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A Century of Service to the Nation

Contents

Members in the News

Mr Mohamed Nasar Mohideen K, CQP, MCQI, MIE
Quality Assurance Manager - IMS / Audit / Compliance, Arabian Industries Projects LLC, Muscat, Sultanate of Oman

Certified as IRCA Principal Auditor QMS BY International Register of Certified Auditors (IRCA), UK.

Awarded with QIMPRO CERTIFIED QUALITIST, Level 2 by QIMPRO Consultants Private Limited, Mumbai.

CH. Rama Krushna Chary, MIE
Senior Environment Engineer, Kuwait Oil Company

Awarded with the Indian Achievers' Award 2020 by Indian Achievers' Forum in recognition of outstanding professional achievements and contribution in nation building.

Dr Omkar Suresh Vaidya, MIE
Assistant Professor, Department of Electronics & Telecommunication Engineering, Sandip Institute of Technology & Research Centre, Nashik, Maharashtra

Elevated to the Senior Member of The Institute of Electrical and Electronics Engineers (IEEE).

Dr Narayan Acharya, FIE
Sr Manager (Excavation), Mahanadi Coalfields Limited (Coal India Limited), Burla. Sambalpur, Odisha

Awarded Doctor of Philosophy in Mechanical Engineering from Veer Surendra Sai University of Technology (VSSUT), Burla, Odisha on the topic 'Some Studies on Performance and Emission Characteristics of Diesel Engine using Bio-Diesel as alternative Fuel' under the guidance of Dr Parsant Nanda, Professor, and Dr Sumant Panda, Associate Professor, Department of Mechanical Engineering, Veer Surendra Sai University of Technology, Burla, Odisha.

Mr V R Senthilkumar, FIE
Assistant Chief Technical Officer, ICAR-Indian Agricultural Statistics Research Institute, New Delhi

Shared his valuable knowledge as a guest speaker in online workshop on the topic 'Operation and Maintenance of Laboratory Buildings and Residential Quarters', organized by Department of Civil Engineering, Sri Ramkrishna Institute of Technology, Coimbatore on July 25, 2020.

Received Certificate of Appreciation for sharing his valuable knowledge as a resource person in the online webinar on the topic 'Repair and Maintenance of Residential and Non-residential Buildings' organized by Department of Civil Engineering, Dr N G P Institute of Technology, Coimbatore on August 26, 2020.

Delivered Lecture on the topic 'Repair and Maintenance of Residential and Non-residential Buildings' in the Civil Engineering Association Webinar organized by Department of Civil Engineering, Coimbatore Institute of Technology on August 29, 2020.

Dr Rajeev Bhatia, MIE
HOD, Civil Engineering, Mehr Chand Polytechnic College, Jalandhar, Punjab

Awarded Doctor of Philosophy in Civil Engineering from Dr B R Ambedkar National Institute of Technology, Jalandhar in July 2020 on the topic 'Behaviour of Fly Ash Fill Reinforced with Geosynthetic Encased Construction Concrete Debris Columns' under the guidance of Prof Arvind K Agnihotri, Department of Civil Engineering, National Institute of Technology, Jalandhar, Punjab.

Dr Suresh Vishwakarma, MIE
Senior Engineer, IPRA and Chair Chartered Engineers Pacific Member of IET Communities Committee America, Vancouver, Canada

Delivered Lecture on the topic 'The Role of Engineers in the Utility Sector', organized on digital platform by the University of Trinidad and Tobago on October 2, 2020.

Publication by Members

Prof (Dr) Jagtar Singh Sivia, FIE

Council Member, IEI and Professor ECE, YCOE, Punjabi University GKC Talwandi Sabo, Bathinda, Punjab

Email: jagtarsivian@gmail.com

Title of Paper: "Design and Development of Virtual Instrument for Fault Diagnosis in Fractal Antenna Array", *International Journal of RF and Microwave Computer-Aided Engineering 30 (1), 2020, John Wiley & Sons, Inc.*

https://doi.org/10.1002/mmce.22026

Co-author : Sunita Rani

Abstract: This paper deals with the development of a virtual instrument for fault diagnosis in fractal antenna array using Lab-VIEW software. Faults in antenna array are considered on the basis of the radiation pattern. In this study, theta and gain values of radiation patterns for each fault are used in Lab-VIEW for curve fitting. An artificial neural network (ANN) has been developed for fitted data points using the Leavenberg Marquard algorithm in MATLAB software and mean square error (MSE) is minimized. The designed ANN model has been embedded in the virtual instrument. The proposed virtual instrument system gets test patterns as input and generates output for several faults present in antenna array. Simulated and measured results of the fractal antenna array are validated experimentally. This virtual instrument model has not been developed for fractal antenna array so far.

