testament to the dedication and relentless pursuit of innovation demonstrated by our entrepreneurial community.

COMPAN

HELP VARY

PROGRAM

TBI Chronicle- https://bit.ly/GECT-tbi-chronicle

International Conference on Emerging Trends in Engineering, Science and Technology ICETEST 2023



International Conference on Emerging Trends in Engineering, Science and Technology: ICETEST 2023is a biennial international conference organized by GovernmentEngineering College Thrissur, since 2009. ICETEST 2023, the seventh edition of ICETEST, is funded by TEQIP four funds. ICETEST 2023 was conducted during 19-21 April 2023 in hybrid mode with a theme "*Society, Energy and Environment – showcasing the roadmap for tomorrow*". ICETEST 2023 is a collegium of three conferences:

- (i) International Conference on Civil Engineering & Architecture for Sustainable Infrastructure Development and Environment (CEASIDE2023),
- (ii) International Conference on Recent Advances in Materials, Processes and Technology for Sustainability (RAMPTS2023) and
- (iii) International Conference on Power, Instrumentation, Control and Computing (PICC2023)

Dr Jayan A.R., Professor ECE Dept., and Dr Uma Syamkumar, Associate Professor EEE Dept. were the Organizing Secretaries of ICETEST 2023. Dr Vinod P. Raphael, Associate Professor, Chemistry Dept. served as the treasurer of the program. Dr Padmakumar G.P (CE) and Dr. Surya (Arch) were the coordinators of CEASIDE2023. Dr. Jaison Mathew (EEE), Dr. Celine Mary Stuart (ECE), Dr. Salim A (CSE) were the coordinators of PICC2023. Dr Madhusoodanan (ME), Dr Padmavathy (CHE) and Dr Boby K. George (PE) were the coordinators of RAMPTS2023

We have received 334 submissions and 125 papers were accepted (PICC-75, CEASIDE-31 and RAMPTS-18).

All the accepted papers of PICC 2023 will be submitted to IEEE for publication in IEEE Xplore, which is indexed in Web of Science, IEEE GlobalSpec, Scopus, and IET Inspec. All the accepted papers of CEASIDE 2023 and RAMPTS 2023 will be submitted for publication in Elsevier SSRN conference proceedings.

On 19th April 2023, Dr Raj Kurup, CEO of Environmental Engineers International Pty Ltd and Adjunct Processor, Chemical Engineering, The University of Western Australia delivered the plenary talk on 'Sustainable Engineering Practice & Circular Economy.' The talk covered the application of sustainability and circular economy concepts in engineering practice which has gained much attention recently.

ICETEST - 2023 Speakers



Dr. Raj Kurup Director & CEO, Environmental Engineers International Pvt Ltd, Australia



Dr. Nishanth Chemmangattuvalappil University of Nottingham Malaysia.



Dr. Ganapati Panda C V Raman Global University, Bhubaneswar, India.



Dr. Angad Warang ESARQ, UIC Barcelona



Dr. Brij N Singh Fellow IEEE, John Deere Electronics, USA



Dr. Marcos Alonsa University of Oviedo, in Asturias, Spain



Dr. Ranjith M NIT Surathkal



Dr. Naveen James Indian Institute of Technology Ropar



GECT RESEARCH

Dr. James M. Manimala School of Mechanical and Aerospace Engineering and faculty director of SSDL



Dr. Vivek Balachandran Singapore Institute of Technology



Dr. Sumesh P Thampi IIT Madras



Ar. Sabu Francis Founder of Limen Leap Labs, Developer of TAD, a BIM software

Journal Articles Congratulations to the Contributors....

