



THIAGARAJAR COLLEGE OF ENGINEERING

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MADURAI 625015, Tamil Nadu



Academic Yr 2020-21

List of research papers published in the Journals as notified on UGC CARE list during 2020 year

S.NO	TITLE OF PAPER	NAME OF THE AUTHOR/S	DEP OF THE TEACHER	NAME OF THE JOURNAL	YEAR OF PUBLISH	LINK
1.	Soft computing-based fuzzy integral sliding mode control: a real-time investigation on a conical tank process	Nagammai S., Latha S., Varatharajan M.	EEE	Soft Computing	2020	View Document
2.	Rigorous reduction of partial shading condition in grid connected solar PV system using discrete time-based PSO controller	Ganeshprabu B., Geethanjali M.	EEE	Soft Computing	2020	View Document
3.	An effective way of improving the course outcomes by using jigsaw technique in core courses of engineering	Suganya R., Kavitha D., Helen R.	EEE	Journal of Engineering Education Transformations	2020	View Document
4.	Stochastic distribution controller for wind turbines with doubly fed induction generator	Munisamy V., Vadivoo N.S., Devasena V.	EEE	Distributed Generation and Alternative Energy Journal	2020	View Document
5.	Fatigue load mitigation in wind turbine using a novel anticipatory predictive control strategy	Sudharsan G.S., Xavier S.A.E., Raghunathan V.R.	EEE	Proceedings of the Institution of Mechanical Engineers. Part I: Journal of Systems and Control Engineering	2020	View Document
6.	The motivation for incorporation of microgrid technology in rooftop solar photovoltaic deployment to enhance energy economics	Rengasamy M., Gangatharan S., Elavarasan R.M., Mihet-Popa L.	EEE	Sustainability (Switzerland)	2020	View Document



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7.	Experimental validation of solar panel integrated modified three-port active clamp flyback converter fed micro-inverter	Kumarasabapathy N., Manoharan P.S., Ramasamy M.	EEE	Semiconductor Science and Technology	2020	View Document
8.	Parameter optimisation of FACTS using cuckoo search algorithm for ATC enhancement in restructured power systems	Bavithra K., Charles Raja S., Anadhakumar K., Latha R.	EEE	International Energy Journal	2020	View Document
9.	Predicting Diabetes Mellitus Using Modified Support Vector Machine with Cloud Security	Thenappan S., Valan Rajkumar M., Manoharan P.S.	EEE	IETE Journal of Research	2020	View Document
10.	A Novel Battery Supported Energy Management System for the Effective Handling of Feeble Power in Hybrid Microgrid Environment	Gangatharan S., Rengasamy M., Elavarasan R.M., Das N., Hossain E., Sundaram V.M.	EEE	IEEE Access	2020	View Document
11.	A modified high voltage gain quasi-impedance source coupled inductor multilevel inverter for photovoltaic application	Periyanayagam M., Suresh Kumar V., Chokkalingam B., Padmanaban S., Mihet-Popa L., Adedayo Y.	EEE	Energies	2020	View Document
12.	Market power analysis in power systems using PSO based must run indices	Marshel J.B., Babulal C.K.	EEE	International Transactions on Electrical Energy Systems	2020	View Document
13.	Hybrid of Genetic Algorithm and Minimum Spanning Tree method for optimal PMU placements	Meenakshi Devi M., Geethanjali M.	EEE	Measurement: Journal of the International Measurement Confederation	2020	View Document
14.	Enhanced learning through blended IC and DCN strategies in C programming for non-IT computer science students	Rajan Prakash R., Charles Raja S., Kavitha D., Baskar S.	EEE	Journal of Engineering Education Transformations	2020	View Document



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15.	A single-stage soft-switching LED driver based on CLCL resonant converter and BCM circuit for lighting application	Saravanan M., Ganesh N.	EEE	Electrical Engineering	2020	View Document
16.	ABC algorithm for estimation of dynamic parameters in radial power system transfer path	Jeha J., Charles Raja S.	EEE	International Journal of Operational Research	2020	View Document
17.	Detection and estimation of grid-connected issues in quasi-Z-source inverter based photovoltaic system using robust parametric methods	Deepamangai P., Manoharan P.S.	EEE	IET Power Electronics	2020	View Document
18.	Demand Response Program with Different Elasticities	Arul Doss Adaikalam I., Babulal C.K.	EEE	Iranian Journal of Science and Technology - Transactions of Electrical Engineering	2020	View Document
19.	A Comparison of the Performance Indices of Embedded EZ-Source Inverter Using Different PWM Techniques	Kannan P., Xavier S.A.E.	EEE	Wireless Personal Communications	2020	View Document
20.	Steady-state concentrations of carbon dioxide absorbed into phenyl glycidyl ether solutions by residual method	Saranya K., Mohan V., Rajendran L.	Mat_Eng	Journal of Mathematical Chemistry	2020	View Document
21.	Application of heuristic method in dual-hesitant fuzzy transportation problem	Jothilakshmi G., Prabha S.K., Thirumurugan P.	Mat_Eng	Advances in Mathematics: Scientific Journal	2020	View Document



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22.	Feedback resolving sets in graphs	Rajeswari M., Anitha A., Sahul Hamid I.	Mat_Eng	Advances in Mathematics: Scientific Journal	2020	View Document
23.	Demonstration of a simple encapsulation technique for prototype silicon solar cells	V.G. Mohan B., Mayandi J., Pearce J.M., Muniasamy K., Veerapandy V.	Chem	Materials Letters	2020	View Document
24.	Biosynthesis of ZnO nanoparticles through extract from Prosopis juliflora plant leaf: Antibacterial activities and a new approach by rust- induced photocatalysis	Sheik Mydeen S., Raj Kumar R., Kottaisamy M., Vasanth V.S.	Chem	Journal of Saudi Chemical Society	2020	View Document
25.	Graphene quantum dots/ZnO nanocomposite: Synthesis, characterization, mechanistic investigations of photocatalytic and antibacterial activities	Sheik Mydeen S., Raj Kumar R., Sivakumar R., Sambathkumar S., Kottaisamy M., Vasanth V.S.	Chem	Chemical Physics Letters	2020	View Document
26.	Facile Synthesis of ZnO/AC Nanocomposites using Prosopis Juliflora for Enhanced Photocatalytic Degradation of Methylene Blue and Antibacterial Activity	Mydeen S.S., Kumar R.R., Sambathkumar S., Kottaisamy M., Vasanth V.S.	Chem	Optik	2020	View Document
27.	Photocatalytic removal of cationic and anionic dyes in the textile wastewater by H ₂ O ₂ assisted TiO ₂ and micro-cellulose composites	Rajagopal S., Paramasivam B., Muniyasamy K.	Chem	Separation and Purification Technology	2020	View Document
28.	Synthesis of 1,2,3-Triazole Tethered 3-Hydroxy-2- oxindoles: Promising Corrosion Inhibitors for Steel in Acidic Medium and Their Anti-Microbial Evaluation	Sampath S., Vadivelu M., Ravindran R., Perumal P.T., Velkannan V., Karthikeyan K.	Chem	ChemistrySelect	2020	View Document



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29.	Characterisation and stability analysis of eutectic fatty acid as a low cost cold energy storage phase change material	Eanest Jebasingh B, Valan Arasu A	Mech	Journal of Energy Storage	2020	View Document
30.	Preparation and characterization of low cost eco-friendly GAO grafted bio- carbon nanoparticle additive for enhancing the lubricant performance	Chellam Pownraj, Valan Arasu A	Mech	Diamond and Related Materials	2020	View Document
31.	Experimental investigation on thermal behavior of graphene dispersed erythritol PCM in a shell and helical tube latent energy storage system	Mayilvelnathan V., Valan Arasu A.	Mech	International Journal of Thermal Sciences	2020	View Document
32.	Design and performance characteristics analysis of a linear fresnel reflector solar concentrator system with a trapezoidal cavity absorber	Rajendran M., Valan Arasu A.	Mech	International Journal of Emerging Technology and Advanced Engineering	2020	View Document
33.	Optimization of CNC-WEDM Parameters for AA2024/ZrB ₂ in situ Stir Cast Composites Using Response Surface Methodology with Desirability Function Technique	Muralidharan N., Chockalingam K., Parameshwaran R., Kalaiselvan K., Nithyavathy N.	Mech	Arabian Journal for Science and Engineering	2020	View Document
34.	Thermal performance of nano-enriched form-stable PCM implanted in a pin finned wall-less heat sink for thermal management application	Reuben Raj C., Suresh S., Vasudevan S., Chandrasekar M., Kumar Singh V., Bhavsar R.R.	Mech	Energy Conversion and Management	2020	View Document
35.	Prediction of Lean Blowout Limits for Methane-Air Bluff Body Stabilized Combustion using a Temperature Gradient	Maran P., Boopathi S., Gowtham P., Chidambaram S.	Mech	International Journal of Turbo and Jet Engines	2020	View Document



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	Method in a Model Gas-Turbine Afterburner					
36.	Photovoltaic Module with Uniform Water Flow on Top Surface	Govardhanan M.S., Kumaraguruparan G., Kameswari M., Saravanan R., Vivar M., Srithar K.	Mech	International Journal of Photoenergy	2020	View Document
37.	Nano-enhanced phase change materials and fluids in energy applications: A review	Valan Arasu A	Mech	Renewable and Sustainable Energy Reviews	2020	View Document
38.	Effect of Various Chemical Treatments of Prosopis juliflora Fibers as Composite Reinforcement: Physicochemical, Thermal, Mechanical, and Morphological Properties	Madhu P., Sanjay M.R., Senthamarai Kannan P., Pradeep S., Siengchin S., Jawaid M., Kathiresan M.	Mech	Journal of Natural Fibers	2020	View Document
39.	Investigation and optimization of friction stir welding process parameters of stir cast AA6082/ZrO ₂ /B ₄ C composites	Umar M.J., Palaniappan P.K., Maran P., Pandiyan R.	Mech	Materials Science- Poland	2020	View Document
40.	Online coding event as a formative assessment tool in introductory programming and algorithmic courses: An exploration study	Anitha D.M., Kavitha D.M.	Applied_Mat_Comp_MCA	Computer Applications in Engineering Education	2020	View Document
41.	Quality assessment of standard and customized COTS products	Parthasarathy S., Sridharan C., Chandrakumar T., Sridevi S.	Applied_Mat_Comp_MCA	International Journal of Information Technology Project Management	2020	View Document
42.	Identification of opinion difference in teaching learning	Anitha D., Kavitha D., Rajan	Applied_Mat_Comp_MCA	Journal of Engineering	2020	View Document



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	methods and recommendation to faculty	Prakash R., Charles Raja S.		Education Transformations		
43.	Kernel Fuzzy Clustering with Output Layer Self-Connection Recurrent Neural Networks for Software Cost Estimation	Resmi V., Vijayalakshmi S.	Applied_Mat_ Comp_MCA	Journal of Circuits, Systems and Computers	2020	View Document
44.	Analogy-based approaches to improve software project effort estimation accuracy	Resmi V., Vijayalakshmi S.	Applied_Mat_ Comp_MCA	Journal of Intelligent Systems	2020	View Document
45.	Investigation of mechanical and micro structural properties of geopolymer concrete blended by dredged marine sand and manufactured sand under ambient curing conditions	Anbarasan I., Soundarapandian N.	civil	Structural Concrete	2020	View Document
46.	Effect of steel macro fibers on engineering properties of copperslag-concrete	John V.J., Dharmar B.	civil	Structural Concrete	2020	View Document
47.	Dam break analysis of mullaiperiyar reservoir for environmental protection – A numerical approach	Rajapriyadharshini J.R., Sudalaimani K.	civil	Journal of Environmental Protection and Ecology	2020	View Document
48.	Risk and its impacts on time and cost in construction projects	Aarthipriya V., Chitra G., Poomozhi J.S.	civil	Journal of Project Management (Canada)	2020	View Document
49.	Investigation on calcined magnesium-based mineral powder and its behavior as alternative binder	Sugila Devi G., Sudalaimani K.	civil	Advances in Materials Science and Engineering	2020	View Document
50.	Spatial time dependent reliability analysis of	Murali Kannan S.P., Sudalaimani K.	civil	Polish Journal of Environmental Studies	2020	View Document



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	carbonation with climate change					
51.	Seasonal variation and spatial distribution of groundwater pollutants in east coastal region from Bamban to Thiruvannamiyur of Tamil Nadu, India	Umarani P., Ramu A., Babu Ponnusami A., Dhanasekarapandi an M.	civil	International Journal of Environment and Waste Management	2020	View Document
52.	Three-dimensional analysis on natural convection inside a T-shaped cavity with water-based CNT-aluminum oxide hybrid nanofluid	Almeshaal M.A., Kalidasan K., Askri F., Velkennedy R., Alsagri A.S., Kolsi L.	civil	Journal of Thermal Analysis and Calorimetry	2020	View Document
53.	Studies on flexural behavior of reinforced concrete beams with copper slag and fly ash	Raju S., Dharmar B.	civil	Structural Concrete	2020	View Document
54.	Developing a ph model using artificial neural network and visual modflow to evaluate groundwater quality	Jessy Mol I., Baskaran T., Justin Jose D.	civil	Applied Ecology and Environmental Research	2020	View Document
55.	Numerical Study on Parametric Analysis of Reinforced Concrete Column under Blast Loading	Rajkumar D., Senthil R., Bala Murali Kumar B., Akshayagomathi K., Mahesh Velan S.	civil	Journal of Performance of Constructed Facilities	2020	View Document
56.	ANFIS-Based Accurate Estimation of the Confinement Effect for Concrete-Filled Steel Tubular (CFST)	Balasubramanian S., Jegan J., Sundarraja M.C.	civil	International Journal of Fuzzy Systems	2020	View Document
57.	HE-Co-HOG and k-SVM classifier for finger knuckle and palm print-based	Veluchamy S., Karlmarx L.R.	Mechatronics	Sensor Review	2020	View Document



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	multimodal biometric recognition					
58.	Piezoelectric energy harvesting from DC-DC converters	Raghavendran S., Umapathy M., Uma G., Karlmarx L.R.	Mechatronics	Ferroelectrics	2020	View Document
59.	Evaluation method to improve standard setting in engineering courses-a study	Julius Fusic S., Rishwana M., Swathilakshmi P.R.K., Kavitha D.	Mechatronics	Journal of Engineering Education Transformations	2020	View Document
60.	An improved zero-voltage zero-current transition boost converter employing l-c-s resonant network	Anandh N., Sharma A., Julius Fusic S., Ramesh H.	Mechatronics	International Journal of Power Electronics and Drive Systems	2020	View Document
61.	Hexagonal Clustered Trust Based Distributed Group Key Agreement Scheme in Mobile Ad Hoc Networks	Janani V.S., Manikandan M.S.K.	ECE	Wireless Personal Communications	2020	View Document
62.	Analytical Model of Double Gate Stacked Oxide Junctionless Transistor Considering Source/Drain Depletion Effects for CMOS Low Power Applications	Manikandan S., Balamurugan N.B., Nirmal D.	ECE	Silicon	2020	View Document
63.	The improved RF/stability and linearity performance of the ultrathin-body Gaussian-doped junctionless FinFET	Manikandan S., Balamurugan N.B.	ECE	Journal of Computational Electronics	2020	View Document
64.	Quadrant Based Neighbor to Sink and Neighbor to Source Routing Protocol and Alternate Node Deployment Strategies for WSN	Paulswamy S.L., Kaluvan H.	ECE	International Journal of Parallel Programming	2020	View Document



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65.	Outage analysis of SWIPT-based full-duplex cognitive NOMA downlink system over Nakagami-m fading channels	Sashiganth M., Thiruvengadam S.J., Sriram Kumar D.	ECE	International Journal of Communication Systems	2020	View Document
66.	Back radiation reduction in jean's slot patch antenna using reflector	Raman I., Alagarsamy T.	ECE	Applied Mathematics and Information Sciences	2020	View Document
67.	BER analysis of full duplex NOMA downlink and uplink co-operative user relaying systems over Nakagami-m fading environment	Sashiganth M., Thiruvengadam S.J., Sriram Kumar D.	ECE	Physical Communication	2020	View Document
68.	Comparison of missing tooth and dental work detection using dental radiographs in human identification	Jaffino G., Banumathi A., Gurunathan U., Jose J.P.	ECE	International Journal of Biomedical Engineering and Technology	2020	View Document
69.	Influence of Germanium Source Dual Halo Dual Dielectric Triple Material Surrounding Gate Tunnel FET for Improved Analog/RF Performance	Venkatesh M., Suguna M., Balamurugan N.B.	ECE	Silicon	2020	View Document
70.	Modeling and Analysis of GPS-GLONASS Navigation for Car Like Mobile Robot	Sekaran J.F., Kaluvan H., Irudhayaraj L.	ECE	Journal of Electrical Engineering and Technology	2020	View Document
71.	Design and analysis of 0.9 and 2.3-GHz concurrent dual-band CMOS LNA for mobile communication	Roobert A.A., Rani D.G.N.	ECE	International Journal of Circuit Theory and Applications	2020	View Document



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72.	MACBHA: Modified Adaptive Cluster-Based Heuristic Approach with Co-operative Spectrum Sensing in Wireless Sensor Networks	Devaraj S.A., Aruna T.	ECE	Wireless Personal Communications	2020	View Document
73.	An enhanced back propagation method for change analysis of remote sensing images with adaptive preprocessing	Dalmiya C.P., Santhi N., Sathyabama B.	ECE	European Journal of Remote Sensing	2020	View Document
74.	A new pyramidal opponent color-shape model based video shot boundary detection	Sasithradevi A., Mohamed Mansoor Roomi S.	ECE	Journal of Visual Communication and Image Representation	2020	View Document
75.	Path optimization of box-covering based routing to minimize average packet delay in software defined network	Gurusamy U.M., Hariharan K., Manikandan M.S.K.	ECE	Peer-to-Peer Networking and Applications	2020	View Document
76.	Energy efficient bidirectional relay network with spatial modulation	Ravindran Unnithan Jalaja R., Periakarupan Gurusamy Sivabalan V., Sundarrajan Jayaraman T.	ECE	International Journal of Communication Systems	2020	View Document
77.	Three-dimensional analytical modeling for small-geometry AlInSb/AlSb/InSb double-gate high-electron-mobility transistors (DG-HEMTs)	Venish Kumar T., Balamurugan N.B.	ECE	Journal of Computational Electronics	2020	View Document
78.	Improvement of Subthreshold Characteristics of Dopingless Tunnel FET Using Hetero Gate Dielectric Material: Analytical Modeling and Simulation	Lakshmi Priya.G, Balamurugan.N.B G L.P., N B B.	ECE	Silicon	2020	View Document



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79.	Video classification and retrieval through spatio-temporal Radon features	Sasithradevi A., Roomi S.M.M.	ECE	Pattern Recognition	2020	View Document
80.	A 1-V, 5 $\hat{1}/4$ W, Atto Current Bulk-Driven CMOS Based Operational Transconductance Amplifier for Biosensor Applications	Gifta G., Rani D.G.N., Nirmal D.	ECE	ECS Journal of Solid State Science and Technology	2020	View Document
81.	Fabric defect detection using the sensitive plant segmentation algorithm	Nisha M.F., Vasuki P., Roomi S.M.M.	ECE	Fibres and Textiles in Eastern Europe	2020	View Document
82.	Target detection in SAR images using Bayesian Saliency and Morphological attribute profiles	Banu A.S., Vasuki P., Roomi S.M.M.	ECE	Computer Communications	2020	View Document
83.	Enhanced recommender system for managing sparse data in secured cloud for e-business management	Indira K., Kavitha Devi M.K.	IT	Advances in Mathematics: Scientific Journal	2020	View Document
84.	Multi Cloud Based Service Recommendation System Using DBSCAN Algorithm	Indira K., Kavitha Devi M.K.	IT	Wireless Personal Communications	2020	View Document
85.	Enhancing student learning and engagement in freshman course on problem solving using computers	Jeyamala C., Abirami A.M.	IT	Journal of Engineering Education Transformations	2020	View Document
86.	Evaluating the quality of final examination question paper in engineering education	Abirami A.M., Palaninatha Raja M.	IT	Journal of Engineering Education Transformations	2020	View Document
87.	Intelligent dynamic grouping for collaborative activities in learning management system	Shanmuganeethi V., Muthuramalingam S., Uma K.V.	IT	Journal of Engineering Education Transformations	2020	View Document



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88.	C5.0 decision tree model using tsallis entropy and association function for general and medical dataset	Uma K.V., Appavu Alias Balamurugan S.	IT	Intelligent Automation and Soft Computing	2020	View Document
89.	An e-health decision support framework to predict the heart disorders	Sivakumar S., Padmavathi S.	IT	International Journal of Business Information Systems	2020	View Document
90.	Parkinson Data Analysis and Prediction System Using Multi-Variant Stacked Auto Encoder	Nagasubramanian G., Sankayya M., Al-Turjman F., Tsaramirsis G.	IT	IEEE Access	2020	View Document
91.	Securing e-health records using keyless signature infrastructure blockchain technology in the cloud	Nagasubramanian G., Sakthivel R.K., Patan R., Gandomi A.H., Sankayya M., Balusamy B.	IT	Neural Computing and Applications	2020	View Document
92.	Automated optimal test data generation for OCL specification using harmony search algorithm	Jalila A., Jeya Mala D.	IT	International Journal of Business Intelligence and Data Mining	2020	View Document
93.	FuRL: fuzzy RBM learning framework to detect and mitigate network anomalies in Information Centric Network	Rani P.V., Shalinie S.M.	CSE	Sadhana - Academy Proceedings in Engineering Sciences	2020	View Document
94.	Semisupervised-Learning-Based Security to Detect and Mitigate Intrusions in IoT Network	Ravi N., Mercy Shalinie S.	CSE	IEEE Internet of Things Journal	2020	View Document
95.	BALANCE: Link Flooding Attack Detection and Mitigation via Hybrid-SDN	Ravi N., Shalinie S.M., Danyson Jose Theres D.	CSE	IEEE Transactions on Network and	2020	View Document



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				Service Management		
96.	Learning-Driven Detection and Mitigation of DDoS Attack in IoT via SDN-Cloud Architecture	Ravi N., Shalinie S.M.	CSE	IEEE Internet of Things Journal	2020	View Document
97.	Prediction of risk factors for pre-diabetes using a frequent pattern-based outlier detection	Rajeswari A.M., Deisy C.	CSE	International Journal of Biomedical Engineering and Technology	2020	View Document
98.	Deep learning framework for early detection of intrusion in virtual environment	Priya G.M., Shalinie S.M., Priya P.M.	CSE	International Journal of Business Intelligence and Data Mining	2020	View Document
99.	Enhanced electrochemical performance by facilitating Li-ion diffusion in $\text{LiNi}_{0.1}\text{Mg}_x\text{Co}_{0.9-x}\text{O}_2$ ($0 \leq x \leq 0.2$) — for high energy Li-ion batteries	Arockia Shyamala Paniyarasi S., Arlyn Sneha J., Padmaja S., Pushpa Selvi M., Sinthika S., Nimma Elizabeth R.	CSE	Nano-Structures and Nano-Objects	2020	View Document
100.	Convolutional neural network for solid waste segregation and management	Pandiaraja P., Santhana Hari S., Suriya S., Karthikeyan S.	CSE	International Journal of Advanced Science and Technology	2020	View Document
101.	Hybrid multilayer network traceback to the real sources of attack devices	Yang M.-H., Luo J.-N., Vijayalakshmi M., Mercy Shalinie S.	CSE	IEEE Access	2020	View Document



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102.	A Smart Approach for Intrusion Detection and Prevention System in Mobile Ad Hoc Networks Against Security Attacks	Islabudeen M., Kavitha Devi M.K.	CSE	Wireless Personal Communications	2020	View Document
103.	Map-optimize-reduce: CAN tree assisted FP-growth algorithm for clusters based FP mining on Hadoop	Ragaventhiran J., Kavithadevi M.K.	CSE	Future Generation Computer Systems	2020	View Document
104.	Effective image stego intrusion detection system using statistical footprints of the steganogram and fusion of classifiers	Hemalatha J., Kavitha Devi M.K., Geetha S.	CSE	International Journal of Computer Aided Engineering and Technology	2020	View Document
105.	Effects of annealing on phase structure and magnetic characteristics of sputter deposited Ni ₂ FeGa/Si (100) thin films	Vinodh Kumar S., Wu Z., Sun Z., Manivel Raja M., Mahendran M.	PHY	Functional Materials Letters	2020	View Document



Soft computing-based fuzzy integral sliding mode control: a real-time investigation on a conical tank process

S. Nagammai¹ · S. Latha² · M. Varatharajan²

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Abstract

In this work, a fuzzy integral sliding mode controller (FISMC) for level control in a conical tank process is demonstrated in real time. In traditional sliding mode controller (SMC) algorithm, the robustness with respect to parameter variations and external disturbances can be achieved only after the reach of sliding phase. However, robustness is not guaranteed during the reaching phase. But integral sliding mode controller (ISMC) hunts to eliminate the reaching phase by imposing sliding mode throughout the system response. ISMC also mitigates chattering caused by discontinuity of controller. Hence, integral of error term is used in the sliding surface. A modified power rate reaching law is proposed to describe the dynamics of the switching function. The fuzzy logic system is integrated to approximate the sliding variable, and control law is formulated so as to alleviate the chattering effect of the control signal. In this paper, Takagi and Sugeno fuzzy logic is integrated with ISMC to achieve smoother sliding surface. Genetic algorithm (GA) is used to tune the membership functions of fuzzy logic and the parameters of the control law. GA-tuned FISMC integrates the features of fuzzy logic control, SMC and soft computing techniques. The effectiveness of algorithm is demonstrated in an experimental setup. The reported results confirm the superiority of GAFISMC compared with proportional integral controller and ISMC algorithm. The real-time implementation ensures the robustness of GAFISMC in terms of operating-level variations, parameter variations and disturbance rejection.