Keywords: Antenna Array; Radiation Pattern; Curve Fitting; Artificial Neural Model; Virtual Instrument.

Title of Paper: "Defected Ground Based Fractal Antenna for S and C Band Applications", *Wireless Personal Communication 110, 2020, pp 109–124.*

https://doi.org/10.1007/s11277-019-06714-2

Co-authors : Swati Jindal, Harminder Singh Bindra

Abstract: Defected ground based modified rectangular fractal patch antenna for mobile devices communication in Delay Tolerant Networks, Wireless sensor networks and Mobile Adhoc networks is being presented in this paper. In view of the overwhelming demand of small and light weight micro-chip patch antenna in wireless communication in the recent years the size of antenna has been reduced considerably. Wideband behaviour of antenna is achieved with improved values of performance parameters like gain, reflection coefficient (S11), Voltage Standing Wave Ratio (VSWR), radiation pattern and bandwidth. The proposed antenna covers various frequency bands like earth to space communication (2.17–2.2 GHz), satellite communication (2.3 GHz), wireless local area networks (2.4–2.484 GHz), Wi Fi (2.4 GHz for 802.11b and 802.11g), Radio Frequency Identification, Microwave oven, Bluetooth (2.45 GHz), Wireless Computer Networking (2.4 GHz), Mobile Wi-Max (2.5–2.69 GHz), Direct to home services (2.5–2.7 GHz), Wi-Max (3.3–3.6) Satellite Communication for Downlink (3.7–4.2 GHz) at various resonating frequencies. High Frequency Structural Simulator; v13 has been used to simulate the proposed antenna. The antenna has been designed and simulated using FR4 epoxy substrate with relative permittivity 4.4 and having size of 32 mm × 30 mm × 1.6 mm with line feeding technique. Ground plane has also made defective. The antenna shows the bandwidth of 2830 MHz with gain of 6.83 dB, reflection coefficient (S11) −19.72 dB and VSWR of 1.23 at resonant frequency 2.85 GHz. Size of the antenna stands reduced by 38.73% with deflective ground surface and frequency shifted towards the lower side. The antenna operates from 2.05 to 4.88 GHz covering S and C band applications.

Keywords: HFSS; Gain; Radiation pattern; VSWR; Reflection-coefficient; Defected ground

Publication by Members

Mr Soumyadeep Samonto, MIE

Department of Electrical Engineering Global Institute of Science and Technology Haldia, West Bengal

Email: ssamonto@gmail.com

Title of Paper: "An Approach to Develop a Dedicated Micro AI Processor for an Intelligent Fault Protection Scheme", In: Castillo O., Jana D, Giri D, Ahmed A, (eds), *Recent Advances in Intelligent Information Systems and Applied Mathematics. ICITAM 2019. Studies in Computational Intelligence, 863. Springer, Cham.*

https://doi.org/10.1007/978-3-030-34152-7_32

Co-authors : Pal S, Khatua D, Islam Sm

Abstract: In Electrical Engineering the term protection is a vital issue since long time ago. The numerous papers have been found on application of intelligent system for different protection schemes. Many of the papers have been found on simulation results only. In some cases it has been found that to interface with the real world input a PC is mandatory in case of intelligent system operation. In this paper a discussion has been drawn in favour of developing one intelligent breaker under MATLAB environment. The same has been programmed under Arduino IDE for designing the corresponding micro processor to test its outcome for authenticating the system with a simple processor in place of a huge setup followed by incorporating PCs or Laptops nowadays.

Keywords: Fuzzy Logic Controller; Arduino; Intelligent Breaker; Intelligent System; MATLAB.

Title of Paper: "Fuzzy Logic Based Multistage Relaying Model for Cascaded Intelligent Fault Protection Scheme", *Electric Power Systems Research, 184, 106341, 2020.*

DoI: 10.1016/j.epsr.2020.106341

Co-authors : Samarjit Kar, Sagarika Pal, Arif Ahmed Sekh

Abstract: Designing an instrument protection system has been considered as one of the most challenging domains in the power system. Intelligent tripping mechanism has been introduced in a few sectors for controlling the moving contacts of a single operating relay connected to an electrical system. In this work, we have developed a cascaded relaying for a priority based decision making fuzzy inference system with fault tripping mechanism for controlling multiple operating relays. To obtain this priority based design of intelligent relaying, a multistage cascaded relaying is considered for achieving the higher accuracy. In this paper, we have discussed regarding the simulation of a load priority based tripping mechanism incorporated intelligent relaying. The differential equation achieved from the stage - I relaying simulation model of measurement blocks and fault generator blocks have been discussed. We have validated the stage - I relaying of the entire concept of the design with the mathematical modeling and also the simulation results of the stage - II output. The proposed method utilizes the concept of two stage relaying by introducing a Fuzzy Inference System designed to control the isolator state for the particular multistage based cascaded intelligent fault protection scheme.