6 GECT RESEARCH

Dept. of Civil Engineering

M.G. Sreelekha, K. Krishnamurthy, M.V.L.R. Anjaneyulu (2023). An Examination of the Land Use Determinants of Travel: A Case Study of Calicut City in India, European Transport \ Trasporti Europei (2023) Issue 93, Paper n° 7, ISSN 1825-3997, https://doi.org/10.48295/ET.2023.93.7

Dept. of Mathematics

Shiny KS, NC Viswanath., Study of Birth-Death Processes with Immigration., Croatian Operational Research Review 13 (1), 49-63,2022

Kumar, P.G.D., Viswanath, N.C., Cyrus, S. et al. (2023) Effects of the 2018 and 2019 Floods in Kerala, India on the Existing Multivariate Statistical Models. Int. J. of Hydrology Science and Technology, DOI: 10.1504/IJHST.2023.10053898 Mathew P. Sindu, Narayanan Viswanath., Study of a Birth-Death Process with Population Independent Death Rate (2023), International Journal of Mathematics in Operational Research., DOI: 10.1504/IJMOR.2023.10056408

Dept. of Chemistry

Vinod P Raphael, K.S. Shaju, T.K. Bindu and A. Sini., In silico investigations on the repurposing of antivirals for Covid-19 and pharmacophore modelling, Current Chemistry Letters (2024); published online., doi: 10.5267/j.ccl.2023.7.001

Conference Publications

1. **N C Viswanath, Sindu M P**; A birth-death process with temporary growth halts and population independent death rate. INTERNATIONAL CONFERENCE ON MATHEMATICS OF INTELLIGENT COMPUTING AND DATA SCIENCE (ICMICDS 2022)ORGANIZED BY THE DEPARTMENT OF MATHEMATICS AND CENTRE FOR TOPOLOGY AND APPLICATIONS (CETA); Springer Conference Series.

2. N C Viswanath, Shiny K S; Study of birth-death processes with growth interruptions. INTERNATIONAL CONFERENCE ON MATHEMATICS OF INTELLIGENT COMPUTING AND DATA SCIENCE (ICMICDS 2022) ORGANIZED BY THE DEPARTMENT OF MATHEMATICS AND CENTRE FOR TOPOLOGY AND APPLICATIONS (CETA); Springer Conference Series.

3. **N C Viswanath, Reya K**; Comparison of Vacation and Mt/Mt/1 Queueing Models for Traffic Flow at Signalized Intersections. INTERNATIONAL CONFERENCE ON MATHEMATICS OF INTELLIGENT COMPUTING AND DATA SCIENCE (ICMICDS 2022) ORGANIZED BY THE DEPARTMENT OF MATHEMATICS AND CENTRE FOR TOPOLOGY AND APPLICATIONS (CETA); Springer Conference Series. IIIC Industry Institute Interaction Cell

For the advantage of both parties, the Industries Institute Interaction Cell (IIIC) of GEC Thrissur (GECT) serves as a bridge between the industry and the university. The businesses and organisations support the institution by working together on research and development projects, as well as by giving the students on-site training and internships.

GECT RESEARCH

With a number of organisations, the institution has signed MoUs to facilitate the exchange of facilities and expertise. Industries offer opportunities for instructors, staff, and students at our college to receive training. Students regularly have access to industry training, internships, academic project work, industrial trips, etc. Periodically, IIIC takes the initiative to sign MoUs with a variety of businesses and start-up organisations. Student internships, industrial training for academics, students, and technical staff, collaborative research, and reciprocal exchange are only a few of the activities covered under the MoU. Student internships, industrial training for teachers, students, and technical staff, joint research, the sharing of technical expertise for visiting faculty programmes, seminars, STTPs, conferences, etc. are just a few of the activities covered by the MoU. IRAC acknowledges **Dr. Praseetha P. Nair**, the coordinator, for her significant commitment to the IIIC of the GEC TCR. During Jan-June 2023, we IIIC, GEC Thrissur cloud sign MoU with the following institutions

i) C-MET Thrissur

- ii) Kerala University of Digital Sciences
- iii) Institute for Communicative and Cognitive Neurosciences (ICCONS), Kavalappara, Palakkad
- iv) Lead Resource Centre (3D Printing/Additive Manufacturing), NIELIT Calicut
- v) Finance Division, Additional Skill Acquisition Programme-ASAP, Kerala Board
- vi) Kerala State Pollution Control Board



MoU is signed between Dr.Satish K P, Principal, GEC Thrissur and Dr. N Raghu, Director, **C-MET, Thrissur**, on 23rd June 2023 for a period of 5 years for joint research activities, R&D training and projects, consultancy works, training programs etc.