Keywords Conical tank process · Fuzzy integral sliding mode control · Genetic algorithm · Parameter variation · Robustness

1 Introduction

Many of the industrial processes present a challenging task to control engineers because of their nonlinear dynamics, interaction between process tanks, constraints imposed on manipulated variables, unmeasured disturbances and innate

dead time. The inherent nonlinearity demands the use of robust controller for the control of the liquid level in storage or surge tanks. In industry, for safe storage of chemicals and for thorough mixing of chemicals, conical bottom tanks (CBT) or conical tanks are used which have more advantages over standard vertical storage tanks. The use of CBT has become a leading choice in industries for storage of fertilizers and molasses, in water treatment plants and beer production plants, wherein the control of the liquid level in the tank is a crucial problem. The process tank with varying cross-sectional area has the difficulty in controlling level in real time. A bench mark system, namely conical tank process (CTP), is considered to reveal the concepts of sliding mode control algorithm (SMC).

Many researchers have demonstrated that conventional proportional–integral–derivative (PID) controller is suitable for systems with linear dynamics. The implementation of PID controller in real time for a process with parameter varying dynamics is still a potential research area. The

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An Effective way of improving the Course Outcomes by using Jigsaw Technique in Core Courses of Engineering

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Abstract: Jigsaw is a cooperative learning method that makes students dependent on each other to achieve the team goals or to understand the concepts. Many faculties in engineering college struggle with the students to make them to understand the technical concepts. A case study was done on the course Microcontroller for B.E fourth semester Electrical Engineering students (2018-2019 Even semester). The process is tested with two different set of students Group A and Group B. The Group A students learning method is traditional classroom lecture and Jigsaw Technique is implemented in Group B. The student's understandability on that Course outcome is evaluated based on their Continuous Assessment Test-II and their Satisfactory Index towards the Course Outcome using Canvas LMS. From the case study, Student's satisfactory index is high when learning is based on Jigsaw technique.

Keywords: Outcome Based Education (OBE), Learning Management system (LMS), Continuous Assessment Test-II (CAT-II), active teaching and learning strategies, peer-to-peer learning.

1. Introduction

Traditional classroom learning is very passive with lecturing and listening. Conventional teaching methods like workbook, black board lecture; homework and assessment test for student learning has received much denigration in modern years. Today students like to learn by participating and interacting than listening lectures. The Fourth Industrial Revolution represents a primary change in the way we live, job and share to one another with extraordinary technology advancement. The actual opportunity is to appear beyond technology and find ways to offer the greatest number of people the capability to optimistically impact their families, organisations and communities. Usage of technology and smart way learning is important in education.

Active learning approach is more booming mode of learning which helps in internalizing the concepts and easy way of recalling the concepts [1]. Several active

learning techniques are involved like debates [2], game based learning [3], Group role-play [4], and problem based learning and project-based learning [5]. There are different types of active learning method, where the students do incredible to acquire knowledge instead of listening. Hands-on laboratory like virtual labs are also one of active learning to improve the student in learning electrical and electronic circuit courses. It first makes them “visible” and “accountable” in the classroom, and then by offering that hands-on practice through the use free and open source simulation software

This paper illustrates the progress of learning by implementing Jigsaw technique. It is done as a case study in the course ‘Microcontroller’ for B.E Electrical and Electronics students at Thiagarajar College of Engineering, an autonomous institution affiliated to Anna University at India. The process is tested with two different set of students Group A and Group B. The Group A students learning method is traditional classroom lecture and Group B learning method is using Jigsaw Technique. In this paper, the Chapter 1 deals with the introduction part and literature survey. Chapter 2 discusses about the Microcontrollers course. Chapter 3 describes the Jigsaw techniques. Chapter 4 describes the Implementation procedure of Jigsaw techniques. Chapter 5 deals with Discussions on Results. Chapter 6 is Conclusion.

2. About The Microcontrollers Course

The course taken for case study is '14EE460 - Microcontrollers' which is a Program Core Course for Forth semester, B.E Electrical and Electronics Engineering students at Thiagarajar College of Engineering, an autonomous institution affiliated to Anna University at India. The syllabus of the course under study covers the architecture and peripherals of 8051 microcontrollers, assembly language, embedded programming and advance microcontrollers such as PIC16F877 and ARM7 (LPC2148). The concept map illustrating the syllabus is given in Fig. 1

Fatigue load mitigation in wind turbine using a novel anticipatory predictive control strategy

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Abstract

Wind energy has become a recent evolving source of renewable energy which needs an extensive exploration. The increased configuration of wind turbine instantaneously increases the structural loading of wind turbine components. The prolonged loading on structural components imposes a great impact on the lifetime of the wind turbine and reduces the feasibility of thinner rotor blade. These economical detriments due to the structural damage of turbine are dealt effectively by proposing an anticipatory preview-based control strategy for individual pitching of blades. The proposed multiple point model predictive controller with fuzzy logic switching, exploits the preview wind measurement from the light detection and ranging system which predicts the wind speed in advance. The utmost objective of the proposed controller is its optimized individual blade pitching to reduce the fatigue loads on the wind turbine components using the preview wind data. The blade root bending moment of individual blades and the tower fore-aft deflection which are chosen as the parameters of fatigue stress to be analyzed and controlled. The National Renewable Energy Laboratory's Fatigue, Aerodynamics, Structures and Turbulence 5 MW baseline onshore wind turbine is used for validating the proposed controller in MATLAB simulation. The non-linear wind field is simulated using the TurbSim software, and the short-term and lifetime damage equivalent loads of the wind turbine for the simulated wind field is analyzed using the MLife software of the National Renewable Energy Laboratory. The proposed controller is compared with the typical model predictive controller and linear quadratic-based controller.

Keywords

Blade root bending moment, tower fore-aft deflection, damage equivalent load, fuzzy logic switching, individual pitching, multiple point model predictive controller

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Introduction

Wind power generation has seen an unimaginable expansion in the global renewable energy market. The new installations of wind energy have reached a new peak of 637 GW in the year of 2015. Its expansion rate was about 172% which is higher than the 164% increase of 2014.¹ The tremendous increase of the wind energy generation has spotted it as a major research field. Many world researchers are involved in eradicating detrimental aspects and optimize the wind energy production. Optimization of wind energy includes power efficiency and reduction of mechanical stress on components which affect the lifetime of the overall wind turbine. The intensity of fatigue load on the wind turbine structure depends on the various region of wind speed in power curve.² The speed of wind could be broadly classified in to four regions based on the

operation of wind turbine. Regions 1 and 2 are the cut-in and power production regions, respectively. Region 2 is the major power production region, where the maximum power production could be tracked. The extreme wind speed could be categorized as Regions 2.5 and 3, which are the cut-off regions and important sources of structural loads.³ This work concentrates on Region 3 wind speed. This region of power curve includes extreme wind gusts hitting the turbine structure at

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Article

A Modified High Voltage Gain Quasi-Impedance Source Coupled Inductor Multilevel Inverter for Photovoltaic Application

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Abstract: The quasi-impedance source inverters/quasi-Z source inverters (Q-ZSIs) have shown improvement to overwhelmed shortcomings of regular voltage-source inverters (VSIs) and current-source inverters (CSIs) in terms of efficiency and buck-boost type operations. The Q-ZSIs encapsulated several significant merits against conventional ZSIs, i.e., realized buck/boost, inversion and power conditioning in a single power stage with improved reliability. The conventional inverters have two major problems; voltage harmonics and boosting capability, which make it impossible to prefer for renewable generation and general-purpose applications such as drive acceleration. This work has proposed a Q-ZSI with five-level six switches coupled inverter. The proposed Q-ZSI has the merits of operation, reduced passive components, higher voltage boosting capability and high efficiency. The modified space vector pulse width modulation (PWM) developed to achieve the desired control on the impedance network and inverter switching states. The proposed PWM integrates the boosting and regular inverter switching state within one sampling period. The PWM has merits such as reduction of coupled inductor size, total harmonic reduction with enhancing of the fundamental voltage profile. In comparison with other multilevel inverters (MLI), it utilizes only half of the power switch and a lower modulation index to attain higher voltage gain. The proposed inverter dealt with photovoltaic (PV) system for the stand-alone load. The proposed boost inverter topology, operating performance and control algorithm is theoretically investigated and validated through MATLAB/Simulink software and experimental upshots. The proposed topology is an attractive solution for the stand-alone and grid-connected system.

Keywords: impedance source; multilevel inverter; coupled inductors; space vector pulse PWM; photovoltaic connected inverter

1. Introduction

Hybrid of Genetic Algorithm and Minimum Spanning Tree method for Optimal PMU Placements

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Abstract— The Phasor Measurement Units (PMUs) generate a huge amount of data during the data acquisition process, which provokes congestion in data transmission. The traffic generation can be reduced by placing the PMUs at appropriate locations. To bridge this gap, Wide Area Monitoring Systems (WAMS) data traffic model has been implemented for PMUs. The main contribution of this technique is to satisfy complete observability, WAMS data traffic index and cost installation index by using the Hybrid algorithm of the Genetic Algorithm and Minimum Spanning Tree method (MST). The MST is combined with the Genetic Algorithm to repair the unobserved combinations of chromosomes. The proposed technique is tested with standard IEEE 7, 14, 30, 57, 118 bus power systems. The results show the efficacy of the proposed technique to find optimal locations. Also, the results of the proposed hybrid algorithm exhibit faster data transmission and convergence.

Keywords— Smart grid; Wide area monitoring, protection and control; Phasor measurement units; Genetic algorithm.

1. INTRODUCTION

In the field of Smart Grid (SG), the Wide Area Monitoring Systems (WAMS) are necessary to record the grid status frequently [1]. In WAMS, Phasor Measurement Unit (PMU) is a device for measuring the basic electrical parameters such as voltage, current, phase angles and frequency with time tags [2]. In a wide area, for the data acquisition purpose, the PMUs measure the above-mentioned parameters from various locations with Global Positioning Systems (GPS). This upgrades the speed of state estimation and raises the precision. The important blocks of WAMS are shown in Fig.1. The PMU devices are placed in numerous buses of Power system substation as clearly shown in Fig.1. These substations will be scattered over a large geographical area across the country.

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Enhanced Learning through Blended IC and DCN Strategies in C Programming For Non – Computer Science Students

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Abstract:

Programming Languages have become one of the core courses even for non-computer science students. The domination of Information Technology markets gives more space job recruitments in software field than in any other core fields in India. However, it is found that, learning C program for non-computer science students is always a difficult task. In this paper, the education research team of department of electrical and electronics engineering has made an attempt through Inverted Classroom (IC) and Desi Chicken Nourishment (DCN) strategies to create a learning environment for C programming class of third semester Electrical Engineering students. Various methods are adopted to promote effective implementation of IC for perfect understanding of the course. The DCN based approach shows a steadfast improvement in programming skills of the non-computer science students.

Keywords: Inverted Classroom, Desi Chicken Nourishment, programming languages.

1. Introduction

The implementation Outcome Based Education (OBE) reformed the Indian Engineering Education System for teaching centred to Learning centred. Many good learning strategies are being adopted by faculty for effective knowledge transfer. The basic issues likes creating learning environment inside classroom, making classroom more interactive, inculcating more activities in classes, handling students with different talents & potential etc are being studied by adopting innovative methods.

One of the issues identified by the education research team of Department of Electrical & Electronics Engineering is the challenging task of teaching programming languages for third semester students of the same department. It is identified that the subject leads them to a different phase when compared with other core subject papers. The students find very difficult to understand and

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study along with other subjects. Again, programming is a skill which should be developed only by practice and not just by studying books. Hence, it demands to adopt a strategy for better understanding of the concepts and sufficient practice sessions to enhance the programming skill of the student.

Inverted Class(IC) is one of the strategies that is being effectively practiced across the world for various courses [1-3]. Research results show that ICs are more effective in knowledge transfer if properly planned. ICs help the faculty and students to conserve class time and use the class time for activities and practices. Hence, it is planned to implement ICs in the class for C programming. Strategies to evaluate student's sincere and serious participation in IC were also developed by the research team.

Peer learning is proved to be another effective learning strategy [4]. The proposed Desi Chicken Nourishment (DCN) promotes peer learning under the direction of a mentor in a naturally accommodative environment[5]. DCN is adopted for conducting programming classes and to promote practical implementation of concepts with proper guidance. The implementation of DCN tends to enhance the programming skill of a student.

Studies show that the implementation of well planned IC enhances the learning ability of students and DCN develops a passion for programming among the students. The methods adopted for the implementation of IC and DCN, and results are discussed in detail in this paper.



A single-stage soft-switching LED driver based on CLCL resonant converter and BCM circuit for lighting application

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Abstract

This paper proposes a single-stage LED driver based on the CLCL resonant circuit and boundary conduction mode (BCM) boost circuit. The input voltage of an LED driver is categorized into two capacitors, which will reduce the input peak voltage by making a single-stage LED driver to work under maximum input voltage modes. The proposed CLCL resonant circuit contains a soft-switching feature where the major and minor area works under zero voltage and zero current phases, respectively. Moreover, this approach has reduced very small turn-off loss, turn-off current of a switch, which in turn proves the system efficiency. In this paper, the proposed BCM circuit, as well as CLCL resonant converter circuit, has been explained with five operational phases, and experimentation and analysis were made for proposed and existing methodologies. For validation of the proposed system, a 100 W investigational prototype is used, and experimental results were analyzed with the theoretical result.

Keywords Light emitting diode · Boundary conduction mode · High-intensity-discharge · AC–DC converter

1 Introduction

Recently, the semiconductor device namely light emitting diode (LED) is employed in our daily life because of its high lifespan, high luminous capacity and enhanced efficiency [1]. Nowadays, tunnel lamps, traffic lamps, and street lamps use LED for better illumination since the power output obtained from such outdoor usages is beyond 20 W. In order to enhance the efficiency of the LED, several literal works have been performed based on numerous studies. The obtained power output for indoor applications is under 5 W. Few characteristic features namely cost, volume, accuracy, and efficiency of an entire appliance must be more significant in case of indoor domestic appliances [2]. Moreover, the form factor and the computational cost of the LED are comparatively low and such type of LED is demonstrated for string as well as chip appliances [3–5]. In case of street lights and various other lamps, it is necessary to connect

numerous numbers of LEDs in parallel for better illumination property and therefore attaining a low-cost and compacted LED design becomes a tough task. This type of challenging issues occurs due to several additional features such as fault protection in open and short circuit, regulation of individual string power, and balancing of current in an LED with multi-strings [6]. The LED driver is designed in such a way that the output current must be controlled in the place of output voltage so that the LED provides better illumination with comparatively low computational cost [1]. Therefore, to obtain a high efficiency low-cost LED driver, a feedback circuit is employed for enhanced system stability and system control [7].

The street light installation strongly relates the growth of the particular region or province because it signifies the economic achievement of a country. High-intensity discharge lamps (HID) namely high-pressure mercury lamps and high-pressure sodium lamps are some of the usual light resource that are utilized in several lightning applications namely street light, tunnel light, etc. In recent times, the street lamps are replaced with LED on the basis of several attractive features namely less striking voltage for lamp start-ups, energy conservation, colour rendering index (CRI), mercury less lamps, rapid switching on and switching off of lamps and in case of hot restarting process it requires very less ignition

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ABC algorithm for estimation of dynamic parameters in radial power system transfer path

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Abstract: In this paper, the artificial bee colony algorithm (ABC) is used to predict the stability of the power system and is evaluated the aggregated machine reactance and inertias in the transfer path. The proposed method is used for estimating the dynamic parameters of the aggregated machines for each area utilising the amplitudes of voltage oscillations measured at any three intermediate points on the transfer path. Two types of voltage control equipment are considered, namely, a static var compensator (SVC) and a thyristor controlled series capacitor (TCSC) including the purpose of voltage support and reducing the disturbance in the system. The proposed methods employ bus voltage phasor data at several buses including the voltage control bus and the line currents on the power transfer path. Here, the three phase fault is applied in the power system. Based on the estimation, the dynamics of the power system is improved and the proposed strategy is utilised for improving the overall dynamic security. The proposed technique is implemented in MATLAB/simulink working platform and the output performance is evaluated and compared with the existing methods such as without facts devices, SVC based controller and genetic algorithm (GA) based TCSC controller respectively.

Keywords: dynamic parameters; voltage; thyristor controlled series capacitor; TCSC; static var compensator; SVC; reactance; inertia; ABC and GA.

Reference to this paper should be made as follows: Jeha, J. and Raja, S.C. (2020) 'ABC algorithm for estimation of dynamic parameters in radial power system transfer path', *Int. J. Operational Research*, Vol. 38, No. 4, pp.544–569.

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Demand Response Program with Different Elasticities

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Abstract

Load control on the consumer side is termed as demand response. Demand response program (DRP) is emerging as a powerful tool for optimal load management in smart grid environment. In this paper, price-based DRP is applied to the system through the management of electricity prices. This management is based on demand elasticity, and system is expected to react enabling to accomplish the required load reduction. Here, fixed value and different values of elasticity are considered, and the reduction in load and price is discussed for both cases. The effect of demand response in electricity prices with fixed and various elasticities is highlighted using a simulated case study on IEEE 30 bus system.

Keywords Demand response · Price elasticity · Real-time pricing · Electricity markets

1 Introduction

For many reasons, deregulation of power system forced power producers and power transfer companies to change their operation from vertically integrated model to open market model (Bhattacharya et al. 2001). The conventional operation of power system operation was changed in deregulation of the power system. In the traditional model, the power demands were supplied whenever they occurred. However, the restructured model is most efficient by keeping the fluctuations of demand as small as possible. Electricity markets have arisen because of the power sector restructuration and power systems deregulation. The players participating in the competitive electricity markets must define strategies and take decisions using all the available information and business opportunities to accomplish their goals (Bhattacharya et al. 2001; US Department of Energy 2006; International Energy Agency 2003).

The main objective of a reliable power system is to maintain a perfect balance between supply and demand in real time. But it is not easy to maintain that balance because both supply and demand are changing unexpectedly. The reason for that unexpected changes are forced outages of generating units, outages of transmission and distribution lines and sudden load changes. The power system infrastructure is highly capital intensive. In the restructured system, demand-side response is one of the cheapest resources for the efficient operation of the system. Demand response (DR) has proved to be a good opportunity for loads to participate in this environment, gaining competitive advantage, and represents significant benefits for the whole electricity market performance. DR programs may produce an increase in power consumption efficiency through active consumer participation, making evident the value that each consumer attributes to his individualized additional demands.

Recent efforts are aiming at improving wholesale markets with more intensive use of DR. This includes, for example, the acceptance of demand bids/offers for ancillary services; the specification of the DR resources of the frequency, duration and the amount of their participation in consumption reduction; and the existence of aggregators that bid into the market on behalf of customers (Rahimi and Ipakchi 2010).

The electricity grid becomes most stressed when there is high demand for electricity. In essence, high demand for electricity requires a higher supply of electricity, which

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A Comparison of the Performance Indices of Embedded EZ-Source Inverter Using Different PWM Techniques

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Abstract

Many converters were proposed for boost/buck operation for power supply. But these converters have more stages due to separate boost or buck converters, as a result, it increases the cost, volume, conduction losses and also reduces the efficiency. Impedance source-based inverter is proposed for reducing the converter stage and achieve buck/boost operation using a shoot through features with simple passive elements. The impedance source converter is modified by replacing capacitor into dc source for reducing current and voltage across dc link and smoothing the dc voltage. This circuit is called as embedded EZ- source inverter. This circuit gives same voltage gain with same passive elements rating and counting. Different PWM technique is used to control the inverter output voltage and reduce the current harmonic. The circuit is simulated using three PWM techniques in MATLAB environment. The circuit performance is compared with simulation results.