Keywords: Intelligent Relaying; Multistage; Cascaded; Fuzzy Inference System; Servomechanism; Isolators.

Publication by Members

Dr Itagi Ravi Kumar, MIE

Swami Vivekananda Yoga Anusandhana Samsthana, Bengaluru

Email: itagi.ravi@gmail.com

Title of Paper: "Biological Cold Fusion Effect in Germination of Green Gram Seeds", *International Journal of Science and Nature, 11(2), 2020, pp 31-35.*

http://scienceandnature.org/IJSN/IJSN_Vol11(2)2020/IJSN-Vol11(2)20-3.pdf

Abstract: Biological cold fusion is the way of changing one element into another, unequivocal fusion of mid-range elements through low energy nuclear reactions. Here green grams seeds were germinated in the room temperature and at its atmosphere condition. Elemental analysis was done with wet method by using optical emission spectrometry. Results show that in germinated seeds Na increased by 235%, Mg by 14%, P by 25%, K by 26% and Cu increased by 14% and among decreased elements Ca decreased by 14%. Changes in the value of trace elements in the germinated seeds might be due to biological cold fusion taken place in the seeds.

Keywords: Biological Nuclear Fusion; Biological Transmutation; Low Energy Nuclear Fusion.

Dr Jitendra Virmani, AMIE

CSIR-Central Scientific Instruments Organisation (CSIR-CSIO), Chandigarh

Email:jitendra.virmani@gmail.com

Title of Paper: "Deep Feature Extraction and Classification of Breast Ultrasound Images", *Multimedia Tools and Applications, 79, 2020, pp 27257-27292.*

https://doi.org/10.1007/s11042-020-09337-z

Co author: Ravinder Agarwal

Abstract: Controlled despeckling (structure/edges/feature preservation with smoothing the homogeneous areas) is a desired pre-processing step for the design of computer-aided diagnostic (CAD) systems using ultrasound images as the presence of speckle noise masks diagnostically important information making interpretation difficult even for experienced radiologist. For efficiently classifying the breast tumors, the conventional CAD system designs use hand-crafted features. However, these features are not robust to the variations in size, shape and orientation of the tumors resulting in lower sensitivity. Thus deep feature extraction and classification of breast ultrasound images have recently gained attention from research community. The deep networks come with an advantage of directly learning the representative features from the images. However, these networks are difficult to train from scratch if the representative training data is small in size. Therefore transfer learning approach for deep feature extraction and classification of medical images has been widely used. In the present work the performance of four pre-trained convolutional neural networks VGG-19, SqueezeNet, ResNet-18 and GoogLeNet has been evaluated for differentiating between benign and malignant tumor types. From the results of the experiments, it is noted that CAD system design using GoogLeNet architecture for deep feature extraction followed by correlation based feature selection and fuzzy feature selection using ANFC-LH yields highest accuracy of 98.0% with individual class accuracy value of 100% and 96% for benign and malignant classes respectively. For differentiating between the breast tumors, the proposed CAD system design can be utilized in routine clinical environment.

Keywords : Despeckling; Segmentation; Augmentation; Deep learning; Convolution Neural Network; ANFC Classifier.

Publication by Members

Dr L Jebaraj, FIE

Department of Electrical and Electronics Engineering, Loyola Institute of Technology, Chennai

Email: jebarajjebin@gmail.com

Title of Paper: "A Comprehensive Review on Evolutionary Optimization Techniques Applied for Unit Commitment Problem". *IEEE ACCESS, 8 (1), 2020, pp 132980 – 133014.*

DoI : 10.1109/ACCESS.2020.3010275

Co-authors : Dr Narayanasamy Muralikrishnan, Dr Charles Christober Asir Rajan

Abstract: Unit Commitment (UC) is a key task in electric power system operation, aiming at minimizing the total cost of power generation. It is essential to monitor wide range of activities and practices of UC necessary to determine the operating plan of generating units. The UC problem is particularly crucial, when the behavior of loads at every hour interval, is oscillatory and with different operational constraints and environments. Many works have been proposed, with different optimization methods to solve the UC problem. This paper gives a detailed review of the evolutionary optimization techniques, employed for solving UC problem, by collecting them from lots of peer reviewed published papers. This review was carried out under many sections, based on various evolutionary optimization techniques, to help new researchers, dealing with modern UC problem solutions, under different situations of power system.

Keywords: Unit Commitment; Evolutionary Optimization; Power Balance; Load Dispatch; Operating Cost; Spinning Reserve.