MoU is signed digitally between Dr.Bindu G R, Principal, GEC Thrissur and Dr. Alex P James, Dean Academics, **Kerala University of Digital Sciences**, **Trivandrum**,on 31st March 2023 for joint research activities, joint academic programs, internship opportunities for students, staff and faculty training programs etc.





MoU is signed virtually between Principal, GEC Thrissur and Dr.Sanjeev V Thomas, Professor of Neurology and Director, **Institute for Communicative and Cognitive Neurosciences (ICCONS), Kavalappara, Palakkad**, on 14th March 2023 for a period of 5 years for joint research activities, consultancy activities, product development initiatives, training programs etc.

MoU is signed virtually between Dr.Bindu G R, Principal, GEC Thrissur and Dr.Pratap, Executive Director, Lead Resource Centre (3D Printing/ Additive Manufacturing), NIELIT Calicut, NIT Campus,Calicut,on 30th March 2023 for a period of 1 year. The MoU aims at jointlyofferingBridge course in 3D printing/Additive Manufacturing, collaborative research projects/programmes of mutual interests etc.





MoU is signed between Dr. Bindu G R, Principal, GEC Thrissur and Mr. Anwar Hussain, Head-Procurement, Finance Division, **Additional Skill Acquisition Programme-ASAP, Kerala Board** on 14 th March 2023 for a period of 1 year. The MoU aims at jointly offering Certificate course in Interior Design, collaborating projects/programmes of mutual interests etc.

MoU is signed between Dr.RanjiniBhattathiripad T, Principal, GEC Thrissur and Mrs.Suchithra V, Environmental Engineer, **Kerala State Pollution Control Board** on 3rd January 2023 for a period of 5 years. The MoU aims at internships, training programs and research collaborative works.





School of Architecture& Planning

A workshop "**VikasanamPlanningilude**": Discussion on Draft Master Plan of Thrissur City 2039" was organized by School of Architecture and planning, Government Engineering College Thrissur on 7th June 2023 at Gloria Hall GECT. Principal Dr Sathish K P presided over the function. Sri Rajeev K R, Town Planner of Thrissur delivered the keynote address. Dr Ajith Kaliyath, Senior urban chair KILA&RtdSenior Town Planner of Ernakulam led the panel discussion. Eminent personalities from various fields participated in the discussion.



B Arch students participated in the NASA (National Association of Students of Architecture) conference held at Lovely Professional University, Punjab from 9th June to 12th June 2023



VikasanamPlanningilude : Discussion on Draft Master Plan of Thrissur City 2039 on 7th June 2023

Congrats to Prof. Bindu C A ...

IRAC congratulates Prof. Bindu C. A., Professor of Architecture, for her valuable contribution to the community. She served as discussant for the following themes.



(i) Discussant for Webinar on 'Urbanization and urban planning' organized by Mayors council, Municipal chairmen chamber, Kila & KMCSU at Thiruvananthapuram on 24/05/2023

(ii) Discussant for panel on 'Future Proofing Thrissur: Regional plan for Thrissur District' organized by KILA, TMA, ESAF & SPA Bhopal at KILA Auditorium Thrissur on **24/06/2023**



The Government Engineering College, Thrissur team, has been selected as one of the top ten national teams for the Robotics competition

Editor : *Dr. Vinod P. Raphael* (Dept. of Chemistry) Contact: Mob: 9287560416 Design & Layout by *Smt. Shincy T P* (Dept. of Electronics & Communication Engineering, GEC Wayanad).