Keywords PWM technique · Voltage gain · Harmonic and impedance source inverter

1 Introduction

Due to power demand and advancement of power semi-conducting device availability increasing the research in boost/buck operation of converter for developing power supply from renewable energy source applications [1–5]. The inverter is used for controlling the speed of the motor. The boost converter is used to control the DC link voltage and maintains the constant voltage any variations occur in input side [6]. This boost converter increases the converter stage and losses. Impedance source inverter is proposed for reducing converter stage, losses and achieves buck/boost operation using simple passive elements [7–9]. The voltage gain is achieved with help of shoot through properties. The z-source inverter is developed for renewable energy applications in [6]. Many control methods are proposed to extract the maximum power from PV cells [10–12]. This converter is proposed for hybrid

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Steady-state concentrations of carbon dioxide absorbed into phenyl glycidyl ether solutions by residual method

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Abstract

In this paper, two coupled nonlinear differential equations related to carbon dioxide (CO₂) and phenyl glycidyl ether (PGE) concentrations are solved using a residual method. This is a particular case of the exp-function method. This model has based a set of boundary conditions for Dirichlet and a mixed set of boundary conditions for Neumann and Dirichlet. This method yields a quick converging, easily computable, and efficiently verifiable approximate closed-form solutions. The numerical result is compared with the approximate solutions obtained by this method and with the other results obtained by the Adomian decomposition method.

Keywords Mathematical modeling · Analytical method · Nonlinear differential equations · Carbon dioxide · Phenyl glycidyl ether

List of symbols

Symbols	Description
C_A	Concentration of CO ₂ (M)
C_B	Concentration of PGE (M)
D_A	Diffusivity of CO ₂ (m ² /s)
D_B	Diffusivity of PGE (m ² /s)
K_1	Reaction equilibrium constant (1/M)
k_1	Forward reaction rate constant in reaction Eq. (2) (1/m ² s)
k_2	Backward reaction rate constant in reaction Eq. (2) (M/m ² s)
k_3	Forward reaction rate constant in reaction Eq. (3) (1/m ² s)
$r_{A,Cons}$	Reaction rate of CO ₂ in consecutive reaction model (M/s)
S_i	Surface area of catalyst (m ²)
z	Distance (m)
z_L	Film thickness (m)

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APPLICATION OF HEURISTIC METHOD IN DUAL-HESITANT FUZZY TRANSPORTATION PROBLEM

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ABSTRACT. Different methodologies and theories were originated in long term research challenge to pact with ambiguity in factual world issues. To handle the ambiguity in various categories of problems, a broad assortment of tools are developed by fuzzy sets further with their expansions, corresponding as, interval-valued fuzzy sets, Atanassov's intuitionistic fuzzy sets and type-2 fuzzy sets etc are introduced. In order to covenant with the hesitant circumstances that are scarcely considered by the prior contrivances a novel extent of fuzzy set namely hesitant fuzzy sets has been established. Dual-hesitant fuzzy set is applied for handling imprecise, hesitant or imperfect facts and expertise circumstances in factual-existence effective investigate predicaments. So far many researchers have applied different methods like North West corner method, least cost method, Vogel's approximation method, allocation table method to solve various fuzzy transportation problems so as to find the optimum elucidation. In this work an innovative technique named as Heuristic Method for unraveling dual-hesitant fuzzy transportation problem is established. An arithmetical exemplar is illustrated with the new technique and the result obtained through this method is compared with the existing methods. This proposed method gives an optimum solution.

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2020 Mathematics Subject Classification. 90B06, 03E72.

Key words and phrases. score function, dual-hesitant fuzzy transportation problem, Heuristic Method, dual-hesitant fuzzy numbers.

**Biosynthesis of ZnO nanoparticles through extract from Prosopis juliflora plant leaf:
Antibacterial activities and a new approach by rust-induced photocatalysis**

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ABSTRACT

Rust-induced photocatalytic and antibacterial activities of ZnO nanoparticles derived from Prosopis juliflora leaf extracts by biosynthesis using the hydrothermal method at 170°C are reported in this study. The characterization has been accomplished by various methods such as XRD, DRS, FT-IR, SEM, TEM, EDAX, and PL spectra. XRD exhibits that ZnO has a hexagonal wurtzite structure with a preferred orientation of 101 planes. The functional groups, which are present in the leaf extracts, are responsible for corresponding peaks in FT-IR spectra. The FESEM images of the synthesized nanoparticles show the morphology sphere like structure. ZnO particle size of 65nm has been observed from HR-TEM analysis. The elemental composition has a good agreement with the biosynthesized ZnO nanoparticles. The antibacterial activities have been carried out in vitro assays against four different pathogens viz Escherichia coli (E. coli), Rhodococcus rhodochrous (R. rhodochrous), Bacillus subtilis (B. subtilis) and Vibrio cholera (V. Cholera) against a standard (streptomycin sulfate). Furthermore, the Photocatalytic ability of the titled nanoparticles has been experimented from the rust solution with methylene blue and degradation under UV radiation of 99%. The proposed mechanism is based on scavenger studies and it is investigated during the photo degradation of Methylene blue. The catalytic amount and recovery of photocatalyst have also been studied in detail.

. **Keywords:** Biosynthesis; ZnO; XRD; Rust solution; Antibacterial; photocatalytic activity



Research paper

Graphene quantum dots/ZnO nanocomposite: Synthesis, characterization, mechanistic investigations of photocatalytic and antibacterial activities

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ABSTRACT

A new nanocomposite of the type ZnO fence with graphene quantum dots GQD/ZnO has been synthesized by the hydrothermal method. The crystallinity, structural and morphological properties are characterized by XRD, FT-IR, Raman, FESEM, TEM, DRS and PL techniques. Interestingly, the prepared GQD/ZnO nanocomposites act as photocatalyst for the degradation of the phenol solution with a maximum of 79% under UV light irradiation. The effect of pH for photodegradation of the catalyst has also been investigated in detail. Further, the antibacterial activity of GQD/ZnO has been investigated against *P. aeruginosa* and the results show enhanced activity, even at low concentration.

1. Introduction

Graphene belongs to renowned carbon nanomaterials, which have received much attention due to their remarkable electrical and mechanical properties that can be exploited to improve the properties of host materials for various applications [1–4]. Graphene is a two-dimensional platelet which comprises carbon atoms that are tightly packed in the honey-comb like structure. Semiconductor-mediated photocatalysis has attracted worldwide attention for its potential in environmental and energy-related applications [5–8]. Carbon–semiconductor based hybrid materials become a new class of photocatalysts, which has recently attracted lots of attention. However, the rapid recombination rate of photogenerated electron–hole pairs within photocatalytic materials results in its low efficiency, thus limiting its practical applications. Therefore, the suppression of recombination of charge carriers is the key to the enhancement of photocatalytic activity of semiconductor photocatalysts [9–13]. Recently, functionalized graphene-based semiconductor photocatalysts have attracted a lot of attention due to their good electron conductivity, large specific surface area, and high adsorption [14–19].

During the past decade, a variety of strategies have been employed to

increase the photocatalytic performance of semiconductor photocatalysts, for example, via suitable textural design [20–25], doping [6,26–28], noble metal loading [29–31] and forming semiconductor composites [32,33]. Furthermore, the semiconductor has been made to combine graphene to form photocatalyst composite material to improve their photo-catalytic performance [16–18,34–36]. The ZnO based nanomaterial has been broadly studied, due to their excellent properties such as high redox potential, nontoxicity, low cost, and environmentally friendly feature [37,38]. Even though ZnO creates a band gap (3.37 eV) and great exciton binding energy (60 meV) [39], the small size nanoparticles have a larger surface area compared to bulk particles. This dissimilar property is used in many application fields such as nanomedicine, bio-nanotechnology, and biosensor, etc. However, photocatalyst action of ZnO is moderate under UV or sunlight, due to the quick recombination of the excited electron from the conduction band to the valence band [40]. To overcome such difficulties, modification of morphological change, surface defects, creating oxygen vacancies, doping or preparing composite material, and finally tuning the band gap of semiconductor material [41] have been conducted.

The synergistic effect of ZnO nanorods on photocatalytic performance and biological activity of graphene nano sheets has been reported

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■ Organic & Supramolecular Chemistry

Synthesis of 1,2,3-Triazole Tethered 3-Hydroxy-2-oxindoles: Promising Corrosion Inhibitors for Steel in Acidic Medium and Their Anti-Microbial Evaluation

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Herein, we designed and synthesized a series of 1,2,3-triazole tethered 3-hydroxy-2-oxindoles (**4a-j**) using *N*-propargyl isatin derivatives as key starting materials (**1a-d**) under ball-milling conditions by merging aldol condensation and click reaction. The synthesized compounds (**4a-j**) were examined for their corrosion inhibition behavior in mild steel using gravimetric and electrochemical analysis. The compound **4i** was identified

as the most efficient compound with an efficiency of > 70%. Also, the adsorption of inhibitors on the surface of mild steel and mixed type of behaviors was evidenced by impedance and Tafel polarization studies, respectively. Further, the evaluation of antibacterial and antifungal activities demonstrated that compound **4g** possessed a significant potential to behave as an antimicrobial agent.

Introduction

Isatins are eminent heterocyclic scaffolds possessing a reactive keto-carbonyl that is susceptible to nucleophilic addition and condensation reactions to result in C-3 functionalized oxindole derivatives. Among the C-3 functionalized oxindoles, 3-hydroxy-3-substituted-2-oxindole has drawn remarkable attention due to their prevalence in natural products,^[1] as valuable key intermediates in organic synthesis,^[2-4] and superior pharmaceutical properties.^[5,6] On the other hand, 1,2,3-triazoles are found as a promising choice of heterocycle in drug discovery based on their merits including rigidity, ability to form strong hydrogen-bonding, high dipole moment and stability towards *in vivo* biological studies.^[7,8] To enhance the proteolytic stability and pharmacological efficacy, 1,2,3-triazoles are considered as an alternative to amide bond.^[9,10]

For instance, the most accessible method for the regioselective synthesis of 1,2,3-triazoles is azide-alkyne cycloaddition reaction catalyzed by copper(I)- (CuAAC)^[11,12] or ruthenium(II)- (RuAAC),^[13,14] which results 1,4- or 1,5-disubstituted 1,2,3-triazole isomers, respectively. However, in the bulk process, the

homogeneous nature of catalyst triggers the complexity in the separation of catalyst and product at the end of the reaction. Further, the requirement of reducing agents and stabilizing ligands are considered potential disadvantages of this method. In this regard, the heterogeneous catalytic system is finding remarkable attention due to its merits such as catalyst recovery by simple filtration, reusability of catalyst, and additives are not required.^[15-18] Even though CuAAC reactions are proficiently performed in conventional solution phase, there is an increasing demand for non-conventional approaches such as mechanochemistry (ball milling), microwave and ultrasound irradiation in terms of economical (feedstock) and environmental (energy consumption) response.^[19,20] Particularly ball milling,^[21-23] is known as mechanical force-induced chemical transformations, has been rapidly progressing in various fields such as organic synthesis,^[24,25] inorganic^[26] and supramolecular materials.^[27] It is pertinent to note that this method has been successfully implemented in copper-catalyzed azide-alkyne cycloaddition for the synthesis of 1,2,3-triazoles.^[28-30]

In general, mild steel is a well-known alloy of iron with various applications in petroleum industries due to relatively low cost and excellent mechanical properties.^[31] However, resistance of mild steel towards the aqueous mineral acids is relatively very low. Usage of mineral acids in industrial activities is inevitable because they are required in many industrial activities such as acid pickling, cleaning of oil refinery equipment, chemical etching and removal of salt and scale deposit.^[32-33] Thus, the use of organic inhibitors is one of the most valid approach for corrosion inhibition in acidic environments,^[34-35] because the inhibitors containing heteroatoms such as nitrogen, oxygen and sulfur and aromatic rings can act as reactive center to adsorb onto the mild steel surface and block active sites, thus decreasing corrosion rate.^[36] Interestingly, oxindoles and 1,2,3-triazoles were reported as promising corrosion inhibitors for mild steel in acid media,^[37-43]

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Design and performance characteristics analysis of a linear fresnel reflector solar concentrator system with a trapezoidal cavity absorber(Article)

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Abstract

A linear Fresnel reflector solar concentrator system is developed and its performance is studied theoretically. A trapezoidal cavity absorber, placed at focus of the concentrator, has multiple tubes and water is considered as the working fluid. Various mass flow rates are tried to evaluate the performance of the concentrator system. The quantum of heat absorbed by water, overall heat loss coefficient, absorber plate temperature, collection efficiency factor and heat removal factor in the cavity absorber with 40 number of reflecting mirrors on either side of concentrator are numerically simulated by using MATLAB program. Overall heat transfer coefficient varies from 5.5 to 5.3 W/m²K. Similarly, the useful heat gain after considering the heat loss from the absorber plate varies from 2374 to 2390 watts. Also from the analysis, it is inferred that, the absorber plate temperature varies from 440 to 460 K for the different mass flow rates. © 2021 International Journal of Emerging Technology and Advanced Engineering. All Rights Reserved.

Author keywords

[Heat removal factor](#) [Linear fresnel reflector solar concentrator](#) [Overall heat transfer coefficient](#) [Trapezoidal cavity absorber](#)

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Optimization of CNC-WEDM Parameters for AA2024/ZrB₂ in situ Stir Cast Composites Using Response Surface Methodology with Desirability Function Technique

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Abstract

In recent years, application of aluminum materials in aircraft structures with output responses like maximum material removal rate and minimal surface roughness is at great necessity. This performance is attained during the wire cut electrical discharge machining and is influenced by the extent of ceramic inclusions in the aluminum matrix. The current research focuses on improving the machining performance of as-prepared aluminum zirconium diboride AA2024–ZrB₂ prepared at different weight ratios of ZrB₂ particles as 0, 2.5, 5, 7.5 and 10 wt%. The as-prepared samples are investigated for different characterizations like phase identification using X-ray diffraction technique; microstructure analysis using both optical microscope and field emission scanning electron microscope; and analysis of mechanical properties using tensile strength and micro-hardness tests. During the machining process, four input parameters like pulse on time T_{on} (μ s), pulse off time T_{off} (μ s), gap voltage GV (V) and ZrB₂ wt% are considered for optimization and obtains 23 μ s, 41 μ s and GV 100 V at 2.5 wt% ZrB₂. During machining, multi-response optimization, using response surface methodology with desirability function is performed. The output responses as of maximum material removal rate (MRR) of 0.0765 g/min and minimum surface roughness (SR) of 3.618 μ m are obtained. The addition of different wt% ZrB₂ in the base matrix has greatly influenced the output response like MRR and SR in the aluminum matrix.

Keywords Aluminum metal matrix composites · Zirconium diboride · Differential scanning calorimetry · Wire cut electrical discharge machining · Response surface methodology

1 Introduction

New classes of advanced materials like metal matrix composites (MMCs) show its path in aerospace, nuclear reactors and precise component manufacturing sectors. A rapid growth in industries is looking for improved strength to weight ratio, superior wear resistance, thermal stability and reduced corrosion rate that paved way for development of aluminum MMCs (AMCs) [1–4]. Due to the predominant characteristics of AMCs, the fabrication and machining process seems to be as leading edges. The different techniques involved in fabrication of AMCs are powder metallurgy, stir casting, gas pressure infiltration technique, vapor deposition, squeeze casting method and in situ stir casting or direct inorganic salts reaction method) [5, 6]. In the available techniques, in situ stir casting is used in preparing composites of thermodynamically steady and litter sized particles that have the prevailing interfacial bonding and the enhanced wettability nature. The ZrB₂ particles produced through in situ method

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Effect of Various Chemical Treatments of *Prosopis juliflora* Fibers as Composite Reinforcement: Physicochemical, Thermal, Mechanical, and Morphological Properties

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ABSTRACT

The present environmental regulations enforced by the government authorities have made the investigators around the globe to make use of more and more green materials particularly in composite systems. In this context, natural fibers play an important role and proven to be excellent reinforcements in polymer matrices. However, these natural fibers have got one major limitation: their incompatible hydrophilic behavior which affects their bonding with hydrophobic matrixes. Researchers over the years have come up with several fiber surface modification processes to overcome this defect. So, in this present study, the effect of various chemical treatments like alkaline, benzoyl peroxide, potassium permanganate, and stearic acid on *Prosopis juliflora* fibers has been discussed. These various chemical treatments on the fiber surfaces impacted on their structure, composition, and properties which were discovered through chemical analysis, Fourier transform-infrared, X-ray diffraction, thermogravimetric analysis, differential scanning calorimetry, scanning electron microscopy, and tensile testing.

KEYWORDS

Chemical properties and density analysis; FTIR; XRD; TGA and DSC; SEM

关键词

化学性质和密度分析

摘要

政府当局实施的现行环境法规已经使世界各地的调查人员越来越多地使用绿色材料，特别是在复合系统中。在这种情况下，天然纤维起着重要的作用，并证明是优异的增强聚合物基质。然而，这些天然纤维有一个主要的局限性：它们不相容的亲水性影响了它们与疏水性基质的结合。多年来，研究人员已经提出了几种纤维表面改性方法来克服这一缺陷。因此，本研究探讨了碱、过氧化苯甲酰、高锰酸钾和硬脂酸等化学处理对 *Paopopijululula* 纤维（PJFS）纤维的影响。通过化学分析、FTIR、XRD、TGA、DSC、SEM 和拉伸试验发现，纤维表面的各种化学处理对纤维的结构、组成和性能均有影响。

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/wjnf.

Investigation and optimization of friction stir welding process parameters of stir cast AA6082/ZrO₂/B₄C composites

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In the present investigation, aluminium-based alloy (AA6082) is stir-casted with 3 % ZrO₂ and 5 % B₄C reinforcement particulates to fabricate Aluminium Metal Matrix Hybrid Composites (AMMHCs) which are further friction-stir welded at different welding conditions to develop a welded joint with optimum ultimate tensile strength (UTS) and microhardness. This newly developed AMMHC will find its specific application as bulkhead partitions in the hull of a ship due to its excellent properties, such as lower weight, higher specific strength, superior resistance to wear, and lower thermal expansion coefficient than that of AA6061 and AA5083 composites. The friction-welded butt joints performance of AA6082/3%ZrO₂/5%B₄C is generally determined by varying the FSW process parameters such as tool rotational speed (TRS), welding speed (WS), axial load (AL), tool tilt angle (TTA), tool pin profile (TPP), shoulder diameter (SD), etc. In the present work, the empirical relationships are established between parameters highly influencing FSW process (TRS, WS, and AL) and their responses (UTS and weld nugget microhardness (WNH)). The desirability approach is employed for predicting the optimal UTS and WNH. The corresponding values of input process parameters are TRS of 1030.95 rpm, WS of 38.5 mm/min, and AL of 5.88 kN. The calculated UTS and WNH for the present investigation are 239.98 MPa and 94.2 HV, respectively, and these values are consistent with the results of validation experiments.

Keywords: *friction stir welding; ultimate tensile strength; microhardness; response surface methodology; Box-Behnken design; optimization; desirability approach*

1. Introduction

Friction-stir welded aluminium matrix composite (AMC) joints find application in the areas of automobile, naval and aeronautical engineering, due to their attractive characteristics like higher strength, lower density, excellent corrosion resistance, better thermal conductivity, low thermal expansion, and better dimensional stability with good strength to mass ratio [1–6]. AMC, being an ideal material for this new generation, also faces many problems in welding by conventional fusion welding owing to the reaction between matrices and particulates of reinforcement that lead to the development of secondary brittle phases in the molten pool of the weld or reinforcement breakdown in the molten pool of metal [7].

To achieve efficient defect-free weld (less cracking, no distortion, decreased porosity, etc.) on AMC's, friction stir welding (FSW) is considered to be a less expensive and more effective solid-state welding process for AMCs [8]. FSW has numerous advantages like green cleaning, low distortion and residual stresses, no fumes and spatter, and no requirement of filler material and shielding gas [9]. These attractive features of FSW have made many researchers start and continue their research in the application areas of aviation, aerospace, automotive, and shipbuilding industries. They are developing advanced techniques and newer materials for base matrix and reinforcement to optimize the performance of the FS welded joints. Advanced techniques are needed for the optimization of maximizing mechanical properties, such as UTS, WHN, etc. Response surface methodology (RSM) is one of the most accurate methods for determining

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Identification of Opinion Difference in Teaching Learning Methods and Recommendation to Faculty

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Abstract:

Today's teaching learning process in education comprises variety of tools and techniques. A large number of active learning strategies are identified to make the student active and engaging. In spite of these developments, conventional style of passive teaching also exists. Research reviews ensure the fact that the practice of the active learning strategies engage the students positively and promote their performance. There is a concern whether the strategies are practiced rightly and always been a success. The inclusion of active learning strategies by the teachers is always made with the assumption that all the students enjoy and get engaged in learning. Is it the truth really? This research work attempts to find the difference in the perspectives of students and teachers in practicing different active learning methodologies. Few commonly used teaching learning strategies are identified, practiced and reviewed by a set of teachers and the students. The analysis of the obtained data reveals the existence of gap between their perspectives and indicates the need of adopting suitable pedagogy in implementing those strategies.

Keywords:

Teaching learning, Teacher perspective, Student perspective, Useful learning, Enjoyable learning

1. Introduction

With the millennial learners, Teaching is not an easy task now. There are rapid developments in the field of Education in terms of teaching learning processes. Lectures and black board teaching were the predominant teaching tools in the older days. Home works and written assignments were the important parts of the process. But now, after the developments in the teaching learning process, there are new jargons in education such as active learning, collaborative learning and cooperative learning. Active learning, a set of prescribed teaching learning strategies, has been recognized globally as a teaching learning method that engages students and makes learning enjoyable.

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The learning sessions carried out with these strategies are said to be impacting student performance and engagement level. Most of the educational institutions have started supporting their faculty by giving training in these methods and insisting them to follow in their classroom. In India, National level programmes such NMEICT have been conducting special hands on training for teachers across India on these strategies. ICT tools have been introduced to associate with these active learning methods for providing digital support. Learning Management Systems, Student responsive systems and digital repositories are part of modern education.

The present teachers are now required to develop not only their technical skills but also their pedagogical skills. When practicing these strategies, there are some common assumptions among teachers. When teachers get trained in these innovative teaching learning methods and start practicing inside the classroom, they assume to get the attention of 100% of their students. They strongly believe that the strategies they follow have nearly 100% positive impact on the students [1][2]. Also, there is some common belief among them that some teaching learning methods are not useful to the students. A teacher may be comfortable and strong in practicing a teaching learning method but the concern here is whether the students feel comfortable in practicing it[5]. This concern leads to this research as "Do all the students experience the same and find those methods useful?". Also this research provides insights about the preferred teaching learning methods of students and thus bridging the gap between assumptions and reality.

2. Research Questions

The proposed research work is carried out with the following Research questions.

1. Teachers may follow any teaching learning method based on their personal assumptions. Do these assumptions match the student expectations?
2. What are the suitable recommendations to address the perspective gap between students and teachers in conventional teaching learning methods and modern teaching learning methods?