Dr S A Rizvi, MIE

Workshop Superintendent, University Polytechnic, Jamia Milia Islamia, New Delhi

Email:saritbhu@gmail.com

Title of Paper: "Effect of Heat Input on Microstructural and Mechanical Properties of AISI 304 Welded Joint Via MIG Welding", *International Journal of Engineering, IJE Transactions C: Aspects, 33(9), 2020, pp 1811-1816.*

DoI: 10.5829/IJE.2020.33.09C.16

Abstract: In this experimental work, AISI 304 was welded via metal inert gas (MIG) welding process with Argon (Ar) as shielding gas. In the present study, AISI 304 was subjected to different heat input using a standard 308L electrode. Weld quality i.e. ultimate tensile strength, toughness, microhardness, and microstructure of AISI 304 were examined. Microstructures of welded joints were studied using scanning electron microscopy (SEM), linked to the SEM was used to determine the chemical composition of phases formed at the joint interface and from the result, it was revealed that at low heat input ultimate tensile strength is higher than those at medium and low heat input. From the result, it was also observed that grain coarsening extent in the HAZ increases with an increase in the heat input. It was also found that the fractures of toughness samples were brittle in nature which shows the low ductility and brittle fracture. Weld zone microstructure exhibited skeletal δ-ferrite in austenite matrix with various ferrite contents. Microhardness of weld bead was found to decrease with increases in the heat input. It was also observed that at medium heat input there was an improvement in tensile strength, elongation, and hardness due to finer grain structure and smaller inter-dendritic spacing.

Keywords : AISI 304; Fracture Mode; Heat Input; Microhardness; Microstructure; MIG Welding; SEM.

Publication by Members

Dr Santosh Kumar Bindhani, AMIE

Associate Professor, Department of Chemical Engg., GIET, Gunupur Rayagada,Odisha

Email: santubindhani@gmail.com

Title of Paper: "Prediction of Thermophysical Properties in Binary Liquid Mixture of Propiophenone and Ethyl Acetate at 303.15, 308.15 and 313.15 K", *Russian Journal of Physical Chemistry, 94, 2020, pp. 1827–1835.*

https://link.springer.com/article/10.1134%2FS0036024420090046#citeas

Co-authors : G K Roy, Y K Mohanty

Abstract: Density, viscosity, ultrasonic velocity and refractive index values of the binary liquid mixtures of propiophenone (PP) and ethyl acetate (EA) have been measured for the whole range of compositions at temperatures 303.15, 308.15, and 313.15 K. The variation of excess properties (VE, Δη, Δu, Δn, ΔZ, ΔβS, ΔLf, and G*E) with composition and temperature is discussed in the paper in terms of molecular interaction of components in the mixture. Redlich–Kister type polynomial has been used to fit the excess properties. A standard RSM design based on central composite design (CCD) has been applied to study the thermo physical properties of binary liquid mixtures as function of mole fraction and temperature. The molecular interaction between PP and EA has been analyzed by the excess properties along with the acoustic properties, and the developed equation can be used to calculate the thermophysical properties at various temperatures and compositions.

Keywords: Viscosity; Ultrasonic Velocity; Isentropic Compressibility; Response Surface Methodology.

Mr Padam Jee Omar, AMIE

Assistant Professor, Motihari College of Engineering, Motihari, Bihar

Email: sss.padam.omar@gmail.com

Title of Chapter: "Development and Application of the Integrated GIS-MODFLOW Model. In: Gupta P K, Bharagava R N, (eds)", *Fate and Transport of Subsurface Pollutants, Microorganisms for Sustainability, 24, 2020, Springer, Singapore.*

DoI: https://doi.org/10.1007/978-981-15-6564-9_16

Co-authors : Shishir Gaur, Shyam Bihari Dwivedi, and Prabhat Kumar Singh Dikshit

Abstract : Water scarcity is the major problem faced by today's world. Groundwater is the most valuable resource of drinking water due to the scarcity of good quality surface water. Groundwater occurs in hard rock layers whose thickness may vary from few meters to 100 m. Aquifer stores the groundwater and yielded the water at the time of pumping. A groundwater model was developed for Kanpur city, a fast growing City of Uttar Pradesh, India. Progressive increase in the land reclamation projects, continuous population growth and increasing industrial water demand, an efficient water resource management plan was needed for the city. Groundwater extraction is increasing excessively due to the high river water contamination. For the better management of groundwater, steady state groundwater flow model was conceptualized for 10 years from January 2007 to December 2017. This three-layer model was calibrated for 7 years to symbolize the actual field condition and validated for 3 years. In groundwater flow model preparation, Geographic Information System (GIS) techniques were integrated to simulate the groundwater flow. This integration of GIS and groundwater flow model was very helpful in evaluating the groundwater potential zones and generating the various possible scenarios for management and prediction of groundwater. The results of the current study confirm that the groundwater aquifer in Kanpur city is prone to significant water head reduction, especially in the high elevation zones. Therefore, there is need of an efficient integrated and sustainable management plan for the groundwater resources to minimize the impact of too much extraction of groundwater in the study area.