10⁶⁶⁰RESEARCH



Research Seed money Project

Between 2021 and 2023, young faculty members availed Research Seed Money Projects sponsored by TEQIP. Eleven investigators successfully completed their project work and submitted their reports. IRAC appreciates the faculty members for their achievements and wishes them the best in obtaining funding for major research projects. The list of researchers and abstracts of their work is provided below.

Development of Polymer Nanocomposites with Enhanced Mechanical and Biological Properties

Principal investigator: **Dr. Praseetha P Nair**, Associate Professor,

Polymer nanocomposites represent an alternative class of materials with versatile properties compared to traditional composites. The presence of reinforcing fillers improves the properties of matrix materials for the optimum combination of constituents. Nanofillers have revolutionized the polymer modification field. They are the ultimate reinforcing agents due to their large surface area and high interfacial activity, which lead to extensive interphase interactions. Here, the reinforcement effect of inorganic and organic nanofillers on Poly Lactic Acid was analysed. Mechanical, biological and morphological properties were studied and found that organic nanofillers provide better reinforcement with optimum properties.

Comparative study of stir casting of AA-6061 hybrid metal matrix composite using impellers with split and tubular elements

Principal investigator : **Prasanth A B**, Assistant Professor, Department of Mechanical Engineering

Co-investigator : **Sajith C**, M.Tech (Production Engineering), Department of Mechanical Engineering

Hybrid Metal Matrix Composites (MMC) with Aluminium as the matrix material and Coconut Shell Ash and Silicon Carbide as the reinforcements were fabricated in a stir casting machine using a tubular impeller called as the Novel-01 impeller and with a split bladed impeller with four elements oriented along shaft direction which was reported as an effective configuration for stir casting of MMC. The characterization of the fabricated composites was done to evaluate the mechanical properties of the fabricated composites and thus a comparative study of the effectiveness of the Novel-01 impeller and the split blade impellers was performed. In order to solve the inconsistencies of the bottom pouring stir casting arrangement, a customized tilting type stir casting furnace was designed and the same was installed in GEC Thrissur.



Dept. of Chemical Engineering

Synthesis, Characterization and Photocatalytic applications of Semiconductor photocatalytic systems

Principal investigator : **Umadevi T U**, Assistant Professor, Department of Chemistry



Photocatalytic technology has become a considerable technique to control environmental pollution. Metal–organic frameworks (MOFs), featuring semiconductor-like behaviour have recently captured broad interest towards Photocatalysis because of their well-defined and tailorable porous structures, high surface areas, etc. In this project, prepared ZIF – 67 at various temperatures and studied the photocatalytic ability and prepared GCN/CD composites at various concentrations and evaluated the photodegradation of methylene blue under natural sunlight. Finally presented more efficient ternary system of MOS_2 , ZIF-67 and reduced graphene oxide with visible light driven photocatalytic activity through green facile hydrothermal method and found that the optimized $MOS_2/ZIF-67/r$ -GO composite exhibited markedly enhanced activity for the photodegradation of Rhodamine B than bare MoS2 and binary forms. This work provides a new insight for the effective synthesis of other multicomponent photocatalytic systems for the water pollutant degradation.

METAL COMPLEXES OF AROYL HYDRADONES Principal investigator : **Reshma P R**, Assistant Professor, Department of Chemistry

Two aroylhydrazones were synthesized and characterized by various physicochemical methods include IR, UV and ¹HNMR spectroscopy. Single crystal X-ray diffraction study of one of the hydrazones HL² revealed that the compound crystallizes in monoclinic crystal lattice with the space group Cc and diffused to form multi-layered structure due to non-covalent interactions such as inter and intramolecular hydrogen bonding. Metal complexes of Cu, Zn and Co were synthesized and characterized by IR and UV spectroscopy. In vitro antibacterial studies of the compounds were carried out against two gram positive and two gram negative bacterial strains by Agar well diffusion method. In silico docking studies of the compound HL² was carried out against Staphylococcus aureus and its target proteins.