Kernel Fuzzy Clustering with Output Layer Self-Connection Recurrent Neural Networks for Software Cost Estimation*

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In the current world, the software cost estimation problem has been resolved using various newly developed methods. Significantly, the software cost estimation problems can be dealt with effectively with the recently grown recurrent neural network (RNN) than the other newly developed methods. In this paper, an improved approach is proposed to software cost estimation using Output layer self-connection recurrent neural networks (OLSRNN) with kernel fuzzy c-means clustering (KFCM). The proposed OLSRNN method follows the basics of traditional RNN models for integrating self-connections to the output layer; thereby, the output temporal dependencies are better captured. Also, the performance of neural networks is improved using the kernel fuzzy clustering algorithm to enhance software estimation results. Ultimately, five publicly available software cost estimation datasets are adapted to verify the efficacy of the proposed KFCM-OLSRNN method using the validation metrics such as MdMRE, PRED (0.25) and MMRE. The experimental results proved the efficiency of the proposed method for solving the software cost estimation problem.

Keywords: Recurrent neural networks; kernel fuzzy c-means; software cost estimation; Output layer.

1. Introduction

Software engineering communities considered the software cost estimation a challenging task during software project planning.^{33–40} However, it is important to produce reliable and accurate software effort estimation for supporting the process of

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Analogy-Based Approaches to Improve Software Project Effort Estimation Accuracy

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Abstract: In the discipline of software development, effort estimation renders a pivotal role. For the successful development of the project, an unambiguous estimation is necessitated. But there is the inadequacy of standard methods for estimating an effort which is applicable to all projects. Hence, to procure the best way of estimating the effort becomes an indispensable need of the project manager. Mathematical models are only mediocre in performing accurate estimation. On that account, we opt for analogy-based effort estimation by means of some soft computing techniques which rely on historical effort estimation data of the successfully completed projects to estimate the effort. So in a thorough study to improve the accuracy, models are generated for the clusters of the datasets with the confidence that data within the cluster have similar properties. This paper aims mainly on the analysis of some of the techniques to improve the effort prediction accuracy. Here the research starts with analyzing the correlation coefficient of the selected datasets. Then the process moves through the analysis of classification accuracy, clustering accuracy, mean magnitude of relative error and prediction accuracy based on some machine learning methods. Finally, a bio-inspired firefly algorithm with fuzzy analogy is applied on the datasets to produce good estimation accuracy.

Keywords: Effort estimation; analogy-based estimation; classification; clustering; firefly optimization; fuzzy analogy; linear regression; multilayer perceptron; *k*-means algorithm; EM algorithm.

1 Introduction

The need for software project effort prediction has been increasing for the last 20 years. The predicted effort is used to find the overall cost and duration of the project. This prediction may lead to either underestimation or overestimation [5]. If it is over or under, it causes several problems in the business plans of the company. Especially, it causes several budgeting problems and schedule slippage [24].

The first thought of software effort estimation came with the presentation of the rule of thumb [13] during the 1950s. Thereafter in the 1960s, a new approach for software effort estimation was unveiled as the consequence of an expert judgment where domain experts applied their prior experiences to discern the effort of the new project [22]. The existing representations on linear equations and regression analysis were proposed [6] in 1965. The first automated tool for effort estimation was Interactive Productivity and Quality [13] established by the IBM researchers. Subsequently, Barry Boehm put forward a new mathematical model based on the regression analysis named COCOMO (COst COnstructive MOdel). This model predicts the software project effort based on the type of project. Ultimately, he propounded another model named COCOMO II which was an augmented version of COCOMO [5]. Furthermore, the models such as Putnam's Software Lifecycle Management [24], Software Evaluation and Estimation of Resources – Software Estimating Model [6] and Function Point (FP) by Albrecht were also used for effort prediction [1]. Analogy-based estimation (ABE) was fostered in the year 1997 [27] as a comparative method.

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TECHNICAL PAPER

Investigation of mechanical and micro structural properties of geopolymer concrete blended by dredged marine sand and manufactured sand under ambient curing conditions

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Abstract

Geopolymers, an unique class of inorganic polymers are new promising binders which are manufactured by the activation of a solid state alumina-silicate with a highly alkaline activating solution using thermal drive. In the recent past, geopolymer binders have been found to be the best alternate to cement binders owing to its environmental sustainability (greener materials lead to cleaner environment). Further, its performance in aggressive environment is promising and these binders could become a replacement for cement concrete in aggressive situation where cement concrete turns to be vulnerable. In this paper, an attempt is made to investigate the mechanical and micro structural properties of geopolymer concrete produced using alternative fine aggregates namely dredged marine sand (DMS) and manufactured sand (M-Sand) in the place of conventional scarce fine aggregate (river sand) under ambient curing conditions. All the tests namely compression, split tensile, flexural and micro structural evaluation have been performed by varying the percentage of DMS and M-Sand. The experimental investigation followed by micro structural evaluation clearly indicate that DMS can very well be substituted in the place of scarce fine aggregate (river sand) under ambient curing conditions.

KEYWORDS

alkaline solution, ambient curing conditions, DMS, geopolymer concrete, M-Sand

1 | INTRODUCTION

The term geopolymer was the name given by Davidovits in 1978 to materials which are characterized by chains or networks of inorganic molecules. Geopolymer concrete shall be made by utilizing fly ash and ground granulated blast furnace slag (GGBS). Fly ash is the waste product generated from thermal power plants while GGBS is waste from steel

plants. Geopolymer concrete technology helps to reduce the stock of wastes and also reduces carbon emission by reducing usage of Portland cement.

The main constituent of geopolymer concrete are sources which are rich in silica and alumina available from thermally activated natural materials (e.g., kaolinite, clay, etc.) or industrial by products (e.g., fly ash or slag) and an alkaline activating solution which polymerizes these materials into molecular chains and networks to create hardened binder. It is also called as alkali-activated cement or inorganic polymer cement.

Discussion on this paper must be submitted within two months of the print publication. The discussion will then be published in print, along with the authors' closure, if any, approximately nine months after the print publication.

TECHNICAL PAPER

Effect of steel macro fibers on engineering properties of copperslag-concrete

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Abstract

In this paper, various engineering properties of the hardened concrete with copper slag and steel macro fibers are investigated. Normal grade concrete has been designed by varying the volume fraction of the fibers from 0.3 to 1.5% with higher aspect ratio (80). The setbacks of the concrete such as quasi-brittle nature and low tensile strain capacity have been improved by adopting steel macro fibers along with copper slag. The study showcases the influence of macro fibers for five different volume fractions of fibers 0.3, 0.6, 0.9, 1.2, and 1.5% with higher length (60 mm) and diameter (0.75 mm) on the mechanical properties and microstructure properties of concrete by incorporating 40% of copper slag as partial replacement of fine aggregate. From the observed results, the addition of fibers and copper slag showed significant results on the mechanical properties of the concrete for the adopted low water–cement ratio of 0.35. The compressive strength, tensile strength, and flexural strength improved up to 16, 54, and 72% for the volume fraction of 1.5% of the fibers compared to the conventional concrete without any fibers. Relationship between the mechanical properties has been compared between the existing empirical relations and the experimental data. Microstructure analysis (Scanning Electron Microscopy and Energy Dispersive X-ray Analysis) has been carried out to validate the bond performance and strength characteristics.

KEYWORDS

copper slag, EDX, macro fibers, mechanical properties, microstructure, reinforcing index, SEM, steel fiber reinforced concrete (SFRC), steel fibers, volume fraction of fibers

1 | INTRODUCTION

Utilization of fibers in cement composites has customary upgrades in the construction industry since ages. Since concrete is a quasi-brittle material with weak strain capacity mainly under tensile stresses, the cracks are exhibited primarily in the interfacial transition zone and in the matrix.

The idea of adopting discrete fibers in concrete is to transmit the internal tensile forces to the randomly dispersed fibers whereas the concrete matrix absorbs the internal compressive forces followed by enhanced straining capacity in concrete after the first crack strength.¹ Based on the governing property of individual fibers, the composite strength tend to increase with increase in aspect ratio, modular ratio, fiber content, and degree of alignment of the fiber.² Among promising fibers, steel fibers have established substantial attention due to its superior qualities and global availability. Since

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Original Research

Spatial Time Dependent Reliability Analysis of Carbonation with Climate Change

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Abstract

The ambiance around the concrete structures could be affected by a dynamic climate, particularly after a long time, results in declination of durability at a quicker rate. The increase in carbon dioxide concentration and temperature can increase the carbonation depth of concrete. Carbonation-induced corrosion of concrete structures in Bern and Seoul under a dynamic climate is investigated during this work by considering high and medium greenhouse gas emissions scenarios RCP 8.5 and RCP 4.5 respectively. This analysis takes into account the effect of change in temperature, carbon dioxide levels and relative humidity on diffusion coefficients considering relative humidity as a time-dependent variable. This work also evaluates the failure probability of durability based on the reliability concept by considering the coefficient of variation of carbonation depth and cover depth. Reliability index of 1.28 which infers the probability of corrosion initiation less than 10% is used for inference.

Keywords: corrosion, climate change, exploratory spatial data analysis

Introduction

Reinforced concrete is extensively used in the construction of buildings as it is comparatively cheap and provides large durability. Durability gets reduced drastically by corrosion when the reinforced concrete structures are situated in environments with high CO₂ concentrations. Carbonation is induced when the atmospheric carbon dioxide reacts with cement hydrates and forming calcite. This chemical reaction significantly decreases the pH in the porous solution and thus it induces corrosion of the reinforcing steel. Parameters governing carbonation depend on temperature,

atmospheric carbon dioxide concentration and relative humidity, all related with time and climate change [1].

Study on the influence of climate change on the durability of concrete structures using statistical regression analysis of a number of pertinent experimental and field data resulted that temperature, concentration of CO₂, and relative humidity play a vital role in the concrete carbonation rates [2]. Park et al presented a probabilistic approach to predict the service life of concrete structures subjected to carbonation based on the climate scenario IS92a which considered natural logarithm of time in prediction of CO₂ concentration from the year 2000 to 2100 and linear variation in the prediction of temperature based on meteorological data from Korea Meteorological Administration [3].

Yoon et al. developed a durability model considering the effect of increase in the concentration of CO₂ on

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Seasonal variation and spatial distribution of groundwater pollutants in east coastal region from Bamban to Thiruvananthapuram of Tamil Nadu, India

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Abstract: The present investigation is focused on seasonal variation and spatial distribution of the groundwater pollutants in the study area during post monsoon (January), summer (May), pre monsoon (August) and monsoon seasons (November). Geologically, the study area comprises quaternary alluvium made up clay, silt and sandstone deposits. Water quality parameters (WQPs) such as pH, EC, TDS, TA, total hardness, chloride, sulphate, bicarbonate, carbonate, calcium, magnesium, sodium, potassium, nitrate were chosen. GIS technique was used to find out the spatial distribution of the soluble pollutants. The WQPs were compared with the standard guidelines values as recommended by the WHO for drinking and public health. The abundance of major ions groundwater was found in the following order: $\text{Na}^+ > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+$ and $\text{Cl}^- > \text{HCO}_3^- > \text{NO}_3^- > \text{SO}_4^{2-} > \text{F}^-$ during all



Three-dimensional analysis on natural convection inside a T-shaped cavity with water-based CNT–aluminum oxide hybrid nanofluid

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Abstract

Three-dimensional numerical simulation on natural convection inside the T-shaped cavity, filled with water-based hybrid nanofluid of CNT–aluminum oxide is performed by vorticity–vector potential formalism. The variables considered are size of enclosure ($0.1 < L < 0.9$), volumetric percentage of nanoparticles ($0 < \varphi < 4\%$), fraction of CNT composites ($0 < fr < 1$), and Rayleigh number ($10^3 < Ra < 10^6$). The heat transfer is increased with the increase in size, volumetric percentage of nanoparticles, fraction of CNT composites, and Rayleigh number.

Keywords Natural convection · Three-dimensional analysis · Hybrid nanofluid · T-shaped cavity

List of symbols

C_p	Specific heat at constant pressure ($\text{J kg}^{-1} \text{K}^{-1}$)
fr	Fraction of CNT in the volumetric fraction of nanoparticles
g	Gravitational acceleration (m s^{-2})
k	Thermal conductivity ($\text{W m}^{-1} \text{K}^{-1}$)
L	Enclosure width
n	Unit vector normal to the wall

Nu	Local Nusselt number
Pr	Prandtl number
Ra	Rayleigh number
Rc	Thermal conductivity ratio (k_s/k_f)
t	Dimensionless time (t'/l^2)
T	Dimensionless temperature $[(T' - T'_c)/(T'_h - T'_c)]$
T'_c	Cold temperature (K)
T'_h	Hot temperature (K)
T_o	Bulk temperature $[T_o = (T'_c + T'_h)/2]$ (K)
$\vec{V}$	Dimensionless velocity vector ($\vec{V}' \cdot l/\alpha$)
x, y, z	Dimensionless Cartesian coordinates ($x'/l, y'/l, z'/l$)

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Greek symbols

α	Thermal diffusivity ($\text{m}^2 \text{s}^{-1}$)
β	Thermal expansion coefficient (1K^{-1})
μ	Dynamic viscosity (kg ms^{-1})
ν	Kinematic viscosity ($\text{m}^2 \text{s}^{-1}$)
$\vec{\omega}$	Dimensionless vorticity ($\vec{\omega}' \cdot \alpha/l^2$)
ϕ	Volumetric fraction of nanoparticles
$\vec{\psi}$	Dimensionless vector potential ($\vec{\psi}'/\alpha$)
ρ	Density (kg m^{-3})
ΔT	Dimensionless temperature difference

Superscript

' Dimensional variable

TECHNICAL PAPER

Studies on flexural behavior of reinforced concrete beams with copper slag and fly ash

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This paper presents the fresh and hardened concrete properties with fly ash (FA) and copper slag (CS). M30 grade of concrete has been designed with a constant water–cement ratio as 0.4. Twenty four concrete mixtures are arrived by cement is partially replaced by FA from 0 to 30% with 10% increment and natural sand is replaced by CS from 0 to 100% at 20% increment. The compressive strength of the concrete was verified at 3, 7, 14, 28, 56, and 90 days curing periods. Five reinforced concrete (RC) beams of size 150 mm × 250 mm × 3200 mm were cast based on the optimum mix proportion and flexural behavior of RC beams was monitored by a four-point bending test. From the experimental results, compressive strength, and flexural strength were increased for concrete with 30% FA and 80% of CS because the smaller surface area of CS per unit volume is exposed with a large quantity of concrete matrix and workability of concrete also increased.

KEYWORDS

compressive strength and flexural strength, fresh concrete property, scanning electron microscope (SEM)

1 | INTRODUCTION

The population growth of a developing country like India has been increasing tremendously every decade. Continuation of that, electricity production and employment are essential and they are to be fulfilled by the government. Industrialization and urbanization have their own priority. In the modern world, though industrialization is unavoidable, it produces a very large quantity of industrial wastes. The wastes generated from different industrial processes are of complex characteristics and the chemicals present in it are hazardous to health and environment. The disposal and storage of these wastes without proper treatment leads to the contamination of the surface of the earth and also they affect the groundwater. The scarcity of land for proper disposal is

one of the major problems, as the quantity of industrial wastes increases every year. Hence, safe disposal of the wastes is very essential to maintain a sustainable environment.

In this work, a detailed investigation has been carried out on the industrial by-products such as fly ash (FA) and copper slag (CS) to find the suitability of suitable alternative materials for cement and fine aggregate. For every tonne of copper metal production, about 2.2 tonnes of slag has been generated. A very small quantity of copper is present in the CS and also the separation of copper from slag is a very complex and tedious process.¹ CS replacement for cement or as natural sand in concrete, not only reduced the cost of concrete manufacturing and also reducing the air pollution problem.² Mortars containing larger amount of CS sand gave lower early strengths at lower water–cement ratio 0.48 and later strength of mixtures with 20–80% substitution of CS was higher than that of the control specimens.³ Incorporation of CS as coarse aggregate in concrete increases the

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DEVELOPING A pH MODEL USING ARTIFICIAL NEURAL NETWORK AND VISUAL MODFLOW TO EVALUATE GROUNDWATER QUALITY

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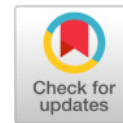
Abstract. Groundwater pollution cause excessive levels of water quality parameters such as pH, Total Dissolved Solids (TDS), hardness etc, therefore, it is a severe problem for people. The present study describes the prediction of pH in groundwater using Artificial Neural Network (ANN) model and visual MODFLOW. It is observed that the pH level of study area is lower than the standard limit so that the water turns to acidic. The water is not suitable for drinking purposes thus a prediction model is needed to rectify this issue. A smart prediction model for pH was developed using ANN. Selected input variables were Hardness, Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Nitrite (NO₃), Chloride (Cl) and Sulphate (SO₄) and the best performance value was 0.025637. Also to simulate the groundwater of the study area, visual MODFLOW model was created. Using this model, pH is simulated for 365 days. From the calibration plot, it is known that the correlation coefficient of the observed and the simulated value is 0.92. From the simulation it is concluded that the pH level was almost the same for 365 days.

Keywords: Mondaikadu, water quality, solute transport, simulation, prediction

Introduction

Groundwater has been essential to sustain India's economy and to fulfill its domestic needs, and it also has agricultural and industrial use. Around 33% of the total population relies upon the utilization of groundwater for drinking (Nickson et al., 2005). Groundwater accounts for about 98% of all of the planet's available fresh water, and it is about 60 times more concentrated than the fresh water present in lakes and streams. India is the world's biggest groundwater user, with a yearly use of roughly 230 cubic kilometers for each annum (World Bank, 2012). The nation as a whole has an annual groundwater supply of 398 billion cubic meters (Water and Related Statistics, 2015). More than 60% of farming and 85% of drinking water supplies depending on it, groundwater is a basic asset for Indian rural zones.

Nowadays, groundwater pollution is considered as a world level issue. Many organizations are taking serious actions against this issue and creating regular monitoring programmes. A research studies on various features of groundwater, such as, storage potential, hydrogeology, water quality, vulnerability, and sustainability and



Numerical Study on Parametric Analysis of Reinforced Concrete Column under Blast Loading

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Abstract: Columns are the main load-bearing structure elements in frame structures and outermost columns are the critical structural elements for potential extremist attacks. The explicit nonlinear finite-element method (FEM)-based computer program LS-DYNA is used in this paper to study the response of reinforced concrete (RC) columns subjected to blast loading. The sole objective of this paper is to quantitatively investigate the effect of geometry on the RC columns under a variability of blast loading. An extensive parametric analysis is executed numerically on different shapes of columns to understand the influence of scaled distance, reinforcement ratio, and seismic detailing, after verifying the model with experimental and numerical studies. The responses reveal that the reinforcement ratio, seismic detailing, and scaled distance have a great influence on the blast performance of RC columns with various cross sections. Using the RapidMiner tool, a linear regression analysis is carried out to investigate the most influential parameter. DOI: [10.1061/\(ASCE\)CF.1943-5509.0001382](https://doi.org/10.1061/(ASCE)CF.1943-5509.0001382). © 2019 American Society of Civil Engineers.

Author keywords: Reinforced concrete; Blast load; Geometry; Finite-element analysis.

Introduction

Dissecting the impact of blast loading on structures is more critical these days because of the increasing number of terrorist attacks and accidental explosions (Yan et al. 2015). The impacts of these attacks and explosions cause serious damage to major and minor infrastructure, as well as injuries and fatalities to people. In 1968, an internal explosion due to a gas leakage in the Ronan Point residential building in the United Kingdom (UK) caused serious damage to structural components, leading to a progressive collapse (Ellingwood 2006). Public buildings such as hospitals, schools, colleges, embassies, ministries, power plants, research labs, and monuments are vulnerable to extremist attacks (Goel and Matsagar 2014). Most of these facilities are constructed using reinforced concrete (RC); hence, a response analysis of RC structural elements to blast waves is inevitable. The research on RC components subjected to the impact of explosive blast loading has grabbed serious attention over the past decade. Columns are the prime load-bearing

structural element in RC frame structures. The failure of critical columns in ground story buildings can trigger progressive collapse after a blast (Aoude et al. 2015). However, knowledge of blast-resistant design systems of RC columns remains crucial.

Literature Review

Woodson and Baylot (1999) experimentally investigated a typical flat-plate structural system, which was a 2-story quarter-scale RC model, under blast loading and concluded that the reinforcement details at the joint with the floor slab greatly influence the failure mechanism of the structure. Baylot and Bevins (2007) performed an analytical investigation to assess the failure mode of quarter-scale structural systems with and without solid masonry wall under various stages of blast loading, and the results were compared with the experiments. The research and findings reveal that the exterior wall of a framed structure was subjected to sudden failure and thereby significantly exposed the column to the additional load. Also, a possible condition for the air blast pressures to ingress inside the structure was created. Shi et al. (2008) proposed a simplified approach to predict the pressure impulse curve of the RC column by using the LS-DYNA and AUTODYN programs. The pressure-impulse curves, which are established from the proposed analytical formulae and numerical simulations of the RC column, agree satisfactorily with each other and exhibit better predictions. Even though these simplified approaches are quite useful, three-dimensional (3D) analysis provides in-depth knowledge on the behavior of RC columns subjected to different ranges of blast loading. In the past, few studies focused on developing numerical models to evaluate the different blast-resistant parameters of RC columns affected by explosions. Ngo et al. (2007) compared the dynamic response of normal- and high-strength concrete columns under blast loading by using LS-DYNA. The authors suggested that the flexural capacity and ductility of an RC column were significantly enhanced due to the increase in the yield strength of steel and compressive strength of concrete at a high strain rate. Shi and Stewart (2015) carried out a numerical investigation to assess

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HE-Co-HOG and k-SVM classifier for finger knuckle and palm print-based multimodal biometric recognition

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Abstract

Purpose – Biometric identification system has become emerging research field because of its wide applications in the fields of security. This study (multimodal system) aims to find more applications than the unimodal system because of their high user acceptance value, better recognition accuracy and low-cost sensors. The biometric identification using the finger knuckle and the palmprint finds more application than other features because of its unique features.

Design/methodology/approach – The proposed model performs the user authentication through the extracted features from both the palmprint and the finger knuckle images. The two major processes in the proposed system are feature extraction and classification. The proposed model extracts the features from the palmprint and the finger knuckle with the proposed HE-Co-HOG model after the pre-processing. The proposed HE-Co-HOG model finds the Palmprint HE-Co-HOG vector and the finger knuckle HE-Co-HOG vector. These features from both the palmprint and the finger knuckle are combined with the optimal weight score from the fractional firefly (FFF) algorithm. The layered k-SVM classifier classifies each person's identity from the fused vector.

Findings – Two standard data sets with the palmprint and the finger knuckle images were used for the simulation. The simulation results were analyzed in two ways. In the first method, the bin sizes of the HE-Co-HOG vector were varied for the various training of the data set. In the second method, the performance of the proposed model was compared with the existing models for the different training size of the data set. From the simulation results, the proposed model has achieved a maximum accuracy of 0.95 and the lowest false acceptance rate and false rejection rate with a value of 0.1.

Originality/value – In this paper, the multimodal biometric recognition system based on the proposed HE-Co-HOG with the k-SVM and the FFF is developed. The proposed model uses the palmprint and the finger knuckle images as the biometrics. The development of the proposed HE-Co-HOG vector is done by modifying the Co-HOG with the holoentropy weights.