Keywords : Groundwater Modeling; MODFLOW; GMS; Water Budgeting; GIS

Publication by Members

Mr Divyanshu Aggarwal, AMIE

Department of Mechanical Engineering, Thapar Institute of Engineering and Technology, Patiala, Punjab

Email: divyanshuaggarwal95@gmail.com

Title of Paper: "Comparison between Single Rare Earth and Mixed Rare Earth Reinforced Aluminium Metal Matrix Composites on the Basis of Wear Properties" *International Journal of Applied Engineering Research, ISSN 0973-4562, 13(9), 2018, pp 55-63.*

https://www.ripublication.com/ijaerspl2018/ijaerv13n9spl_08.pdf

Co-authors : Vipin Kumar Sharma, Dr Vinod Kumar, Dr Ravinder Singh Joshi

Abstract: The paper presents the study on comparison of wear properties of Aluminium metal matrix composites reinforced with single rare earth metal i.e. CeO_2 with mixed rare earth metals i.e. $CeO_2 + LaO_2$ along with mixture of (Al_2O_3 + SiC) used as reinforcements in both types. For this purpose the composites were prepared using stir casting process. The constant weight percentages of 10% of ($SiC + Al_2O_3$) mixture was used, 0.5, 1.5, 2.5 % of CeO_2 was used in one composite sample and 0.5, 1.5, 2.5 % of ($CeO_2 + LaO_2$) mixture was used in another composite. The focus of the research was to investigate and compare the tribological properties of both types of composites in a pin-on-disc configuration using universal tribometer. Wear rates were examined against different sliding velocities i.e. 0.5, 1, 2 m/sec at a constant load of 30N and different sliding distance upto 2000m. Microstructure analysis of the wear specimens before and after the test was done with the help of SEM technique. It was concluded that the composites reinforced with single rare earth metal shows better tribological properties as compared to the composites with mixed rare earth in it. Better microstructure refinement can be seen from the micrographs of the samples before applied to wear testing.

Keywords: Metal Matrix Composites; Wear Properties; Scanning Electron Microscopy.

Dr Mahesh Radhakrushna Gadekar, MIE

Geoenvirovision, Nashik

Email: maheshgadekar@ymail.com

Title of Paper: "Modelling Dye Removal by Adsorption onto Water Treatment Residuals using Combined Response Surface Methodology-artificial Neural Network Approach", *Journal of Environmental Management, 231, 2019, pp 241-248.*

https://www.sciencedirect.com/science/article/pii/S0301479718311459

Co author: M Mansoor Ahammed

Abstract: In this study, response surface methodology (RSM)–artificial neural network (ANN) approach was used to optimise/model disperse dye removal by adsorption using water treatment residuals (WTR). RSM was first applied to evaluate the process using three controllable operating parameters, namely WTR dose, initial pH (pHinitial) and dye concentration, and optimal conditions for colour removal were determined. In the second step, the experimental results of the design data of RSM were used to train the neural network along with a non-controllable parameter, the final pH (pH_{final}). The trained neural networks were used for predicting the colour removal. A colour removal of 52.6 ± 2.0% obtained experimentally at optimised conditions ($pH_{initial}$ 3.0, adsorbent dose 30g/L and dye concentration 75mg/L) was comparable to 52.0% and 52.2% predicted by RSM and RSM-ANN, respectively. This study thus shows that optimising/predicting the colour removal process using the RSM–ANN approach is possible, and it also indicates that adsorption onto WTR could be used as a primary treatment for removal of colour from dye wastewater.

Keywords: Colour Removal; Disperse Dyes; Adsorption; Water Treatment Residuals; Response Surface Methodology; Artificial Neural Networks.

Publication by Members

Dr K Sujatha, Professor, MIE

CSE Department Dadi Institute of Engineering & Technology

Email: sujathak@diet.edu.in

Title of Paper: "IOT-Based Borewell Water-Level Detection and Auto-Control of Submersible Pumps. In: Satapathy S, Bhateja V, Janakiramaiah B, Chen YW. (eds)", *Intelligent System Design. Advances in Intelligent Systems and Computing, 1171, 2020, Springer, Singapore.*

https://doi.org/10.1007/978-981-15-5400-1_6

Co authors: Vaikunta Rao Rugada, Dadi Harshitha

Abstract: Water crisis has been a major problem in day-to-day life. So, people depend on underground water to perform daily activities. Submersible pumps are used in utilizing underground water. Due to the technological advancement in household usage of water is increasing drastically resulting in a decrease in groundwater level. In this scenario, submersible pumps cannot reach water and the pump still works leading to the failure in the pump functioning. So, users are unable to identify the exact problem behind the misfunctioning of the pump. IOT-based Borewell Water Level Detection and Auto-Control of Submersible pumps identify the underground water level by using water detecting sensors and sends the information to the server for Auto-Control of submersible pumps. If the sensor does not reach the water level, it will send an alert message to the user's mobile and shut down the pump automatically. The pump can be controlled over a mobile app which allows the user to control the pump remotely from anywhere. Hence, this reduces the manpower intervention and users need not worry about the functioning of the pump.