AND IT'S BIOLOGICAL APPLICATIONS

nanocomposites

Nanomaterials are known to be highly usefulin environmental and water treatment processes. The study focussed on the preparation of Zeolite/ZnOnanocomposites for the removal of heavy metal Cr (VI) from water using an ultrasound-assisted adsorption process. The prepared adsorbent was used to carry out adsorption of Cr (VI) from solutions of known concentrations. Also studies were carried out to analyze the effect of various parameters such as pH, initial concentration, time of sonication and adsorbent dosage on the adsorption process. Around 50% of Cr(VI) removal was obtained from a 10ppm solution having pH 3 by sonicating for 20 minutes using an adsorbent dosage of 0.2 gm/100 ml. The prepared nanomaterial was found to be useful in water-treatment processes.

Principal investigator : The effect of varying fuel injection pressure on the performance and emission in a diesel engine fueled with Coconut Testa biodiesel

Biodiesel is an ecofriendly, renewable, non-toxic alternate fuel for the Compression ignition engine. Biodiesel properties are very close to diesel properties. The modern diesel engines use high pressure fuel injection which could drastically reduce the emissions and also could improve the performance and fuel efficiency. The biodiesel can be directly used in diesel engines as an alternate fuel. The present available compression ignition engines are tuned for the diesel fuel. The direct use of biodiesel to these tuned engines for diesel may leads to problems like higher NOx emissions and sometimes more smoke. This study focused on the effect of varying the fuel injection pressure and the compression ratio for the reduction in exhaust emissions and for better thermal efficiency.

Investigation on Dissimilar Friction Stir Welding of Aluminium Alloys AA5083 and AA7050

Principal investigator : **Renjith V B**, Assistant Professor, Department of Mechanical Engineering

alloys but problems in efficient joining of the dissimilar alloys are major hurdles in that direction. The solidstate, friction stir welding (FSW) process is reported to be a viable technique for the joining of difficult-toweld materials since it can avoid all the defects that could arise due to the melting and solidification of materials. In this study, dissimilar aluminium alloys, AA7050-T7651 and AA5083-H111 of 5 mm thickness were friction stir butt welded and the microstructural and mechanical properties of the joints are investigated. The experiments were carried out at different tool axis offset of 0.0.25mm, 0.5 mm , 0.75 mm and 1 mm towards both the base materials (AA 5083 and AA 7050). While keeping the tool rotational speed, tool traverse speed, axial force and tool tilt angle, respectively at constant values of 1000 rpm, 30 mm/min, 3.5

kN and 1.50. The experiment was performed by keeping the base alloy AA 5083 on the advancing side as the first trial and the trials were repeated by switching the base material position in the opposite configuration. (AA 7050 on the advancing side). All the fabricated joints were externally defect free and the fractured tensile specimens showed that the joints were fractured in the HAZ at the AA5083-H111 alloy side. In the microhardness observation, the lowest hardness values were observed at the HAZ at the 5xxx alloy side. The highest ultimate tensile strength (UTS) of 303 MPa (98.38% joint efficiency) was observed for the joint fabricated at 0.5 mm tool axis offset towards the 7050 base alloy when AA 7050 alloy was on the advancing side configuration. The microstructure observation at the joint zone showed that the coarsening of grains and loss of cold working at the HAZ of the 5xxx alloy side are the causes of the fracture of the tensile specimen at that zone. The best tool axis was found to be 0.5 towards AA 7050 base alloy and the best alloy configuration was AA 7050 on the advancing side and AA 5083 on the retreating side.