Keywords Biometric identification, Finger knuckle, Palmprint, HE-Co-HOG vector, Layered k-SVM

Paper type Research paper

1. Introduction

Person identification using biometric recognition is one of the major research fields to address the challenges in fields such as banking, immigration and forensic labs (Charfi *et al.*, 2016; Aly, 2014). Detection of the person's identity can be done in the traditional way (handwriting and signature) and the biometric way. The personal identification through the biometrics system has become an emerging technology, as it is more feasible than the other technologies (Charfi *et al.*, 2016). The biometric techniques are preferred over the traditional techniques because the biometric model has a better structure, easier usage and the data can be stored easily (Zhang and Li, 2012). The biometrics such as a finger, iris,

face and palmprint play a major role in the person identification. The biometric recognition system recognizes each person from the database, as their biometrics is distinct from each other. The biometric recognition system has two major classifications. They are:

- 1 Unimodal biometric recognition
- 2 Multimodal biometric recognition

The unimodal biometric recognition system contains any one of the recognized biometric to detect the persons. The multimodal biometric system combines the features of two or more biometrics and identifies the persons. The unimodal biometric recognition system uses only one biometric for the person identification, and hence, the unimodal biometric system does not consider the environmental conditions, sensor precision, etc. These disadvantages have been addressed in the multimodal biometric recognition system (Farmanbar and Toygar, 2016).

The current issue and full text archive of this journal is available on Emerald Insight at: <https://www.emerald.com/insight/0260-2288.htm>



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Piezoelectric energy harvesting from DC-DC converters

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ABSTRACT

Energy harvesting from piezoelectric is proved to be a viable technology to source low power electronic devices. In this paper, piezoelectric energy harvester is designed such that the energy is harvested by utilizing the switching of the MOSFET in DC-DC converter, which becomes an integral part of modern industrial equipment. Energy harvesting is realized by piezoelectric and converse effect of piezoelectric material. The harvester is designed to have transmitter and receiver piezoelectric separated by metal plate, connected across the drain and source terminals of the MOSFET. The performance of the harvester is experimentally evaluated with boost converter for supercapacitor storage.

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KEYWORDS

DC-DC power converters;
energy harvesting; energy
storage; piezoelectricity;
supercapacitor

1. Introduction

Harvesting energy from the ambient resources like mechanical vibrations, acoustic energy, etc., are of interest to the researchers as it can replace or enhance the life of the battery employed in remote operations.[1–3]. Among the energy harvesting techniques, numerous designs are proposed to harvest energy at resonance and in broadband using piezoelectric energy harvesters [4–7]. To improve the performance of the piezoelectric energy harvester, structurally tailored host structures are proposed in [8–9] and demonstrated the same. Hybrid energy harvesters are designed using piezoelectric material with wind and solar as other ambient sources in [10–11]. Energy harvesting from power lines in [12], utilizes permanent magnets to couple the flux around the power lines which in turn vibrate the mechanical structure bonded with piezoelectric. Hall sensor sourced using the energy harvested from the magnetic wire is proposed in [13] and demonstrated that the generated output voltage remains constant independent of the speed of the movement of the magnet. Sensors and associated electronics in electric motors are sourced from the power harvested from current transformer [14].

The DC-DC converters play a major role in power processing circuits and electrical drives which are the major equipment in industries. In the area of piezoelectric energy harvesting various configurations of DC-DC converters are employed for impedance matching and enhancement of power [15–17]. Use of piezoelectric transducers for transmitting energy through a metal wall in the form of acoustic energy is addressed in [18–20]. In this one piezoelectric transducer is used as transmitter and the other one is

Evaluation method to improve standard setting in engineering courses-A study

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Abstract: The older system of education depends only on the theory, which could lag the students to understand the concept properly. So, they feel hard to apply it in their daily life. The introduction of CDIO syllabus helps the students in the application of concepts and also motivates them to do the hands on model. The way of assessment is done through Bloom's taxonomy and Rubric's Tool. There are four common types of assessment that are being used in today life. They are formative, bench mark, diagnostic and summative. They all serve instinct purposes and should work together in order to make up a comprehensive or balanced assessment program. TCEians follow CDIO education system, as to make the students concentrate in both theory and practical. The CDIO stands for Conceive Design, Implement, operate. The initiative created made the education framework that drive engineering fundamentals set in the context of conceiving, designing, implementing and operating real-world systems and products. The CDIO based education approach uses active learning tools, such as group projects and problem-based learning, to better equip engineering students with technical knowledge as well as communication and professional skills. This system also helps the poor students to come up with their latent (inbuilt) ability.

Keywords: Peer teaching, CDIO syllabus, assessment, Gamifying Techniques.

1. Introduction

Assessment is not only validating the student activity but it also stressed as learning technique. When students are able to see how they are doing in the class, they are able to determine whether or not they understand the course material. Assessment can also motivate students throughout the education career. If students know they are doing poorly, they may begin to work harder. Several definitions such as formative assessment, informative assessment, Teacher enquiry, Quantitative & Qualitative research, assessment through gamifying and assessment for learning have to be practiced. The main purpose of valuation is to improve students learning and teaching as both respond to the information it provides. Assessment for learning is a process that arises out of the interaction between teaching and learning.

[1] An entrepreneur Sebastian Thrun detailed that "The Individualization of learning fundamentally redefines the role of assessment. We believe that assessment is an integral and essential part of teaching and learning process.

It should encourage pupils to reflect, enquire and preserve, as they strive to be successful learners".

[2] According to Fenton, "Assessment is the collection of relevant information that may be relied on for making decisions. Evaluation is the application of a standard and a decision-making system to assessment data to produce judgments about the amount and adequacy of the learning that has taken place."

[3] David Ausubel suggested that the most important factor influencing learning is what the learner already knows, that teachers should ascertain this, and teach accordingly.

[4] Guskey said that one to one tutoring is so effective because tutor is able to identify the mistakes, misunderstanding of the students and clarify them immediately.

[5]Randy Elliot benet says that students could gain interest if the subjects were taught in the form of games and he further adds that they should be assessed based on that. This improves their skills

2. Assessment and its Theories

The word "Assessment" means the process of checking the effectiveness of sequences of instrumental activities. Bloom convinced that teaching a student individually is a good method but later on, such method of one to one tutoring seems unhelpful. Natriello, in 1987 proposed another theory involving 8 major stages like voicing the importance of evaluation, tasks given to students, monitoring and setting grades for their performance, sampling and appraising on their works, providing feedback to them and keeping an eye on the output of their performance. Also, it has been told that the use of traditional criteria of validity and reliability will no longer benefits but at the end we get puzzled by the question," Which criteria can be assessed?"

To solve the above question, the assessment cycle is the provided answer. The building blocks of the assessment cycle involves selection of assessment tasks, applying criteria, monitoring, giving grades to the performance and finally giving a review of them, as said by

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Dylan William. They cover almost the major reason of assessment development. A more specific criteria or representativeness, a meaningful content, complicity in fewer rates and finally it speaks about the coverage of the



Analytical Model of Double Gate Stacked Oxide Junctionless Transistor Considering Source/Drain Depletion Effects for CMOS Low Power Applications

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Abstract

This paper proposes a 2-D analytical model developed for Double Gate Junctionless Transistor with a SiO₂/HfO₂ stacked oxide structure. The model is solved by Poisson's equation using the variable separation method. The proposed model gives analytical expressions for electrostatic potential distribution, threshold voltage and drain current with the effects of depletion regions at source/drain side. Furthermore, the potential and drain current models are used to evaluate the Short Channel Effects (SCEs) of the proposed device. The electrical characteristics and SCEs are analyzed by different possible definitions of channel length, silicon thickness, equivalent oxide thickness, and depletion length variations. The developed model results are validated through comparison with Sentarus TCAD simulator results. In addition, the proposed device is also studied for the digital circuit performance of CMOS inverter circuit by the voltage transfer characteristics, transient analysis, and AC small signal analysis.

Keywords Analytical model · Junctionless · Double gate · Gate stack · Threshold voltage · Short channel effects

1 Introduction

The scaling of the CMOS transistors have been continuously increasing to achieve high speed and high packing density of the integrated circuits. CMOS technology leads to an excellent RF circuit with tera-hertz range making technology for mixed signal and memory applications because of its smaller dimension. However, the CMOS transistors have severely been affected by SCEs such as gate leakage, hot carrier effects and DIBL. Furthermore, the formation of a junction between source/drain and the channel is a critical process in the design of the narrow channel device. Recently, Junctionless transistors with

uniform doping have turned up as a potential component in CMOS technology as it overcomes narrow junction fabrication problem [1–3]. The Junctionless transistors conduction relies on the surface current where MOSFETs conducts on bulk current and the device will turn off by fully depleting the channel. Moreover, Junctionless transistor offers moderated short channel effects, high I_{ON}/I_{OFF} ratio, less leakage current and provides optimal subthreshold slope (~60 mV/dec.) [4, 5]. The junctionless transistor act as a gated resistor which is heavily doped in the channel region.

A numerous analytical model has been reported for Junctionless Transistors for electrostatic potential distribution, subthreshold current, threshold voltage, and SCEs for Double Gate structure (DG) [6–8], Gate All Around structure (GAA) [9], Dual Metal Gate engineered Surrounding Gate structure (DMSG) [10] and Gate and Drain work function engineered Double Gate structure [11, 12]. However, parabolic approximation model uses depletion approximation techniques in which an explicit solution is not found. It is reported that the insertion of the gate stack by growing high-k layer over the SiO₂ will improve the performance of the device [13–15]. Simultaneously, the analytical models were also developed for Gate Stack Junctionless MOSFETs [16, 17]. Yet, the

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The improved RF/stability and linearity performance of the ultrathin-body Gaussian-doped junctionless FinFET

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Abstract

The Gaussian-doped junctionless FinFET (GD-JLFinFET) is investigated for radiofrequency (RF)/analog applications. The performance of the device is analyzed by computing the transconductance (g_m), transconductance-to-drain current ratio (g_m/I_{ds}), cutoff frequency (f_T), and maximum oscillation frequency (f_{max}). The stability factor (K) is analyzed based on the Y -parameters, and the linearity of the proposed device is studied based on the g_{m3} , second-order voltage intercept point (VIP2), third-order voltage intercept point (VIP3), third-order intermodulation intercept point (IIP3), third-order intermodulation distortion (IMD3), and 1-dB compression point. The impact of device geometrical parameters such as the fin width, fin height, channel length, voltage biases, and temperature on the RF/stability characteristics is also studied. The proposed device exhibits $f_T = 2.96$ THz and $f_{max} = 9.13$ THz, compared with the values of $f_T = 0.97$ THz and $f_{max} = 5.88$ THz for the uniformly doped junctionless FinFET (UD-JLFinFET). It is observed that proposed device exhibits better RF/analog characteristics.

Keywords Gaussian doping · Junctionless · FinFETs · RF analysis · Stability and linearity analysis

1 Introduction

Downscaling of metal–oxide–semiconductor field-effect transistors (MOSFETs) is severely affected by short-channel effects (SCEs) such as subthreshold swing, drain-induced barrier lowering (DIBL), and threshold voltage roll-off. To alleviate the problems associated with MOSFETs, the junctionless FinFET (JLFinFET) has been proposed and demonstrated [1, 2]. The JLFinFET is a uniformly doped device with a reduced fabrication cost and stronger immunity to SCEs [3–5]. Various device architectures for JLFinFETs have been proposed to improve the ON current and I_{ON}/I_{OFF} ratio, including multiple gates, high- k dielectric, gate oxide engineering, and tapered and stepped structures [6–11]. Among such multiple-gate structures, the trigate JLFinFET offers enhanced gate controllability and reduced SCEs [12–14].

Complementary metal–oxide–semiconductor (CMOS) trigate junctionless FinFET circuits and their logic performance have been reported [15]. The impact of self-heating effects in hybrid JLFinFETs with different channel lengths, fin widths, and buried oxide thicknesses has been presented [16]. Biswas et al. investigated the effect of the fin shape and spacer engineering on the drain current, transconductance (g_m), subthreshold swing, and RF figures of merit (FoMs) such as the cutoff frequency and maximum oscillation frequency [17, 18]. The effect of the device geometrical parameters, doping concentration, and temperature on the RF FoMs of silicon-on-insulator (SOI) JLFinFETs has also been presented [19].

The doping profile of an ion-implanted device looks like a Gaussian distribution; hence, it is necessary to consider such nonuniform, Gaussian doping [20]. It has been reported that the use of such a nonuniform doping configuration in the channel can improve the OFF-current and I_{ON}/I_{OFF} ratio of the device [21, 22]. Recently, Kaundal et al. developed an analytical model for the electrostatic potential and threshold voltage of a Gaussian-doped junctionless FinFET [23]. Later, they also investigated the impact of random discrete dopant fluctuations (RDFs) and gate oxide thickness variations on the Gaussian-doped junctionless FinFET (GD-JLFinFET) [24]. However, no research to date has studied

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Quadrant Based Neighbor to Sink and Neighbor to Source Routing Protocol and Alternate Node Deployment Strategies for WSN

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Abstract Multiple sensor nodes are required to gather the information and exchange the information in the direction of the sink node which makes a network. The static common node (NC) deployment has been work towards the coverage of deterministic territory. At that point, the coordinates of each regular node have been determined with the assistance of geometry of coverage locale. Among those basic nodes, on the off chance that one of the nodes gets fail, at that point, the coverage hole is made. To solve this issue, a viable alternate node (NA) deployment method has been presented for supplanting the damaged node. And furthermore developed quadrant based neighbor to sink and neighbor to source (Q-(NS)²) routing protocol for lessening the superfluous flooding of ‘RREQ’ message to the majority of its neighbor while route discovery. A viable comparison has been done between this other node deployment procedure and references. The performance comparison has been done between Quadrant based Direct routing protocol (Q-DIR), Angle routing protocol (ARP) and Q-(NS)² routing protocol. Therefore, Q-(NS)² routing protocol decreases the pointless flooding of ‘RREQ’ to the greater part of its neighbor which implies it devours less energy for data packet delivery and no redundant node in N_A deployment.

Keywords Wireless sensor network · Wireless application protocol · Wireless networks · Routing protocol · Wireless mesh networks

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RESEARCH ARTICLE

WILEY

Outage analysis of SWIPT-based full-duplex cognitive NOMA downlink system over Nakagami- m fading channels

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Summary

Cognitive nonorthogonal multiple access (NOMA) technique allows multiple users to share the same time and same frequency resources to fulfil the reliability and spectral efficiency requirements of 5G communication standards. In this paper, simultaneous wireless information and power transfer (SWIPT)-based full-duplex cognitive NOMA downlink system is proposed. In this system, secondary source (SS) serves as a relay to far primary user as there is no direct link from the primary source. NOMA technique is used at SS to transmit information to far primary user and secondary user. The time switching mechanism is adopted at SS for harvesting energy and information decoding. Analytical closed-form expressions are derived for the outage probabilities of both primary and secondary users. Outage analysis is carried out in Nakagami- m fading environment in the presence of self-interference at SS. In addition to that, the optimal harvesting time to maximize the instantaneous throughput of the far primary user is also derived. Numerical results are plotted to validate the derived expressions. It is inferred that the outage probability of the proposed system depends on the fading environment, harvesting parameters, and self-interference at SS.

KEYWORDS

cognitive radio, full duplex (FD), Nakagami- m fading channel, nonorthogonal multiple access (NOMA), outage performance, simultaneous wireless information and power transfer (SWIPT)

1 | INTRODUCTION

NOMA has been broadly renowned as a competent multiple access technology in 5G wireless networks to facilitate proficient utilization of spectrum.¹⁻³ It works on the principle of sharing the same time and same frequency resources among multiple users in a cluster using power domain or code domain methods. NOMA has been integrated into the third-generation partnership project long-term evolution (3GPP-LTE) and digital TV standard ATSC 3.0 as multi-user superposition transmission (MUST) and layered division multiplexing (LDM) technique, respectively.⁴ Power domain NOMA system is more compatible in spectral efficiency compared with sparse code NOMA and orthogonal multiple access (OMA) technique.⁵⁻⁷ In power domain NOMA, multiple users are paired based on the difference in channel conditions. In a downlink two-user scenario, more power is allocated to far user (FU), and less power is allocated to near user (NU). NU decodes FU information initially and then decodes its information using successive interference cancellation (SIC) technique.⁸ In Wang et al.,⁹ quality of experience (QoE)-aware NOMA designs towards the improvement of users perceived experience in the upper layers is investigated. It is reported that the direct link between the base station (BS) and FU may be subjected to shadowing or blockage effects due to buildings, roof corners, etc.¹⁰ Cooperative relaying (CR) is applied to address this challenge and improve reliability and link diversity in conventional power domain NOMA system.

Back Radiation Reduction in Jean's Slot Patch Antenna Using Reflector

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Abstract: In this paper, the minimization of back radiation by means of sophisticated designs using the Jeans slot patch antenna with reflector is discussed. We focus on decreasing the back radiation and increasing the gain and directivity. It is shown that, the reflecting layer with an air gap of 5 mm with first layer maximize the gain. The simulation results show that the antenna parameters are enhanced reaching a gain up to 9.14dBi with directivity 9.21 dB with -30 dB return loss.

Keywords: Jeans substrate, Reflector, Slot Patch Antenna.

1 Introduction

The textile antenna is a special kind of antenna made up of textile materials with rigid materials. Textile antennas are of different kinds, such as electrically conductive fabrics and denoted electro-textiles which are used substrates. In the antenna, the insulating parts are made up of dielectric materials. The main intention of applying antenna in the textile garment is for sensing functions. These are effective in detecting the body temperature, heart rate, position, external temperature, and humidity. Generally, textile antenna has fabric material such as cotton, jean, and felt as substrate materials have low dielectric constant value between 1 to 2. Kavitha & Swaminathan 2018 [1] have proposed monopole textile antenna with a new substrate material like jeans cotton and Teflon for medical applications such as monitoring the patient health. Luigi Vallozzi, Hendrik Rogier and Carla Hertleer have designed a dual polarized patch antenna for ISM band (2.4-2.4835 GHz), as wearable textile systems for rescue workers 2008 and 2009 [2]. The wider application of medical, military and other field encourage the researchers on full filling the need for specialized design in textile-based antennas. Improved design can guarantee the off-body communication of the information sensed by the sensors and transmitted to the base stations. Another main objective of using these embedded textile components is the reused facility alongside the guarantee of washing the suit.

The Federal Communications Commission (FCC) in 2002 [3-9] supports commercial use of UWB bands from 3.1 to 10.6 GHz. On the UWB transmission antennas there is no need of a larger battery and also no need of transmitting a large-power signal to the recipient. Implementing the UWB antenna, with textile material succeeds and improve its parameters by means of flannel as substrate [10-18]. There are several enhancements are raised in recent years, especially in the wearable electronic devices. The main motto of this works is to fulfill the real-time requirements like minimum power consumptions, robust and comfortable for wearable applications [19,20, 21]. Broadly speaking, for communication purposes, these wearable antennae are utilized as mobile computing, wireless communication, public safety, tracking, and piloting. Some of the significant properties include gain, reflection coefficient (S11) and radiation pattern, etc. These properties are analyze and calculation was discussed detailed in [13-15]. The impact factors like easy installation, lightweight, low cost, low intensity, low profile, and planar configuration make the involvement of textile-based antennas on the high priority. For textile based antennas, planar microstrip patch antennas (MSP) are perfectly suited [3-8], but MSP results in a low gain, which causes this system unpopular [6-8]. Normally, the textile material has less dielectric constant in nature which minimizes the rear lobe. This architecture maximizes the antenna's gain [17]. Additionally, the gain is further improved by means of utilizing flexible dielectric materials [18] like denim, cotton, leather and felt as a substrate [20] on MSP.

Reflectors are an effective key for achieving the antenna's

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BER Analysis of Full Duplex NOMA Downlink and Uplink Co-operative User Relaying Systems over Nakagami-m Fading Environment

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Abstract

A Co-operative user Relaying Full Duplex Non Orthogonal Multiple Access (CR-FD-NOMA) system is considered, when there is no direct link between base station and the far user. Deriving analytical expressions for probability of error of systems with NOMA technique is a challenging task. In this paper, the Bit Error Rate (BER) performance of pre-paired CR-FD-NOMA users in downlink and uplink scenarios over Nakagami-m fading distribution is investigated. Quadrature Phase Shift Keying and Binary Phase Shift Keying modulations are used for near user and far user information respectively. By exploiting self interference and using the properties of Gaussian Q-functions at high signal to noise ratio regime, an approximated closed form BER expressions of both the users in downlink and uplink systems are derived. The performance of the proposed downlink and uplink CR-FD NOMA systems are compared with the conventional NOMA systems with the existence of direct path for both the users from BS. It is observed that the uplink performance of the CR-FD-NOMA systems outperforms the conventional NOMA systems.

Keywords: Co-operative Relaying Non-Orthogonal Multiple Access, Full Duplex, Self-Interference Exploitation, Nakagami-m Fading, BER.

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Comparison of missing tooth and dental work detection using dental radiographs in human identification

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Abstract: Victim identification plays a vital role for identifying a person in major disasters at the time of critical situation when all the other biometric information was lost. At that time there is a less chance for identifying a person. The major issues of dental radiographs are dental work and missing or broken tooth was addressed in this paper. This algorithm can be established by comparing both ante mortem (AM) and post-mortem (PM) dental images. This research work is mainly focuses on the detection of dental work and broken tooth or missing tooth, then comparison of active contour model with mathematical model-based shape extraction for dental radiographic images are proposed. In this work, a new mathematical tooth approximation is presented and it is compared with online region-based active contour model (ORACM) is used for shape extraction. Similarity and distance-based technique gives better matching about both the AM and PM dental radiographs. Exact prediction of



Influence of Germanium Source Dual Halo Dual Dielectric Triple Material Surrounding Gate Tunnel FET for Improved Analog/RF Performance

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Abstract

This paper investigates the RF Stability performance of the Germanium Source Dual Halo Dual Dielectric Triple Material Surrounding Gate Tunnel FET Ge(SRC)-DH-DD-TM-SG-TFET using 3D - Silvaco Atlas TCAD device simulator. The impact of the geometrical parameter, high-k dielectric material and bias conditions on the key figure of merit (FoM) like Transconductance (g_m), Gate capacitance (C_{gg}) and RF parameters like Stern Stability Factor (K), Critical Frequency (f_k) are investigated. The analytical model provides the relation between f_k and small signal parameters which provide guidelines for optimizing the device geometrical parameter. The results show improvement in I_{ON} current, g_m , f_t and f_k for the optimized device structure. The optimized Ge(SRC)-DH-DD-TM-SG-TFET exhibits f_k of 75.0 GHz.