Keywords : Water Crisis; Submersible Pumps; IOT-based Borewell Water-level Detection and Auto-control of Submersible Pumps (IBAS).

Mr Naveed Akhtar, MIE

Department of Civil Engineering, Maulana Mukhtar Ahmad Nadvi Technical Campus, Mansoora, Malegaon

Email: akh0071@gmail.com

Title of Paper: "Effect of Different Curing Systems on Strength Characteristics of Geopolymer Concrete", *International Journal of Advanced Science and Technology, 29(9s), 2020, ISSN: 2005-4238, pp. 7830-7845.*

http://sersc.org/journals/index.php/IJAST/article/view/24668

Co-authors : S V Patankar, S S Jamkar, Faizan Ahmed, Saud Mahvi

Abstract: Geopolymer concrete is a novel development in concrete technology and still it is developing. In the present investigation, effect of different curing systems on compressive strength of fly ash based geopolymer concrete is highlighted. Three system of curing were considered for study by varying fineness and quantity of fly ash. Two types of low calcium processed flyash were taken from thermal power plant of fineness 600m2/kg and 400m2/kg. Ten geopolymer mixes were prepared and tested for compressive strength using cubes of size 100x100x100 mm. The systems of curing are hot air oven curing, solar oven curing and atmospheric curing. The results show enhanced compressive strength by solar oven curing as compare to atmospheric temperature curing of geopolymer concrete. Similarly, there is no large variation in compressive strength of geopolymer concrete using Electric oven curing and solar oven curing for fineness of FA 400m²/kg.

Keywords: Curing Systems; Fineness; Flyash; Geopolymer Concrete.

Publication by Members

Dr Kaarthik M, MIE

Department of Civil Engineering, Coimbatore Institute of Technology, Coimbatore

Email: kaarthik@cit.edu.in

Title of Paper: "Experimental and Analytical Study with Stiffened Web Cold Formed Steel Lipped Columns with Batten Sheets", *Solid State Technology, 63(2s), 2020.*

http://solidstatetechnology.us/index.php/JSST/article/view/1676

Co-authors : S M Rubhan Prakaash, Uma Chandru

Abstract : This project represents the laboratory test studies and finite element analysis on web stiffened cold formed lipped channel columns with batten sheets at reasonable space joined by means of bolt connection without varying slenderness ratio. The batten sheet exerting major impact, at the time of attaining maximum strength of the column and also in failure mode with respect to the loading conditions like eccentricity and axial conditions. From the base studies on AISI-S100:2007 sectional limitations, the cross section of the web stiffened channel column was modelled in this research work. After completion of laboratory studies, to calculate the ultimate strength and also the failure behaviour of the column models the research was extended to analytical studies with the help of ANSYS software. The regression analysis was carried out with the help of ANSYS software, in which the effect on varying loading conditions were investigated and concluded that the column strength gets decreased at eccentric loading conditions. The spacing between batten sheets could be ($d \leqslant \lambda/3$) for both the axial as well as eccentrically loaded columns. The proposed stiffened lipped column were experimentally studied for the varying batten space. With the results arrived form laboratory tests and calculated analytically, a comparison study was undergone in this research.

Mr Sanjay Kumar Srivastava, FIE

Mechanical Engineering Department, VIAET - Vaugh Institute of Agricultural Engineering and Technology, SHUATS - Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh

Email: sanjaysri_engineer@yahoo.co.in

Title of Paper: "Studies on Solar Box Cooker with Thermal Energy Storage", *International Journal of Advanced Research in Engineering and Technology (IJARET), 11(10), 2020, pp. 410-417.*

DoI: 10.34218/IJARET.11.10.2020.044

Co-authors : Anjikey Shukla, Rohit Tiwari, Ajeet Kumar Rai

Abstract : In the present work, an attempt has been made to find the performance of a solar box cooker using Sunflower oil (SFO) and Mustard oil (MO) as thermal energy storage mediums. Thermal storage cum cooking unit is constructed and tested in the actual metrological conditions of Prayagraj, U.P. India (250N, 810 E). Cooker performance is obtained using stagnation test and load test. Tests are performed at different load of water. Daily energy and exergy efficiencies are obtained. It is observed that daily energy and exergy efficiencies are increasing with increasing the load. It is also observed that solar box cooker is 25% more efficient with Mustard oil as energy storage medium than that of Sunflower oil as storage medium.