GECT RESEARCH

Principal investigator : Dr. Mercy Anna Philip, Assistant Professor, Dept. of Chemical Engineering

Tennison K Jose,

Experimental Investigations on prestressed cold formed steel beams

Principal investigator : Jikhil Joseph, Assistant Professor, Dept of Civil Engineering



The project aimed to improve the flexural strength of cold-formed steel (CFS) structural members by delaying early buckling through prestressing. The study involved two phases: a numerical analysis on prestressed CFS sections using cables and an experimental and numerical analysis of prestressed CFS beams. The finite element model for unbondedprestressed CFS beams was validated through experimental testing. Parametric studies were conducted to analyze the effectiveness of prestressing in enhancing load capacity and determining the optimum prestressing force. The role of the cross-sectional profile of the beam in prestressing effectiveness was investigated, as well as the effectiveness of unbonded prestressing in longspan beams.

South Indian Classical music synthesis using machine learning techniques

Principal investigator : **Dr. Sinith M S**, Associate Professor, Department of Electronics and Communication Engineering

Synthesis of musical instrument sounds has been an important area in the field of computer music. There are two approaches in synthesizing sounds. They are simulation and extrapolation. Simulation is the actual replication of an original signal and extrapolation is the creation of new sound from the existing pieces. In musical applications, the analysis-synthesis method is used for the musical instrument sound synthesis. There are many techniques used for digital music synthesis. This project mainly focuses on the analysis-synthesis of Indian classical music using Short Time Fourier Transform (STFT) model, analysis-synthesis of sound using sine model, analysis-synthesis of sound using Neural Network (NN) like Long Short-Term Memory (LSTM) model. STFT and sine model reproduces the original sound whereas LSTM can create both original and new sound. The quality of the music generated by the above mentioned methods will be compared based on Mean Opinion Score (MOS).



Preparation and Characterisation of Carbon/zeolite Supported Catalyst from Industrial by-products and **Optimisation of Oxidation/Reduction Reaction**

Principal investigator : Ranjana R, Assistant Professor, Department of Chemical Engineering

Principal investigator : **Divva B Mathew**,



Biochar- and Zeolite-supported iron oxide catalyst (BC-Fe and Z-Fe, respectively), were prepared from industrial by-products using a solvent-free method. The effectiveness of the prepared catalysts for the degradation of methyl orange (MO) dye from dye- laden water was tested by conducting batch experiments. The optimum process variables for a maximum removal efficiency were identified using the Box-Behnken design of experiments (DoE) technique. BC-Fe has a removal efficiency of 95% at a high acidic pH with a lower adsorbent concentration (3-5 g/L), as compared to that of the Z-Fe adsorbent (4–5 g/L). The higher surface area and pore volume of BC-Fe (66.998 m2/g, 17 cc/g) than that of Z-Fe $(50.039 \text{ m}^2/\text{g}, 13.07 \text{ cc/g})$ resulted in a better removal efficiency with a low adsorbent dosage. The methyl orange (MO) dye adsorption was best described by the Langmuir and Temkin adsorption isotherms. Kinetic studies revealed that the pseudo-second-order kinetic model with rate constants of 0.01156 (BC-Fe) and 0.02063 g/mg·min (Z-Fe) was the best fit for adsorption. Thermodynamic studies revealed that the adsorption is spontaneous and endothermic with an increase in randomness at the solid-liquid interface.

Effect of web slenderness in lateral torsional buckling behaviour of monosymmetric I section subjected to end moment

Assistant Professor, Dept of Civil Engineering The project focussed on the study of the effect of compression flange and depth to width ratio on lateral torsional buckling behaviour of welded monosymmetric I section beam subjected to constant moment. For the elastic critical moment calculation of simply supported monosymmetric I beam subjected to linearly varying moment, IS:800-2007 suggests constant c₃ values for reverse curvature bending which is not a function of compression and tension flange second moment of area. But Eurocode 3 suggests c₃ value in terms of second moment of inertia of compression and tension flange. In the

reverse curvature bending, compression flange will get flipped within the beam length and hence the compression flange area cannot be ignored in elastic critical buckling moment calculation. Also, the approximations in the calculation of monosymmetry parameter in terms have resulted in conservative results of elastic critical moment where material contribution is less on compression side and overestimation for more material contribution on compression side in IS 800-2007.