Keywords Halo doping · Germanium source · RF stability · Surrounding gate TFET · Analog FOMs

1 Introduction

For the past three decades, the CMOS devices were driven the semiconductor industry due to the continuous growth of semiconductor processing and technology. Over the years, the CMOS device physical dimensions were reduced to nanometre scale and further scaling is limited by Short Channel Effects (SCE) [1–5]. To overcome such challenges, multi-gate devices are proposed, which show excellent immunity to SCE and yielded better scalable operations [6–9]. Still, these multi-gate devices suffer from DIBL and Threshold Voltage roll-off effects. To overcome the above problems,

recently Tunnel Field Effect Transistor (TFET) is proposed which has gained wider significance because of its low sub-threshold slope and small leakage current [10–14]. Moreover, the conventional tunnel FET also suffers from low ON drive current and requires abrupt junctions for tunnelling [15–17]. To overcome the fabrication challenges posed by the MOS and TFET devices, a new transistor called halo doped TFETs which overcomes reverse short channel effects is proposed to achieve better ON and OFF states [18–20].

Even though the halo doping device has better scalable performance than the MOSFETs, still it suffers from the low subthreshold slope. To counter the above challenges, Surrounding gate Tunnel Field Effect Transistor (SG-TFET) is proposed, which exhibits better subthreshold slope of 24 mV/decade and DIBL of 38 mV/V as compared to conventional TFET [21–25]. Further, most of the research is carried on investigating the analog performance metrics like transconductance (g_m), unity gain cut off frequency (f_T), output conductance (g_d) and intrinsic gain (g_m/g_d) for the n-type and p-type triple material high -k surrounding gate TFET [26–28]. Impact of geometrical variability's on the performance of gate stacked and silicon based single halo doped TFETs (Si-SH-TFETs) is investigated and proposed for better performance [29, 30]. The effect of the gate dual material (DMG) and gate engineering approach on the performance of DGJL-TFET is studied [31, 32].

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Modeling and Analysis of GPS–GLONASS Navigation for Car Like Mobile Robot

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Abstract

An idea to amalgamate GPS and GLONASS to form the best part of GNSS tracking system for mobile robot navigation. The introduction of GNSS made additional satellites visible to localize Mobile robot accurately in both indoor and outdoor application; hence the localization accuracy will be increased in the non-line of sight areas of GPS satellites. This paper explains about an antenna which operates in GPS-1.575 GHz and GLONASS-1.602 GHz system frequency bands. A single layer square patch antenna with size of 45 mm * 45 mm is designed and simulated using Computer Simulation Technology Algorithmic model of the proposed antenna is derived and RLC values of equivalent circuit are identified using MATLAB program. The prototype antenna is fabricated and tested using network analyser for observing the experimental results. The Proposed antenna parameters are compared with simulation, theoretical and existing antenna results. Thus, the findings support that the proposed antenna system could be useful for the localization of car like mobile robot in indoor and outdoor environments.

Keywords GNSS Navigation · Antenna · Mobile robot

1 Introduction

The satellite navigation system was the predominant one in modern car robotic application. Over that the combination of GPS and GNSS system paved a way to multiple research in current era. In adding to that, Sourav Chakraborty et al. explained about a highly precise localization system for future autonomous vehicles using GSM, GPS and multiple on-board sensors. In this research they proposed that advance driving assistance system enhanced the vehicles to be active, safety and mushrooming. Thus, it is clear that, the usage of complex and cheap sensors along with embedded technology, computer science and power does not enhance navigation accuracy [1]. Likewise, in another research Farid bouncing et al. explained the real-time co-operative localization

of autonomous vehicles. Thus, the real time co-operative localization reduced the impact computing time using the multi sensor data fusion algorithm and vehicle to vehicle (v2v) communication on parallel architecture [2]. Yet another research Bassmaguermah et al. analysed the GNSS mobility and its important role in integral part of all navigation application. The research also explained multi-path effects and masking of satellites by buildings affects the GNSS systems in urban and indoor environment [3]. The Non line of sight (NLOS) detection algorithm was to improve accuracy and integrity of position estimate in urban areas. Around 38% of GNSS applications were used in the road transportation systems for vehicle navigation, satellite-based road traffic monitoring and fleet management applications. The Satellite based vehicle localization unit (SatVeLU) was applied to the part of GNSS receiver for delivery of safe location [4]. Khaoula Lassoued et al. stated in his research as a Quad band (GPS, GLONASS, BDS-1, and BDS-2) probe fed annular antenna was designed for Global Navigation Satellite System (GNSS) applications. It was designed to operate the navigation system at satellite navigation frequency bands. This stacked annular antenna achieved multiband operations and compactness [5]. The compact array of antenna with complex structure was also used to sense L1, G1 band frequencies [6]. The

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RESEARCH ARTICLE

WILEY

Design and analysis of 0.9 and 2.3-GHz concurrent dual-band CMOS LNA for mobile communication

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Summary

A complementary metal-oxide-semiconductor (CMOS) dual-band low-noise amplifier (LNA) for 2G/3G/4G mobile communications is presented. It operates at 0.9 and 2.3 GHz of frequencies. The dual-band operation is achieved by adding a modified notch-filtering path in the wideband LNA. The modified notch-filtering path does not require additional power to cancel the signals of the stop band frequency. The impact of the filtering path in the proposed LNA is analyzed. Improved results are observed in dual bands of frequency. Sustainability of the LNA under process corner variation and temperature variation are examined, and it is found to be suitable for the application. The proposed LNA is designed at 90-nm technology in Cadence Virtuoso with 0.5 and 0.6-V supply. The post-layout simulation shows 22 dB of gain (S_{21}), 2 dB of Noise Figure (NF), and -5.5 dBm of IIP3 at the high band. In the low band, 24 dB of S_{21} , 2.7 dB of NF, and -6.65 dBm of IIP3 are reached. The circuit consumes 5.2 mW of power and 0.0918 mm^2 of area. The efficiency of the LNA is estimated by the figure of merit, and comparable results are secured in the proposed work.

KEYWORDS

CMOS LNA, dual-band LNA, mobile communication, modified notch filtering

1 | INTRODUCTION

In the past two decades, 2G, 3G, and 4G technologies are familiarized in the telecommunication market; 0.9/2.1/2.3/2.5-GHz frequencies are mainly used for this mobile communication.¹ To meet these requirements, wideband systems are designed to operate from 0.9 to 2.5 GHz of frequency.² In a wideband system, the sensitivity of the receiver gets reduced by out-of-band interference. Instead of designing a wideband receiver, a dual-band receiver is designed to be operated at two narrow bands, and the sensitivity issue is mitigated. Moreover, power consumption is reduced by the tuned circuits.

Since the low-noise amplifier (LNA) is the first active block of the receiver side, the sensitivity of the receiver highly depends on the LNA.³ Multiple methods are used to design dual-band LNA. Traditionally, two narrowband LNAs are connected with separate antennas, and they are operated at two different frequencies. After that, two narrow-band LNAs were placed in parallel to make a dual-band LNA, which had a radio frequency (RF) switch to shift the LNA connected with an antenna.⁴ Here, the sensitivity of the LNA is improved at the cost of additional signal lines, large footprint area, and high-power consumption.

On-chip LNA designs are preferred to reduce the Noise Figure (NF), area, and power. In addition, the speed and overall efficiency are increased in the on-chip design. During on-chip dual-band LNA design, NMOS devices are



MACBHA: Modified Adaptive Cluster-Based Heuristic Approach with Co-operative Spectrum Sensing in Wireless Sensor Networks

S. Allwin Devaraj¹ · T. Aruna²

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Abstract

In this paper, a Modified Adaptive Cluster-Based Heuristic Approach (MACBHA) has been proposed for wireless sensor networks (WSNs) to perform the cooperative spectrum sensing (CSS) in the shopping mall, weather forecasting, military area and audio, video transmission applications. A Secure CSS based MACBHA has been proposed for secondary spectrum usage. Unlicensed Secondary Users (SUs) utilize parts of the spectrum, which are not used by the licensed primary users (PUs) in cognitive radio WSNs. The unused spectrum of the PUs is utilized by the secondary user cluster. The performance of the MACBHA in WSNs is evaluated using the network simulator tool NS-2.35 in Ubuntu 16.04.6 LTS (Xenial Xerus) operating system. The simulation result shows the performance improvement in network utility. Even though, the number of SUs increases, a minimum latency is achieved.

Keywords Wireless sensor networks · MACBHA · Cooperative spectrum sensing · Cognitive radio networks · Latency

1 Introduction

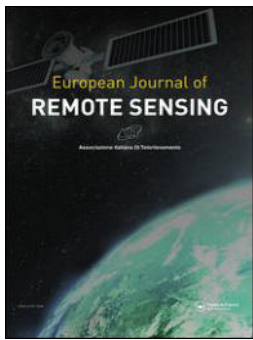
In WSNs, nodes are acting together in an atmosphere to observe an occurrence of interest, and multiple pieces of information are collected in it [1–4]. WSNs are typically known as Wireless Sensor and mechanism Networks (WSAN), which are distributed autonomous sensors to watch physical or environmental conditions like temperature, sound, pressure, etc. They work for hand in glove to pass the sensed information through the network to the main location [1–3]. The development of wireless sensor networks was ambitious in

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An enhanced back propagation method for change analysis of remote sensing images with adaptive preprocessing

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A new pyramidal opponent color-shape model based video shot boundary detection ☆

Sasithradevi A.^a Mohamed Mansoor Roomi S.^b

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Abstract

Video shot boundary detection (VSBD) is one of the most essential criteria for many intelligent video analysis-related applications, such as video retrieval, indexing, browsing, categorization and summarization. VSBD aims to segment big video data into meaningful fragments known as shots. This paper put forwards a new pyramidal opponent colour-shape (POCS) model which can detect abrupt transition (AT) and gradual transition (GT) simultaneously, even in the presence of illumination changes, huge object movement between frames, and fast camera motion. First, the content of frames in the video subjected to VSBD is represented by the proposed POCS model. Consequently, the temporal nature of the POCS model is subjected to a suitable segment (SS) selection procedure in order to minimize the complexity of VSBD method. The SS from the video frames is examined for transitions within it using a bagged-trees classifier (BTC) learned on a balanced training set via parallel processing. To prove the superiority of the proposed VSBD algorithm, it is evaluated on the TRECVID 2001, TRECVID2007 and VIDESEG2004 data sets for classifying the basic units of video according to no transition (NT), AT and GT. The experimental evaluation results in an F_1 -score of 95.13%, 98.13% and 97.11% on the TRECVID 2001, TRECVID2007 and VIDESEG2004 data sets, respectively.

Introduction

Progressive improvements in recent Internet access and technologies provide ubiquitous high dimensional video data. Hence, intelligent video analysis is mandatory for organizing and managing these big video data. This requirement has prompted researchers working in multimedia to develop intelligent video content analysis methodologies. The prerequisite step for any intelligent video analysis is parsing the video into meaningful basic units termed as shots. A video shot is a sequence of frames, continuous in time and space, from the perspective of a single camera. Transition in video shots can be broadly categorized into abrupt (hard) and gradual (dissolve, fade in, fade out, wipe). An AT exists between the frame belonging to one shot and the subsequent shot as in Fig. 1.

AT occurs as a hard cut between two shots. As shown in Fig. 1, if transition frames occur between shots due to editing effects (fade, dissolve and wipe), then the transition is a GT. Most recent works [28], [29], [30], [31], [32], [33], [36], [37] mainly focus on AT detection, whereas GTs are challenging to detect due to the fast camera and object motion within a shot. The hard task in any VSBD algorithm is the selection of a feature representation method, which is able to discriminate both gradual and sharp transitions, even in the presence of illumination changes and significant camera and object motion.



Improvement of Subthreshold Characteristics of Dopingless Tunnel FET Using Hetero Gate Dielectric Material: Analytical Modeling and Simulation

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Abstract

An improved subthreshold analytical model of Dual Material Double Gate Junctionless Tunnel FET (DMDG JLTFET) with stacked / hetero-dielectric gate oxide structure is proposed. The stacked gate oxide structure comprises of Silicon-dioxide (SiO₂) and Titanium Oxide (TiO₂). The high-K gate stack engineered device overcomes the Short Channel Effects (SCEs) caused by the ultrathin silicon devices. The subthreshold analysis is carried out by solving a two-dimensional Poisson's equation using Parabolic approximation method. These characteristics are analyzed against various device parameters. Also, the impact of different high-K gate oxide materials with SiO₂ is also studied. A comparative analysis of short channel effects for DMDG TFET and DMDG JLTFET has been carried out. The results reveal that the proposed device provides better I_{ON} current, low leakage current and improved Transconductance-to-drain current ratio. Using TCAD Sentaurus device simulator, the subthreshold analytical model results have been simulated and verified with other TFET models.

Keywords Junctionless transistor · Tunnel FET · Hetero gate dielectric · Stacked gate oxide · Subthreshold swing

1 Introduction

With growing Microelectronics industry, device scaling is the biggest challenge. Scaling solid-state devices improves cost, power consumption and speed [1–2]. Device scaling has certain practical limits such as Drain Induced Barrier Lowering (DIBL), Hot Carrier Effects (HCE), lower Subthreshold Slope, high OFF current and low transconductance efficiency. On the part of addressing these issues, circuit designers are looking at alternate devices for conventional MOSFET's. Tunnel FET is considered to be the potential candidate to improve the subthreshold characteristics of a device. Band-To-Band Tunneling (BTBT) assists in achieving Subthreshold Swing (SS) less than 60 mV/dec [3–4]. However, the adverse scaling effects can be further improved

through multi-gate and channel engineering techniques [5–7]. To strengthen the immunity against severe SCEs, work-function engineered devices have evolved. The fundamental idea of work-function engineering involves dual metals in the gate M₁ and M₂ with distinct work functions. Such a configuration is named as Dual Material Double Gate FET (DMDG FET), in which the material with higher work function is set near the source end to improve the carrier generation rate and material with lower work function at the drain end. Numerous drain current and threshold voltage analytical models have been proposed and developed for multi-gate TFET's [8–10]. This structure provides a simultaneous increase in transconductance and suppressed SCEs, owing to faster electron transport. But, TFET's suffer from providing low ON current by virtue of its ambipolar behavior. Also, huge demand has raised for low power and high-speed digital IC applications [11–12].

To achieve such performance, we are in the urge of replacing conventional gate-oxide (SiO₂) material with high-K gate oxide material. This may be adapted to deepen the BTBT generation rate and to provide protection against direct tunneling of carriers through the gate-oxide layer [13–14]. In recent years many researchers, have explored the benefits of

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Video classification and retrieval through spatio-temporal Radon features

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Abstract

The rise in the availability of video content for access via the Internet and the medium of television has resulted in the development of automatic search procedures to retrieve the desired video. Searches can be simplified and hastened by employing automatic classification of videos. This paper proposes a descriptor called the Spatio-Temporal Histogram of Radon Projections (STHRP) for representing the temporal pattern of the contents of a video and demonstrates its application to video classification and retrieval. The first step in STHRP pattern computation is to represent any video as Three Orthogonal Planes (TOPs), i.e., XY, XT and YT, signifying the spatial and temporal contents. Frames corresponding to each plane are partitioned into overlapping blocks. Radon projections are obtained over these blocks at different orientations, resulting in weighted transform coefficients that are normalized and grouped into bins. Linear Discriminant Analysis (LDA) is performed over these coefficients of the TOPs to arrive at a compact description of STHRP pattern. Compared to existing classification and retrieval approaches, the proposed descriptor is highly robust to translation, rotation and illumination variations in videos. To evaluate the capabilities of the invariant STHRP pattern, we analyse the performance by conducting experiments on the UCF-101, HMDB51, 10contexts and TRECVID data sets for classification and retrieval using a bagged tree model. Experimental evaluation of video classification reveals that STHRP pattern can achieve classification rates of 96.15%, 71.7%, 93.24% and 97.3% for the UCF-101, HMDB51, 10contexts and TRECVID 2005 data sets respectively. We conducted retrieval experiments on the TRECVID 2005, JHMDB and 10contexts data sets and the results revealed that STHRP pattern is able to provide the videos relevant to the user's query in minimal time (0.05s) with a good precision rate.

Introduction

In recent years, rapid developments in storage devices, recording technology and video editing tools have made a large quantity of multimedia items available to Internet users worldwide. However, accessing these data requires description, organization and management of the available multimedia items. Researchers in computer vision and pattern recognition are developing approaches for managing this plethora of unorganized multimedia content. Videos represent one of the largest classes of multimedia content, as 300 hours of video data are uploaded to YouTube per minute. Despite continual efforts over a number of years, a reliable and effective video classification and retrieval system for managing this video data is still elusive. The process of any video classification task is twofold: (i) acquiring knowledge about the features extracted from the training videos (administrator module) and (ii) using the knowledge gained to assign the query video into one of the predefined classes (user module). In a video retrieval scenario, the

Enhancing Student Learning and Engagement in Freshman Course on Problem Solving using Computers

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Abstract: The paper presents a detailed impact analysis of incorporating appropriate active learning strategies for enhancing student learning and engagement in the first year introductory course on Problem Solving using Computers. The major challenge in Education system is that, most of the graduates learn by rote all the way from school to college. Most of the students do not have prior experience in programming and exhibit an aversion towards programming. Active learning techniques have been proved as a viable solution to eradicate rote learning. In order to promote higher order cognitive skills and student engagement, a systematic plan incorporating appropriate active learning techniques has been designed. The experimental study has been carried out in a first year student group comprising of 119 members from the Department of Information Technology at Thiagarajar College of Engineering, Madurai. Along with traditional assessment strategies, exclusive rubrics have been designed to measure the learning outcomes. This blend of instructor led and inquiry based teaching practices in the introductory course on Problem Solving using Computers has shown positive impact on student learning and engagement. Compared with the previous academic years, Students' performance in continuous assessment and End Semester Examinations has improved significantly. Positive feedback from students and increased count of participation in programming contests and online certifications demonstrate the improved effectiveness of the adopted teaching learning strategies in promoting self learning.

Keywords: Computer Programming, Problem Based Learning, Active Learning, Higher Order Thinking skills, Self learning

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1. Introduction

The freshman course on Problem solving using computers is intended to introduce about computational thinking and the methodology of programming with emphasis on modularity. The course on Problem solving using computers cannot be handled using the conventional method of lecturing alone (Gottfried, 1997). It has been pointed out that,

- Traditional 50 minutes of lecture
- Detailed programming examples on the board
- More emphasis on syntax ignoring program design
- More emphasis on program design ignoring syntax
- Individual assignments
- Unrelated in-class activities with the assignments

will not work effectively for handling a computer programming course. As many of the learners are new to computer programming, significant time must be spent on "learning by doing". Also, feedback by the instructor on every stage of learning is crucial to avoid misconceptions in learning. The limited meeting time for the instructor and students on a weekly basis is the major challenge for increasing student learning and engagement.

2. Related Works

Active learning has been strongly recommended by many of the education researchers to promote student engagement and learning (Bullard et al., 2008; Felder et al., 2009; Hake, 1998). Astrachan et al., 2002 have studied the effect of using collaborative learning in groups to increase participation and interest of the learners. Learners who were reluctant in class were able to discuss the solution freely in the groups. Female students made a remark that collaborative learning has made them comfortable in their classroom. Learners preferred group problem solving rather than lecturing. A novel practice of incorporating active learning to traditional in class labs led to an improvement in student outcomes (Briggs, 2005). Every lab exercise in the lab manual started with a brief description of concepts required for the experiment. It includes a narrative or sample code and make the students to get actively engaged by predicting the output, solving a problem or by completing a partial code. Learners extend the lab manual

Evaluating the Quality of Final Examination Question Paper in Engineering Education

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Abstract: In recent years, there has been a downtrend in the pass percentage of UG Engineering Mathematics papers among students. Students find it difficult to score pass marks in the subject in the recent batches. Factors like lack of understanding in basic concepts, lack of quality of teaching, lack of quality in question papers, strict evaluation, and so on may be related to poor performance of students. Hence, it becomes necessary to examine the nature of final examination question papers, especially for the maths courses. It is essential to assess the type of questions asked in the examinations using the statistical techniques and measures. In this paper, the descriptive study has been made to evaluate the quality of question papers of Mathematics with the result data.

Keywords: Engineering Mathematics, Item Analysis, Difficulty Index, Discrimination Index, Student Performance, Question Paper Quality

1. Introduction

According to the article published in press (<https://timesofindia.indiatimes.com/city/chennai/tough-maths-only-25-1st-year-engineering-students-in-tamil-nadu-clear-exams/articleshow/69420474.cms>), only one in four first year students cleared all subjects in TamilNadu Engineering affiliated Colleges. It is equivalent to 25% of students passed all subjects for the year 2019. When Engineering Mathematics subject is considered, the pass percentage has come down to 31% in the year 2019, when compared with the previous year which was more than 40%. However, the pass percentage of Engineering Physics and Chemistry was slightly better with 55% and 68% respectively.

Some Faculty members admitted that the students were lack in understanding the basic mathematical concepts of their Higher Secondary Education syllabus. Engineering teachers have expressed their concern and mismatch between the school and college education.

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Students with >90% score in their school exams also find difficult in scoring good marks in college education. Professors expected the changes in school education so as to give strong foundation in basic concepts of mathematics and science.

This situation motivates to examine the student performance in Engineering courses especially in mathematical courses. Arthur (2010) analysed final examination papers and observed that there were more Lower Order Thinking Skills (LOTS) questions and recommended for Higher Order Thinking Skills (HOTS) for various academic levels. Ajithkumar (2011) evaluated the quality of examination by recommending the Quality parameters and their level of presence in question papers through different student groups. Kashefi et. al. (2012) observed that both students and lecturers felt obstacles in imagining and visualizing the mathematical problems which ultimately resulted in poor results. Their study recommended Creative Problem Solving tools and techniques along with Active Learning Strategies for teaching and learning mathematical concepts. Ganeshkumar et. al. (2013) analysed question papers of two prominent institutions of India and United States. The team found that questions set in India had slight edge over the questions set in US institutions in HOTS domain.

Sowmya et. al. (2015) studied a set of question papers of Engineering programmes and explored the faculty awareness of Bloom's taxonomy in the cognitive domain and the possibility of achieving Higher Order Thinking Skills (HOTS) through examinations. Gul-Ar et. al. (2015) used item analysis technique for analysing essay type questions given in summative examination of medical college students. Serpil et. al. (2016) used statistical measures like difficulty and discrimination indices for analysing multiple choice questions for Open and Distance Learning context. Abubakar et. al (2017) analysed the various causes and effects for reduction in the student registration for advanced mathematics courses like

Intelligent dynamic grouping for collaborative activities in Learning Management System

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Abstract : In a sustainable education environment, Learning is fixed everyone and learning time may vary with individual capability. To provide additional learning space, Learning Management System (LMS) is a perfect solution. All kind of learners can make use of the additional learning space and attain the objectives of the content. Learning Management System is an integral component of the e-Learning design and development, and to manage the learning process. LMS would provide pre-defined templates for development as well as to deploy e-content, integrate multimedia content such as audio, video, images, graphics and animation, organise assessments, evaluation procedures and analyze the learner style by including the learning analytics. Most of the Learning Management Systems offer convenient tools that allow to create custom courses and thus implement educational, teaching, training and management processes in an organization. Today learners are more towards active and team-oriented learning. LMS would improve active and collaborative learning by providing varieties of activities and group projects. While giving the group assignments and projects to the learners, an effective and dynamic grouping mechanism need to be integrated. Based on the group size, the group should consist of mixed kind of learners to learn from group

activity and to lead a group activity. The formation of the group must be dynamic for every activity. The groups should be dynamic in nature and every learner of the course must have active learning with each other in the same course. To prepare an intelligent grouping mechanism, a framework was developed and deployed in the MOODLE LMS. This intelligent dynamic grouping mechanism improve the overall learning activities in the LMS environment.