Keywords: Solar Box Cooker; Thermal Energy Storage.

Publication by Members

Dr Manpreet S Bhatti, FIE

Associate Professor, Department of Botanical & Environmental Sciences, Guru Nanak Dev University, Amritsar, Punjab

Email: mbhatti.dobes@gndu.ac.in

Title of Chapter: "Comparison of Ambient Air Pollution Levels of Amritsar during Foggy Conditions with that of Five Major North Indian Cities: Multivariate Analysis and Air Mass Back Trajectories", *SN Applied Sciences, 2(11), 2020, 1761.*

DoI: https://doi.org/10.1007/s42452-020-03569-2

Co-authors : Rekha Yadav,Sushil K. Kansal, Laxmi Das, Vishakha Gilhotra, Aditi Sugha, Dipti Hingmire, Shweta Yadav, Ankit Tandon, Rajbir Bhatti, Anubha Goel, Tuhin K Mandal

Abstract : In the present study, winter fog events (Nov. 2017–Feb. 2018) in Amritsar city were compared with other major cities of North India. Multivariate data analysis, along with air mass trajectory analysis, was used to explain the complex behaviour of ambient air quality during winter fog. Average particulate matter (PM) during fog events was $PM_{2.5}$ (77 µg m^{-3}), PM10 (162 µg m^{-3}) above the 24 h average National Ambient Air Quality Standards (NAAQS) of $PM_{2.5}$ (60 µg m^{-3}) and PM_{10} (100 µg m^{-3}), respectively prescribed by Government of India. Wind speed and visibility during fog events were studied along with prevailing wind direction for major PM episodes. Amritsar's $PM_{2.5}$ comparison with Ludhiana, Delhi, Kanpur, Lucknow, and Jaipur showed a clear link between Amritsar with Ludhiana (r = 0.807), a North Indian industrial hub. Lucknow and Kanpur had a strong correlation (r = 0.826) due to their proximity. Box-plot of $PM_{2.5}$ to PM_{10} ratio revealed a lower contribution of $PM_{2.5}$ in Amritsar as compared to other cities. Dimensionality reduction using factor analysis of ambient air quality and meteorological parameters grouped the data in order of their variance explained. The first principal component (PC-1) was $PM_{2.5}$ and Pm_{10}, followed by an antagonist correlation of humidity with wind velocity and visibility in Amritsar city. Factor analysis of ambient air quality of six cities, grouped Delhi, Kanpur, and Lucknow into PC-1, followed by Ludhiana and Amritsar as PC-2 which could be due to their proximity signifying the similar ambient air quality of the sites. In order to determine the origin of air mass, 24 h backward trajectories were studied and corroborated with wind rose profile. The results revealed the transport of air masses from the west to the source location.

Keywords: Urban Air Quality, $PM_{2.5}/PM_{10}$ Ratio, Moving Averages, Cluster Analysis, Wind Rose, HYSPLIT Modeling.

Mr K Murugesan, SMIE

Department of Mechanical Engineering, K Ramakrishnan College of Engineering, Trichy, Tamil Nadu

Email: murugesankumar5@gmail.com

Title of Chapter: "Wheelchair Cum Stretcher for Patients -Design and Fabrication". *AIP Conference Proceedings, 2283, 020130, 2020.*

https://doi.org/10.1063/5.0025031

Co-authors : Dr M Ravichandran, Mr P C Santhosh Kumar, J Manivasagan, K Maharaja, H Jegadeeswaran

Abstract : From olden times it was the problem of transferring the patients exists. After certain period of times they will be carried on wheels, which further reduced the effort of the people carrying the patients. This problem is not properly addressed by the medical field or healthcare technology efficiently. The patient's carrying is achieved by some mobility aids. Shifting the persons from chair to stretcher or to the bed or vice versa is always a challenging one. There is a need for upheaval of wheelchairs. Hence we design a wheelchair convertible stretcher by using reverse motion linkage mechanism and rectilinear mechanism with mild steel and sheet metal materials, which is an innovative to the therapeutic field. It can be operated safely by the patient according to the patient's comfort.

Keywords: Mobility Aids; Upheaval; Rectilinear and Linkage Mechanism.