Keywords: Active learning, Collaborative learning, Learning Management System, Learning Analytics, Learning space

1. Introduction

Teaching and Learning (TL) paradigm changing its shape to facilitate active and collaborative learning methods. TL in e-Learning environment has been improved drastically to meet common features of face-face learning. In the face to face traditional learning environment, most of the experience of the teacher in the teaching context and the experience of the learner in the learning context are not documented. The evolution of the e-learning system never leaves an experience without documentation. This documentation details are very much useful to understand the learners. This e-Learning platform leads to personalized learning practices where the teacher could address the individual learner. To address the individual learning preferences and engage with different learning activities, the Learning Management System (LMS) is a perfect solution. It brings the teacher and learner under a single umbrella.

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C5.0 Decision Tree Model Using Tsallis Entropy and Association Function for General and Medical Dataset

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ABSTRACT

Real world data consists of lot of impurities. Entropy measure will help to handle impurities in a better way. Here, data selection is done by using Naïve Bayes' theorem. The sample which has posterior probability value greater than that of the threshold value is selected. C5.0 decision tree classifier is taken as base and modified the Gain calculation function using Tsallis entropy and Association function. The proposed classifier model provides more accuracy and smaller tree for general and Medical dataset. Precision value obtained for Medical dataset is more than that of existing method.

KEYWORDS: Data Mining, Association Function, Classification, Decision Tree, Entropy

1 INTRODUCTION

CLASSIFICATION techniques are considered to be the most important Data Mining functionalities. It is called as a supervised learning technique since it contains class label for training the model. There are different Classification techniques. Davis, et al. (2006) proposed a cost sensitive decision tree learning algorithm. Claes, et al. (2014) developed an Ensemble SVM. Bobadilla, et al. (2013) proposed a recommender system based on k-nearest neighbors. One of the initial machine learning approaches that were successful till now is a Decision tree classification technique. This technique remains as a good method till now in machine learning for its simplicity, interpretability, efficiency and flexibility. Some of the Decision tree algorithms are ID3, CART, C4.5, C5.0 etc. These techniques are widely applied to variety of task. Imai, et al. (2017) used decision tree model for analysis of adverse drug reactions. Hunt (1993) used classification by induction model for control of nonlinear dynamical systems. Attigeri, et al. (2017) used Machine learning algorithms to detect credit risk of loan applicants. Decision tree algorithms uses entropy and Gain measures to determine the important attributes in a dataset. The most important attribute form the root node of the decision tree which is considered as the best predictor. Entropy is a measure that is used by the Decision tree algorithm

that is used to identify the homogeneity of a sample. The calculated value of entropy will be zero if all the samples in the dataset are homogeneous and it will be one when the samples are equally classified. The best splitting attribute of tree can be identified using Information Gain measure. The attribute that have highest value of Information gain forms the root node of the Decision tree.

During Decision tree induction, identification of split criterion and tree construction is the two primary issues that need to be handled effectively. Some of the Decision tree algorithms such as Iterative Dichotomiser3 (ID3) algorithm use Shannon entropy and Gain ratio to determine the split of the tree. Similarly, C4.5 algorithm uses Gain Ratio and Gini index is used by Classification and Regression Tree (CART) algorithm as a Split criterion. It's not always the split criteria identified through these measures will suit all datasets. All these measure are based on entropy. C5.0 is an extension of C4.5 algorithm. C5.0 algorithm is easy to understand and more robust (although the dataset is large and has missing value). It requires less training time to build the model. It is a powerful boosting method with improved classification accuracy. Here, a Decision tree induction method is proposed which is based on the C5.0 algorithm and with different types of entropies.



Securing e-health records using keyless signature infrastructure blockchain technology in the cloud

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Abstract

Health record maintenance and sharing are one of the essential tasks in the healthcare system. In this system, loss of confidentiality leads to a passive impact on the security of health record whereas loss of integrity leads can have a serious impact such as loss of a patient's life. Therefore, it is of prime importance to secure electronic health records. Health records are represented by Fast Healthcare Interoperability Resources standards and managed by Health Level Seven International Healthcare Standards Organization. Centralized storage of health data is attractive to cyber-attacks and constant viewing of patient records is challenging. Therefore, it is necessary to design a system using the cloud that helps to ensure authentication and that also provides integrity to health records. The keyless signature infrastructure used in the proposed system for ensuring the secrecy of digital signatures also ensures aspects of authentication. Furthermore, data integrity is managed by the proposed blockchain technology. The performance of the proposed framework is evaluated by comparing the parameters like average time, size, and cost of data storage and retrieval of the blockchain technology with conventional data storage techniques. The results show that the response time of the proposed system with the blockchain technology is almost 50% shorter than the conventional techniques. Also they express the cost of storage is about 20% less for the system with blockchain in comparison with the existing techniques.

Keywords Electronic health record (EHR) · e-Health · Keyless signature infrastructure (KSI) · Timestamped algorithm · Merkle tree · Blockchain

1 Introduction

Today, health care is of prime importance as the number of patients and diseases continues to increase. Maintaining an individual's health records is necessary so that future

health needs can be effectively managed. The current environment ensures the maintenance and sharing of health data across various organizations of a similar pattern. Even if records are safely shared with other institutions, the integrity of health records [1] remains a major issue. Data

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Automated optimal test data generation for OCL specification using harmony search algorithm

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Abstract: Exploring software testing possibilities at an early software life cycle is increasingly necessary to avoid the propagation of defects to the subsequent phases. This requirement demands technique that can generate automated test cases at the initial phases of software development. Thus, we propose a novel framework for automated test data generation using formal specifications written in object constraint language (OCL). We also defined a novel fitness function named exit-predicate-wise branch coverage (EPWBC) to evaluate the generated test data. Another focus of the proposed approach is to optimise the test case generation process by applying, harmony search (HS) algorithm. The experimental results indicate that the proposed framework outperforms the other OCL-based test case generation techniques. Furthermore, it has been inferred that OCL based testing adopting HS algorithm forms an excellent combination to produce more test coverage and an optimal test suite thereby improving the quality of a system.

Keywords: specification-based testing; SBT; object constraint language; OCL; exit-predicate-wise branch coverage; EPWBC; optimal test case generation; harmony search algorithm; HS.

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FuRL: fuzzy RBM learning framework to detect and mitigate network anomalies in Information Centric Network

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Abstract. Information Centric Network (ICN) is a promising next-generation internet architecture in which the network focuses on retrieving the content by employing open in-network caching scheme to provide an efficient content distribution to users. However, such open in-network caching is vulnerable to network anomalies. In particular, cache pollution attack disrupts the smooth working of in-network caching by flooding unpopular contents. Hence, the in-network caching malfunctions and legitimate consumer requests are dropped. To address this problem, a secure framework based on Fuzzy Restricted Boltzmann Machine has been proposed to detect the anomalies and defend against such pollution attacks in ICN. Further, a reward-based cache replacement (ReBac) algorithm that is capable of avoiding cache pollution attack has also been proposed. The experimental results obtained while testing the proposed framework show better detection rate compared with the state-of-art solution and the proposed framework shows better cache rate.

Keywords. Information Centric Network; in-network caching; cache pollution attack; cache replacement.

1. Introduction

Today's world has been exploding with numerous gadget users. All these devices are being connected to the internet for providing various services. Thus, today's internet traffic is crowded and the delay in the internet is also increasing. Many times this delay jeopardizes critical systems, and leads to unwanted and unexpected problems in such connected systems. To solve these problems, major network providers like CISCO and others are trying to provide new networking paradigm through a clean-slate architecture approach to avoid such delay in sharing information. This new network for sharing information is called Information Centric Network (ICN), which uses different naming structures for each information item on the network and they can be in either human readable or non-readable format [1]. The ICN router has three core functionalities: content store (CS), pending interest table (PIT) and forwarding information base (FIB). The frequently accessed information is cached in the CS. Thus, the information request can be serviced faster independent of the producer or host. The interface request is temporarily stored in PIT and it forwards the request to FIB table [2]. The FIB module is responsible for exploring the data packet from various faces (nearest routers who have appropriate data packet). The ICN enlists the in-network caching mechanism where the contents are cached by any node (who

really need the content for future use) that can act as router to serve a content to end-users. The Universal caching policy is a default caching strategy used for caching all contents in ICN [3]. This simplest method does not require additional computational effort in routers. According to this policy, each router is forced to cache all contents, including unpopular content/information. Therefore, this policy over-utilizes the resource space, thus incurring content retrieval delay in cache lookup. Various caching policies have been proposed in [4–6]. Most of the studies [7, 8] focus on popularity-based caching in ICN. Further, popularity is defined as the content being requested several times within a specific time frame and it is content popularity. To identify the specific content popularity, the router evaluates the interest arrival rate of a particular content and it compares to the previous content popularity on a specific router [9]. The existing studies [10] have proved that the poor caching strategies possess security challenges in ICN.

Even though the ICN provides security by maintaining the integrity in the network, there are some security issues present in the ICN architecture. One such devastating attack is the “Cache Pollution Attack”. The aim of this attack is to pollute the caches of routers in ICN with unpopular content/information items. Also, it ruins the cache performance and creates a false assumption of caching content. Due to this flooding, the legitimate user requests are dropped and thus, rapid content dissemination is reduced in ICN. Hence, the major purpose of the ICN, i.e. to serve frequent information faster, is hampered by the cache pollution attack. This

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Learning-Driven Detection and Mitigation of DDoS Attack in IoT via SDN-Cloud Architecture

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Abstract—The Internet-of-Things (IoT) network is growing big owing to its utility in smart applications. An IoT network is susceptible to security breaches, in majority due to the resource-constrained nature of IoT. Of the various breaches, the Distributed Denial-of-Service (DDoS) attack can snip off the network service to the users in various ways, such as consumption of server's resources, saturating link bandwidth, etc. These types of DDoS breaches can turn out to be a catastrophe in critical IoT use cases. This article delves into tackling the DDoS attack triggered by malicious wireless IoT on IoT servers. Our security scheme leverages the cloud and software-defined network (SDN) paradigm to mitigate the DDoS attack on IoT servers. We have proposed a novel mechanism named learning-driven detection mitigation (LEDEM) that detects DDoS using a semisupervised machine-learning algorithm and mitigates DDoS. We tested LEDEM in the testbed and emulated topology, and compared the results with state-of-the-art solutions. We achieved an improved accuracy rate of 96.28% in detecting DDoS attack.

Index Terms—Cloud, Distributed Denial-of-Service (DDoS) attack, extreme learning machine (ELM), Internet of Things (IoT), security, semisupervised learning, software-defined network (SDN), wireless.

LIST OF ABBREVIATION

AA	Authentication and authorization.
DDoS	Distributed Denial of Service.
ELM	Extreme learning machine.
F	Effect of failure of fIoT on the use case.
fIoT	Fixed IoT.
fMS	fIoT mitigation strategy.
fMS-ILP	fMS integer-linear programming.
fMS-RLP	fMS relaxed-linear programming.
IoT	Internet of Things.
LEDEM	Learning-driven detection mitigation mechanism.
mIoT	Mobile IoT.
ML	Machine learning.
risk	Value of risk involved in setting drop rule to VLAN.
Score	Importance measure of fIoT.
SDELM	Semisupervised deep extreme learning machine.

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SDN	Software-defined network.
T	risk threshold.
UCC	Criticality of IoT use case.
UFP	IoT use case failure probability.
V	$V \in VI$.
VI	Set of VLANs to which malicious fIoTs belong.
γ	Optimal solution of fMS-RLP.
ϑ	Feasible solution of fMS-RLP.

I. INTRODUCTION

THE IoT network is growing big and is expected to make an impact in our lives through smart home, healthcare, environment, grid, etc. [1]. IoT is constrained in all angles, such as size, processor, memory, power, etc., and billions of IoT getting connected makes security provisioning more complex. A security breach can cause malfunctioning of the IoT use cases like smart grid [2], smart city, etc. A breach can lead to theft of data like medical data [3], smart meter data [4], etc. A breach may even weaken a country's security and monetary status [5]. The DDoS attack in IoT networks can turn out to be a threat to human life and may lead to destruction [6].

Of the various security breaches, DDoS is known to bring down the network making it unavailable to the users [7]. In this article, we have focused on mitigating DDoS attack (MDA) which is triggered by malicious wireless IoT on IoT servers.

Many IoT applications, such as autonomous vehicles, industry, etc., are dependent on real-time inputs. Network unavailability in such cases will be catastrophic. For instance, when an autonomous vehicle is on road and a DDoS attack is on the server by IoT, the vehicle will stop getting sensory inputs to steer. The huge IoT network, resource constraints, and diversity of IoT makes it a piece of cake for the intruders to launch the DDoS attack on the IoT servers [8]. The DDoS can be launched using several ways like Mirai malware-infected IoT, Internet Relay Chat Telnet malware-infected Linux IoT, smart home IoT botnet, etc. [9]–[11]. This makes it difficult to detect and mitigate DDoS [7], [12]. Resource constraints in IoT make cryptography least suitable owing to the time, power, processing cycles, and memory necessary for running these algorithms. The fact that there are various ways of launching DDoS attack by wireless IoT on IoT server, the ill-effects DDoS can cause, difficulty in detecting and mitigating DDoS motivated us to probe into it.



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Prediction of risk factors for pre-diabetes using a frequent pattern-based outlier detection(Article)

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Abstract

Pre-diabetes is the forerunner stage of diabetes. Pre-diabetes develops type-2 diabetes slowly without any predominant symptoms. Hence, pre-diabetes has to be predicted apriori to stay healthier. The risk factors for pre-diabetes are abnormal in nature and are found to be present in a few negative test samples (without diabetes) of Pima Indian Diabetes data. The conventional classifiers will not be able to spot these abnormal samples among the negative samples as a separate group. Hence, we propose algorithm frequent pattern-based outlier detection (FPBOD) to spot such abnormal samples (outliers) as a separate group. FPBOD uses an associative classification technique with few surprising measures like lift, leverage and dependency degree to detect outliers. Among which, lift measure detects more precise outliers that are able to correctly classify the person who did not have diabetes, but just takes the risky chance of being a diabetic patient. Copyright © 2020 Inderscience Enterprises Ltd.

Author keywords

[Associative classification](#) [Infrequent pattern](#) [Outlier detection](#) [Pre-diabetes](#) [Surprising measure](#)

Indexed keywords

Engineering controlled terms:

[Anomaly detection](#) [Data handling](#) [Statistics](#)

Engineering uncontrolled terms

[Abnormal samples](#) [Associative classification](#) [Conventional classifier](#) [Dependency degree](#) [Diabetic patient](#) [Negative samples](#) [Pima Indian Diabetes](#) [Type-2 diabetes](#)

Engineering main heading:

[Pattern recognition](#)

EMTREE medical terms:

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Deep learning framework for early detection of intrusion in virtual environment(Article)

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Abstract

Today's business enterprise adapts cloud-based services as its architectural design. Intelligence technique incorporated into the architecture gives massive tangible and intangible benefits in terms of performance and reliability. Such cloud-based business architecture faces many threats towards its availability. DDoS attack is the most prominent threat as its impact is more in the virtual resource-based cloud infrastructure. Therefore, there is a need for a business intelligence-based framework to detect early the attack by monitoring the virtual network traffic. The proposed intelligence framework uses a deep learning framework, continuous discriminative-deep belief network (CD-DBN). CD-DBN dynamically captures attack patterns from the network data, analyses the data and detects the intrusion to the cloud. The observed result shows that the earlier detection approach guarantees the availability of cloud services to the legitimate users and enhances the cloud resource usage. Copyright © 2020 Inderscience Enterprises Ltd.

Author keywords

[Availability threat](#) [Cloud environment](#) [DDoS attack](#) [Deep belief network](#) [Deep learning](#) [Hypervisor](#) [Intrusion detection](#) [Restricted Boltzmann machine](#) [SysBench benchmark suite](#) [Virtualisation](#)

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S. Mercy Shalinie is currently heading the Department of Computer Science and Engineering at the Thiagarajar College of Engineering. She has published several papers in international journals and conferences. She was awarded Young Scientist Fellowship by Tamil Nadu State Council for Science and Technology, Chennai and received Best Paper Award for her paper published in the journal of IE. She is a life member of ISTE, IE, CSI and senior member of IEEE. Her areas of interest include machine learning, neural networks and security systems.

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Convolutional neural network for solid waste segregation and management(Article)

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Abstract

Garbage, a solid material that is dumped in billions of tons a very year. About a lakh of one metric of wastes is dumped every day in some countries like India. This is due to the increase in the productivity of goods and all object matters that concern day to day use. We, as a consumer will collect the necessary materials and throw away the wastes into open lands or in some water bodies, sometimes even on the roadsides. Since the segregation of waste materials which are useful and useless items seems to be a tedious task for humans at home. They simply throw away the waste materials into the garbage can or land areas, and in turn, all these wasteland areas are filling rapidly. This is all due to the production of materials for meeting the demands of the exponentially growing world's population. Though the production of these plastic/packing materials can be avoided to some sought of the amount. The real matter tells about the segregation and recycling of these materials. The solid waste materials which are left untreated or uncollected will definitely cause degradation to the land areas, water bodies and much more pollution to the environment. Even though we are collecting all the waste materials regularly, it is really a tuff job to segregate waste materials. With the help of manpower, we can able to segregate these materials, but how quick and efficient it can be done when comparing with the automatic detection of waste materials and segregation propose. This automatic segregation of waste will also help in reducing the cost of labor wage, in terms of business productivity. More the segregation of waste from trivial waste will helpful for the recycling process. The process of recycling can able to reduce the production of new solid substances. Overall proposed work is done successfully, for the efficient classification of solid waste matters and had achieved good accuracy. © 2020 SERSC.

Author keywords

Biodegradable Controller Convolutional Neural Network Deep learning Flap Internet of things Non-Biodegradable Raspberry Pi Servo motor Ultrasonic Sensor

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A Smart Approach for Intrusion Detection and Prevention System in Mobile Ad Hoc Networks Against Security Attacks

M. Islabudeen¹ · M. K. Kavitha Devi²

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Abstract

Design of intrusion detection and prevention scheme for improving MANET security, with considered energy efficiency, detection rate, delay, and false positive rate are major research issues. Most of the existing solutions have suffered to obtain accurate detection rate in minimal time execution and energy consumption. In this work we proposed a Smart approach for intrusion detection and prevention system (SA-IDPS) to mitigate attacks in MANET by machine learning methods. Initially, mobile users are registered in Trusted Authority using One Way Hash Chain Function. Each mobile user submits their following information to verify authentication: finger vein biometric, user id, and latitude and longitude. Intrusion detection is executed using four entities: Packet Analyzer, Preprocessing Unit, Feature Extraction Unit and Classification Unit. In packet analyzer, we verify whether any attack pattern is found or not. It is implemented using Type 2 Fuzzy Controller which considers information from packet header. In preprocessing unit, logarithmic normalization and encoding schemes are considered, which is time series and suitable for any application. In feature extraction unit, Mutual Information is used where we extracts optimum set of features for packets classification. In classification unit, Bootstrapped Optimistic Algorithm for Tree Construction with Artificial Neural Network is used for packets classification, which classifies packets five classes: DoS, Probe, U2R, R2L, and Anomaly, and then Association Rule Tree are used to classify whether the attack is Frequent or Rare. In this case, historical table is used for packets classification. Finally, experiments are conducted and tested for evaluating the performance of proposed SA-IDPS scheme in terms of Detection Rate (%), False Positive Rate (%), Detection Delay (s), and Energy Consumption (J).

Keywords Mobile ad hoc network · Intrusion detection and prevention · Type 2 fuzzy controller · BOAT with ART · Artificial neural networks

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Map-Optimize-Reduce: CAN Tree Assisted FP-Growth Algorithm for Clusters based FP Mining on Hadoop

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Abstract— Over the past era, Frequent Pattern Mining (FPM) is emerging as a significant approach to discover fascinating knowledge concealed in the data. However, preceding works failed to address the validation of FPM with user queries and also achieving better scalability and execution time is still bottleneck owing to difficulties in handling large data set. To address this downside, our proposed work establishes FPM using extend version of MapReduce framework in Hadoop environment. Our proposed work comprises of five processes that are: 1) Preprocessing 2) Affinity Propagation (AP) based Clustering 3) Load Balancing 4) Map-Optimize-Reduce 5) Mining User Queries. Primarily, our proposed work performs preprocessing to remove data redundancy. To speed up the MapReduce framework, we propose AP clustering which generates effective clusters from the given dataset. Load balancing is executed to balance load among different blocks concerning where reputation is computed. To avoid oversight in scanning and minimal searching space in MapReduce, optimizer is included between Mapper and Reducer where Emperor Penguin Colony (EPC) optimization is used. Frequent patterns are mined using CANonical order (CAN) tree based Frequent Pattern (FP) growth which reduces execution time and frequent tree construction. User provides Mining Request to the Hadoop and frequent patterns are mined for given query which is send back to the user. If user given query is not present in the CAN tree, then it sends Relevance Feedback as a recommendation to the user. Finally, we validate our proposed work performance with the previous works for succeeding metrics that are Execution Time, Response Time, Load Balancing Rate, and Scalability.

Index Terms— Frequent Pattern Mining, Map-Optimize-Reduce, Clustering, Load balancing, CAN Tree based FP growth, User Query.

I. INTRODUCTION

With the advancement of big data, growth of the dataset size is increased tremendously. Due to this, traditional algorithms are not scalable to achieve better performance. In regard to achieve better scalability, MapReduce framework is introduced [1]. Execution time for FPM is another major shortcoming in mining on large data. To overwhelm this problem, Hadoop with Map Reduce Model is utilized [2]. Association Rule Mining (ARM) based Frequent Pattern mining is one of the approaches to mine frequent pattern in given dataset [3]. Association produced for frequent itemsets are too large that induces complexity in the system. For this purpose, MapReduce based consistent and inconsistent rule

detection process is introduced [4]. In order to improve the efficiency of mining frequent patterns, two parallel incremental frequent patterns mining algorithm is introduced where MapReduce model is used with Parallel FP growth [5]. Mining overhead introduced via redundant transaction is more in large dataset that reduces performance of the mining. Concerning this, data partitioning approach named FiDooP-DP is utilized in MapReduce model which uses Voronoi diagram based data partitioning method [6].

In FPM, there exist two types of dataset layouts that are horizontal and vertical. Here, horizontal requires more time to scan the database. Hence, vertical layout dataset is introduced to diminish the problem of scanning the dataset in each iteration. Candidate itemset is reduced to enhance the pattern mining [7] [8] [9]. Here, Itemsets on different dataset is spilt into multiple sub dataset that are executed using parallel algorithms which is associative rule mining. In this, efficient adaptive miner is used to extract the frequent patterns with the aid of Hadoop framework.