Publication by Members

Mr Partha Haldar, AMIE

Assistant Professor of Mechanical Engineering, Government College of Engineering & Ceramic Technology, Kolkata

Email: partha.jumech@gmail.com

Title of Chapter: "Effect of Nano CuO Addition on the Tribo-mechanical Behavior of Alumina Ceramics in Non-conformal Contact", *International Journal of Applied Ceramic Technology, 2020.*

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Co-authors : Tapas Kumar Bhattacharya; Nipu Modak

Abstract : Sintering of alumina from 1500°C to 1650°C and tribo-mechanical properties at room temperature had been investigated using nano CuO as a sintering aid. Bulk density gradually increases with sintering temperature from 1500°C to 1600°C and is optimized at 1600°C, beyond this, bulk density does not significantly increase at 1650°C. The addition of 2 wt% CuO showed the best result on densification. Densification of about 97.74% was attained at 1600°C with the incorporation of 2 wt% CuO. Nano CuO at grain boundaries forms CuAl2O4 liquid which modifies the morphology of the grain and improves mechanical properties. The formation of self-lubricating tribo-film on the wear track results in a low coefficient of friction <0.2 and reduces specific wear rate. 4 wt% CuO addition increases contact tensile stress (σmax) by 51.2% and high Hertzian contact pressure (Pmax ≈ 1.51 GPa) causes plastic deformation of wear track. The re-solidified strengthening bond phase on the wear track simultaneously increases in friction coefficient and wear resistance with CuO addition. The optimizing effect of CuO addition shows that 2 wt% significantly decreases wear rate, and increases hardness and fracture toughness.

Keywords: Al_2O_3, Mechanical Properties; Sintering; Wear Resistance.

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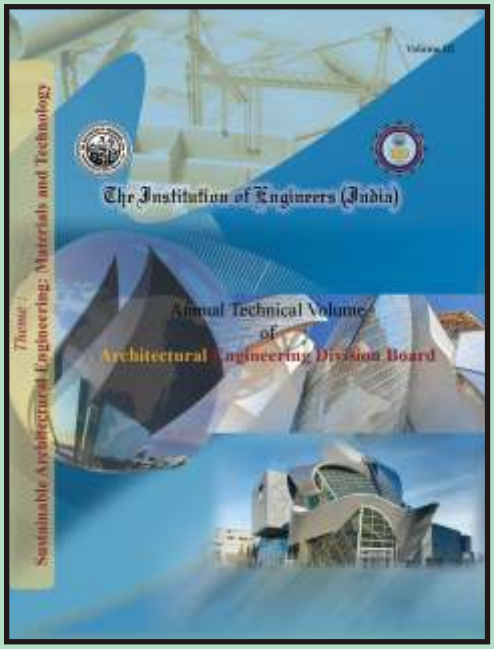

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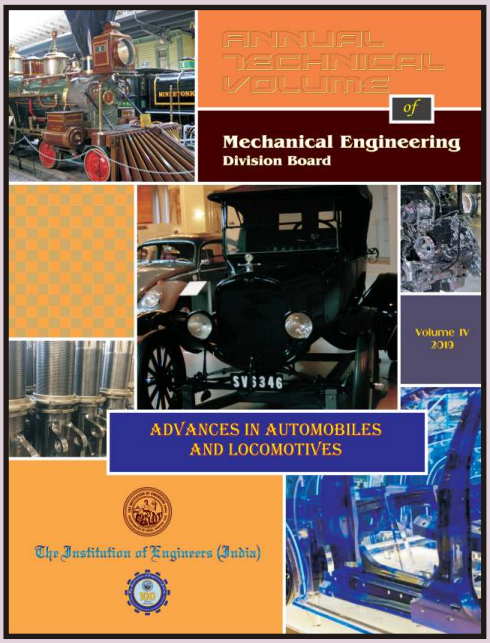

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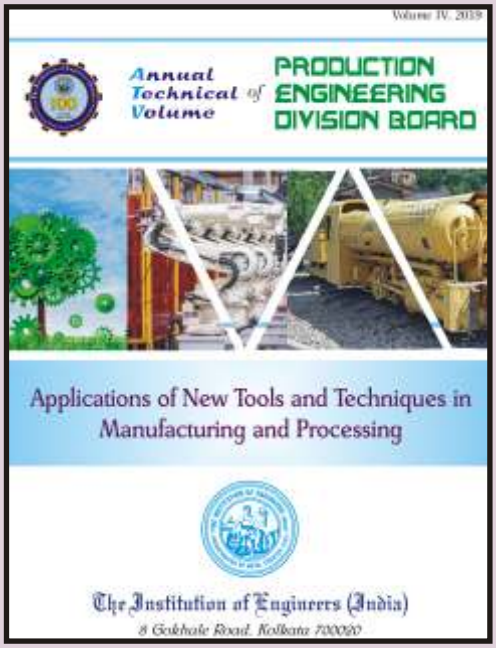

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