Load balancing is essential to reduce the execution time during mining of frequent pattern. Two partitioning strategies are utilized to balance the load in the nodes among cluster. In this, total computing load of the node is estimated to balance the load and database is equally split into the sub data base, hence each node has equal six sequence [10]. In order to overcome this drawback, balancing factor is estimated on each node to balance the load among all data nodes. Association rule mining based FPM in MapReduce introduces process skewness problem while mining frequent patterns. In regard to overcome the process skewness problem in FPM, Hadoop computes load present in each node. This measure is named as balancing factor to balance the load among nodes [11]. Parallel frequent pattern set is estimated along with the load balancing process. Load balancing is achieved through decomposing of time consuming frequent-1 itemset into sub dataset [12]. Fine grained partitioning based load balancing is established to balance the load in the Hadoop MapReduce system. Multistage algorithm is used to provide the load equally among all the nodes where greedy selection strategy is used to sort the mapper based on the work load [13]. Sorted balance algorithm is used to balance the load among the node where sampling results are used. Herein, Map Reduce framework has two phases that are: Phase 1 mapping and sampling, Phase 2 data placement policy and executing the reduce method [14]. Frequent Itemset mining is implemented

Effective image stego intrusion detection system using statistical footprints of the steganogram and fusion of classifiers

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Abstract: Enlightening the processing record of a digital image is a significant problem for steganalysers and the forensic analysers. In the present day, the most precise steganalysis techniques are built as supervised classifiers by extracting the feature vectors from the digital media. This paper presents an ensemble classification method for effective image stego intrusion detection system on JPEG images consists of two step process. In the first step the features are engineered as higher-order statistics for blind steganalysis. In the second step ensemble classifier is used by fusing the classifiers such as support vector machine, neural networks, k-nearest neighbours. By applying the mentioned classifiers to these features, the steganogram and the clear (unadulterated) carrier signals are effectively discriminated. For generating the image dataset, images are undergone with six embedding schemes with different payload. Experimental results show that the proposed approach remarkably improve the metrics such as specificity, sensitivity and accuracy of the system.

Keywords: SVM; ensemble; higher order statistics.

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Rigorous reduction of partial shading condition in grid connected solar PV system using discrete time-based PSO controller

B. Ganeshprabu¹ · M. Geethanjali¹

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Abstract

Solar industry has seen tremendous development over the past decade and in particular, the PV (Photovoltaic) system which has an imperative advancement almost in all fields of science. Envisaging various faults in the PV system will significantly enhance the efficiency, reliability, and life of the PV system. The main vulnerable element in the PV system which is subjected under different weather condition causes total damage to the system. Proper monitoring and maintenance are needed to increase the life of the system. Several investigations were made so far to predict the faults in the PV system such as the Visual method, the Thermal method, the Electrical detection method, the Machine learning techniques, the Arc fault detection technique and the Protection device-based techniques were used generally. But more effective fault diagnosis techniques are required for PV arrays. The proposes a novel method for reducing the partial shading condition in solar PV system connected to a grid which consists of a discrete time-based particle swarm optimization (PSO) controller that controls the irradiation or partial shading as well as any short circuits in PV cell. Hence, this proposed work enhances with producing efficient energy by achieving high predictive accuracy of about 99%, high efficiency of about 98.9% and low THD (0.9) under partial shading conditions as well as harmonics.

Keywords Photovoltaic · Solar · Partial shading · Harmonics · PSO controller · Discrete time model

1 Introduction

Today's world PV energy plays a pivotal role in the renewable energy system and it is very essential for PV based system. As the renewable and non-polluting energy is demanding need for preventing the atmosphere from polluting and the fastly depleting fossil fuels, many researchers have tried to unearth the advancement in this field. (Wim et al. 2019; Kannan et al. 2016). Therefore, an exclusive system was built to enhance PV energy and detect potential system defects such as ground defects, line-by-line defects, and arc defects (Alam et al. 2015; Saleh

et al. 2015) which were investigated by a wide range of experts. A different calculation is used to secure over current assurance gadget, ground issue insurance gadget and blocking diodes (Stellbogen et al. 1993). Since some temporary faults are possible like partial shading faults and irradiation faults. These issues create some problems like reducing output power, efficiency, harmonics, and non-linear current, non-linear voltage (Sangwongwanich et al. 2017; Kasem Alaboudy 2020).

In this proportional integral (PI) current controller algorithm is used for 3 level inverters with (threshold) THD level 12.85% and 5 level inverters with THD level 6.8% (Fadhela et al. 2019). This method achieves success rate of 87.38% (Souroy Roy et al. 2018), but all these identification and harmonics mitigation methods (Abdel-Salam et al. 2018; Kulkarni et al. 2013) are not efficient. So, we are using a new proposed method namely a harmonically identification method and minimizing the harmonics level under IEEE Code 519-2014.

In this paper Sect. 2 represents various existing method used in partial shading condition in grid system whereas Sect. 3 describes the proposed system, which gives a clear

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Stochastic distribution controller for wind turbines with doubly fed induction generator(Article)(Open Access)

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Abstract

The major purpose of this work is to design the controllers for controlling the variable speed, variable pitch wind turbine (WT) with doubly fed induction generator (DFIG). Vector control strategy is adopted for controlling the DFIG active and reactive power. Generator torque is control to provide the regulated real power with minimum fluctuation. The fixed gain proportional-integral (PI) controller designed to the converter of rotor side and grid side has limited operating range and inherent overshoot. Gain scheduling PI controller is designed to minimize the overshoot and fluctuation exists in proportional-integral controller. Since DFIG based wind energy conversion system (WECS) works in uncertain wind speed, stochastic distribution control (SDC) method is proposed to control the probability distribution function (PDF) of DFIG based WECS. It copes with nonlinearities in the WECS and contiguous variations at operating point and provides satisfactory performance for the whole operating region. It improves the performance together with power quality of generated electric power thereby maximizing the lifespan of installation and ensures secure and acceptable operation of the DFIG based WECS. © 2021 River Publishers

Author keywords

PI controller Probability distribution Reactive power control Stochastic processes Wind turbine

Indexed keywords

Engineering controlled terms:

Asynchronous generators Controllers Distribution functions Electric fault currents Energy conversion Power quality Stochastic systems Two term control systems Wind Wind power Wind turbines

Engineering uncontrolled terms

Active and Reactive Power Doubly fed induction generator (DFIG) Doubly fed induction generators Proportional integral controllers Stochastic distribution control Variable-pitch wind turbines Vector control strategies Wind energy conversion system

Engineering main heading:

Electric machine control

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Article

The Motivation for Incorporation of Microgrid Technology in Rooftop Solar Photovoltaic Deployment to Enhance Energy Economics

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Abstract: Deployment of rooftop solar Photovoltaic technology in domestic premises plays a significant role in accomplishing renewable energy transformation. The majority of domestic consumers still do not have a positive perception about adopting rooftop solar PV technology, due to its high capital cost and prolonged payback period. In this aspect, the proposed work identifies the factors causing energy deprivation in the present distribution and utilization system. To explicitly express the importance of the present work, an extensive case study based on an Indian scenario has been carried out to investigate where the losses occur in the existing distribution system and how the solar power and its storage system have been ineffectively utilized. The deep investigation has thrown light on several issues that lead to the performance deterioration of PV technology. Finally, in this work, a scheme to incorporate hybrid microgrid technology in the domestic distribution network has been proposed to effectively manage the distribution system and to efficiently utilize solar power and its storage systems. The real-time electricity tariff data have been taken for cost comparison and payback period calculations to prove the effectiveness of the proposed method. Crucial comparisons have been presented based on energy saving and carbon dioxide CO₂ emission reduction strategies.

Keywords: distribution system; solar PV; energy storage system; hybrid microgrid; conversion loss reduction; CO₂ emission reduction; payback period

1. Introduction

The world as a whole is on a trajectory towards the exhaustion of fossil fuels [1]. When that unavoidable exhaustion has been accomplished, possibly around the end of this century, whatever electrical energy is consumed by the civilization must be derived from renewable resources, which means that the sophisticated electricity-on-demand to which we have been accustomed, will be lost [2]. Numerous researches have been accomplished in the field of renewable energy. Especially, research regarding renewable energy potential in a geographical location is much needed to promote renewable energy penetration [3–5]. For instance, studies such as [6,7] focusing on India's renewable mix, renewable harnessing potential, political aspects are highly needed to drive the decisions towards renewables [8]. Apart from it, due to seasonal variations and intermittency characteristics of renewable energy, accurate predictions of various renewable energy resources are pivotal [9]. Distributed generation systems have been gaining importance and renewable energies are getting a bigger ratio within energy production [10–13].



Document details - Experimental validation of solar panel integrated modified three-port active clamp flyback converter fed micro-inverter

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Experimental validation of solar panel integrated modified three-port active clamp flyback converter fed micro-inverter(Article)

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Abstract

In this paper, a photovoltaic (PV) tied modified three-port active flyback converter (MTPACFC) operated three-phase micro-inverter is presented to provide enhanced voltage gain with fewer components. The proposed micro-inverter transfers the power generated on the 12 V PV power generation system to 400 V, AC grid. Generally, the DC-DC converter designed with an active clamp circuit provides improved power transfer capability to transfer the power from the PV array. The conventional active clamp flyback converters are designed to offer a limited boost factor for the input voltage. The recommended three-port altered flyback converter is intended to offer double boosting for the input voltage with extended performance. Besides, a synchronous reference frame theory with an artificial neural network based grid side controller is adapted to provide low total harmonic distortion at the point of common coupling. The outcomes of the simulated and test models are introduced to approve the boosting capacity and performance of the proposed MTPACFC. © 2020 IOP Publishing Ltd

Author keywords

[DC link voltage control](#) [Dual input and dual output artificial neural network](#) [Modified three-port active clamp flyback converter](#) [Photovoltaic tied three-phase micro-inverter](#) [Synchronous reference frame theory](#)

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[DC-DC converters](#)

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Parameter Optimisation of FACTS using Cuckoo Search Algorithm for ATC Enhancement in Restructured Power Systems

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Abstract – In electrical industry, deregulation intended at creating economical markets to do business with electricity. Many utilities provide transaction services for wholesale customers, they must know about the post information on ATC of their transmission networks. Such information will help power marketers, sellers and buyers in reserving transmission services. ATC must be rapidly updated for new capacity reservations. Various mathematical models have been developed by the researchers to determine the ATC. ATC is an impending question in the conceptualization of deregulation in addition to congestion management and pricing. This research work follows a line of investigation of calculating ATC using AC- power transfer distribution factors (AC-PTDF) and its enhancement using flexible AC transmission system (FACTS) devices like static compensator (STATCOM) and unified power flow controller (UPFC). This solution eliminates extravagance in erecting new transmission system. FACTS devices whose settings are optimized using cuckoo search algorithm (CSA) are placed by accounting sensitivity of lines to provide reactive power that recuperates the ATC of the desired line. Undoubtedly, it is very important and imperative to carry out studies on exploitation of FACTS technology to enhance the ATC. The Bilateral and multi-lateral transactions are randomly chosen and tested in IEEE 30 and sample 6 bus system.

Keywords – AC- power transfer distribution factor, bilateral and multi-lateral transactions, open access, slope of linear sensitivity factors.

1. INTRODUCTION

Since many utilities provide transaction services for wholesale customers, they must know about the post information on ATC of their transmission networks. ATC must be rapidly updated for new capacity reservations, schedules or transactions, various mathematical models have been developed by the researchers to determine the ATC of the transmission system. AC-PTDF technique is adopted to determine ATC by Manikandan *et al.* [6] FACTS devices are employed to enhance them is acknowledged by Ashwani *et al.* [1]. The PSO algorithm is used to obtain the optimal settings of FACTS devices for enhancement of ATC is approached by Bavithra *et al.* [4] and same by modified PSO is dealt by Jeslin *et al.* [5]. CSA is proposed and engaged to solve electrical issues by Basu *et al.* [3], Ramin *et al.* [7]. The security issues are also accounted by abdelaziz *et al.* [2]. This paper aims at determining ATC using AC-PTDF technique and enhanced them using STATCOM, UPFC whose optimal

settings are obtained using CSA thus evading significant concern of deregulation.

2. METHODOLOGY

2.1 ATC computation by ACPTDF Methodology

The PTDF measures the sensitivity of line real power flows to a real power transfer. PTDF of line i-j for transaction m-n is given as:

$$PTDF_{ij,mn} = \Delta p_{ij} / p_{mn} \quad (1)$$

Where, P_{mn} is the transacted power flow between seller bus m and buyer bus n.

$$\Delta P_{ij} = \left[\frac{\partial P_{ij}}{\partial V_i} \right] \Delta V_i + \left[\frac{\partial P_{ij}}{\partial V_j} \right] \Delta V_j + \left[\frac{\partial P_{ij}}{\partial \delta_i} \right] \Delta \delta_i + \left[\frac{\partial P_{ij}}{\partial \delta_j} \right] \Delta \delta_j \quad (2)$$

Equation 2 may be written as:

$$\Delta P_{ij} = \left[\frac{\partial P_{ij}}{\partial \delta_2} \dots \frac{\partial P_{ij}}{\partial \delta_n} \frac{\partial P_{ij}}{\partial V_2} \dots \frac{\partial P_{ij}}{\partial V_n} \right] * \begin{bmatrix} \frac{\partial \delta_2}{\partial V_2} \\ \vdots \\ \frac{\partial \delta_n}{\partial V_2} \\ \vdots \\ \frac{\partial V_n}{\partial V_2} \end{bmatrix} \quad (3)$$

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Predicting Diabetes Mellitus Using Modified Support Vector Machine with Cloud Security

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ABSTRACT

Diabetes mellitus is one of the major concerned diseases that cause a large number of deaths every year. It is considered as the chronic disease which is caused by an increase in blood sugar. If diabetes remains unidentified and untreated, it creates more complexities. So, the early prediction of diabetes can reduce the fatal rate of a human. The data mining concept assists to diagnose diabetes. Various research studies are presented with various data mining algorithms for early prediction and disease diagnosis but still with lack of accuracy. At the same time, mining the diabetes data in a secure manner is one of the critical issues. To recover this issue, this paper designs the new model for early prediction of diabetes with high accuracy. This research explores the enhanced principal component analysis for efficient feature extraction from the dataset. To achieve the highest accuracy of classification, it has proposed the machine learning algorithm, namely, modified support vector machine (MSVM) which is used to detect the diabetes disease at an early stage. The main contribution of this research is to mining the patient's disease results in cloud security. For this security purpose, honey bee encryption and decryption algorithm is used. The performance measures of the proposed method are evaluated on various measures of accuracy, sensitivity, specificity, precision, and negative predictive value. Results obtained show the proposed MSVM classifier outperforms with the highest accuracy of 97.13%. We have compared the proposed methods with existing methods for proving our method has better performance.

KEYWORDS

Principal Component analysis; Support vector machine; diabetes mellitus; Honey bee encryption; decryption

1. INTRODUCTION

Diabetes mellitus (DM) is the most occurring metabolic disorder, which implied severe pressure in the health rate of humans. A large number of remarkable research studies have been done to detect/predict diabetes at the initial stage. This results in generating a huge amount of data. Data mining has a major role in diabetic research. The results that are generated using data mining are extensively deployed in further scientific research. This data mining would be an asset for researchers because it contains a large amount of diabetic-related data. This data mining approach comprises of three processes, namely Pre-processing, Feature extraction, and Classification. Pre-processing is an initial step of processing input data. Usually, the provided data should set bearable accuracy standard to get good prediction output. In order to get better quality data, data pre-processing should be done.

A large number of pre-processing techniques are widely used in predicting diabetes. In the pre-processing method, the inputted data should be scaled within a specified range. This, in turn, will improve the quality of data. Zhu *et al.* [1] proposed that during data pre-processing,

the inputted data are scaled such that it should fall within a specific range between [0, 1] where the normalization of data can be done. The databases used by hospitals and other diabetic centers are exposed to missing values, inconsistent values, and other noisy values, as the original data are coming from various sources. These data should be extracted, in order to maintain accuracy. This feature extraction can be achieved by employing various knowledge discovery methodologies. The final extracted data can be highly useful for further classification process easily. Sometimes, some data do not have their own class labels. So to find a specific function or specific model that explains and classifies the data classes or its concepts, such that data can be predicted easily, data classification is done.

Vidhyavathi [2] proposed principle component analysis (PCA)-based applications that were applied in image processing in the medical field which is DICOM-based. Enhancement of data visualization, outlier detections, and classifying new dimensions can be achieved by this algorithm. This algorithm is highly helpful in the case of learning without supervision. For prediction and data

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A Novel Battery Supported Energy Management System for the Effective Handling of Feeble Power in Hybrid Microgrid Environment

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ABSTRACT One of the crucial challenges in the present power distribution system is the conversion loss phenomenon. Modern microgrid integrates various converters for varieties of applications, such as distributed power generation interconnection, energy storage management system, grid integration, demand management, etc. The increased usages of power converters further worsen the existing situation. Any initiatives taken towards energy conservation go in vain due to the excessive conversion loss phenomenon in the present distribution schemes. In this regard, a novel microgrid energy management scheme is proposed and developed to reduce the conversion losses in the residential distribution system. It uses a new control algorithm that finds the strength of power available in the DC side before being transferred. The conversion process is invoked only if the power is adequate, and if found feeble, then the conversion process is withdrawn and stored in an auxiliary battery. Conversion of feeble power would result in high loss across the converters and transformers. In this scheme, the AC loads are supplied by the utility grid, and the DC loads are fed by a solar PV and an auxiliary battery bank. The power conversion is done only during unavoidable circumstances. A prototype hardware setup has been developed, and the objective of the proposed research task has been validated. Further, the proposed scheme would gain importance in reducing the cost of the electricity for a time-of-use tariff system by optimization. A genetic algorithm is proposed to optimize the energy management of the microgrid system.

INDEX TERMS Battery based energy management system, solar PV, hybrid microgrid, conversion loss reduction, energy saving.

I. INTRODUCTION

One of the important challenges in the present power distribution system is the conversion loss phenomenon. Nowadays, the usage of DC appliances has been increasing significantly. In this scenario, there is a remarkable increase in the usage of DC operated equipment in daily lives [1]. Usually, the DC loads are plugged into the AC terminals due to the unavailability of separate DC supply systems at

the consumer premises. The AC power is customized using converters for various DC load requirements and it results in multiple conversions. The conversion losses and harmonics produced by the converters are significantly increasing day by day and polluting the power system network. These conversion processes render an average power loss of 10-30% [2]. Further, the photovoltaic (PV) systems generate DC power. To respond to the growing use of DC systems, and to accommodate the low power distributed generation resources, the concept of microgrid has been evolved. The microgrid offers several advantageous features; it includes

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RESEARCH ARTICLE

WILEY

Market power analysis in power systems using PSO based must run indices

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Summary

The development of restructuring has encouraged and brought up competitive markets in power systems. However, the exercise of market power evokes monopoly into the power system and tends to decrease competitiveness. This article assesses the market power of a generating company in a power system using must run indices and proposes a method to mitigate market power. Modified must run generation, must run share (MRS) and nodal must run share indices are used to quantify the market power of generating companies. Phase shifting transformers (PST) are installed in selected lines for mitigating the market power. Particle swarm optimization is used in the determination of must run indices and optimizing the angle of Phase Shifting Transformers. IEEE 14 bus test system is used to illustrate the proposed technique. The analysis also includes the impact of contingencies. Sensitivity analysis is performed to analyze the impact of phase shifting angle variation on MRS. The results clearly quantifies the market power of a generating company and show that the market power incurred by the generating companies can be minimized by installing PST with optimum phase shift angle.

KEYWORDS

generating company, market power, must run share, nodal must run share, particle swarm optimization, phase shifting transformer

1 | INTRODUCTION

The global electric power industry is undergoing significant changeover in its vertically integrated structure to unbundled structure which is termed as restructured or deregulated power systems. This changeover has encouraged competitiveness in the electricity market and offers multiple options for the consumers. Conversely, the exercise of market power in the system encourages monopolistic structure. Market power, the antithesis of competition, is defined as the ability of a seller or a group of sellers, to maintain prices over a competitive level and control the total output or eliminate competitors from the market for a significant period of time. This reduces the competitiveness, quality and development in the field of power systems technology.¹ Hence, it is important to analyze the impacts of market power in power systems and reduce its severity.

Several researchers have analyzed the impacts of market power in restructured power systems.¹⁻¹² In broader sense, the major sources of market power in the power industry are market dominance and transmission constraints.² Several indices and methodologies have been proposed to analyze and quantify the market power in the system.²⁻¹² A fuzzy

Detection and estimation of grid-connected issues in quasi-Z-source inverter based photovoltaic system using robust parametric methods

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Abstract: This study presents robust parametric methods for the detection and estimation of grid-connected issues such as islanding, harmonics, and interharmonics. The power system signals are time varying owing to the intermittent nature of renewable energy sources. IEEE and IEC consider signals as stationary, which are negated in a future scenario. Therefore, parametric methods need to be applied for the estimation of these signals. In this study, parametric methods such as estimation of signal parameters via rotational invariant technique (ESPRIT) and multiple signal classifier are implemented in a grid-connected quasi-Z-source inverter, for the mitigation of the aforementioned grid-connected issues. Additionally, a novel ESPRIT-aided support vector machine (ESPRIT-SVM) is proposed for harmonics estimation. A comparative study is also conducted on the different parametric methods using MATLAB/SIMULINK. The proposed method is verified for application in various scenarios such as power mismatch, load switching, and capacitor switching. The simulation results of the proposed ESPRIT-SVM are validated through real-time experiments.

1 Introduction

In today's scenario, renewable energy sources (RES) such as the solar photovoltaic (PV) and wind have become inevitable for power generation. Integration of PV into utility grids is more advantageous as it generates more power. However, integration of RES onto the utility grid should ensure the safety and reliable operation of the installed PV system [1]. The two crucial factors in the integration of RES onto the utility grid are the grid interconnection issues and the extension cost factor. The grid interconnection issues such as islanding, harmonics, and inrush current should be effectively handled to ensure safe and reliable operation of the system.

The integration of PV into the utility grid requires a power electronic interface (PEI) to convert the power from DC to AC. PEIs such as inverter and converter are nowadays important candidates for grid interconnection. However, conventional voltage source converters and current source converters are still widely used as PEIs.

However, conventional converters suffer from limitations such as it either buck or boost the input voltage [2]. Therefore, they are not suitable for PV applications as solar power is intermittent in nature, and PV voltage is unpredictable. Hence, converters with both buck and boost capabilities are suitable for PV applications. Impedance source inverter is one of the promising technologies for PV applications, as it converts DC to AC directly without the need of an additional DC–DC converter. The Z-source inverter comprises an impedance network followed by a voltage source inverter (VSI). The Z-source inverter, however, draws discontinuous current from PV. The modified topology of Z-source inverter is the quasi-Z-source inverter (QZSI), which is advantageous over the Z-source inverter as it draws a continuous current from the source, which is the main constraint for RES [3]. Furthermore, QZSI has a high voltage gain and high boost factor and also reduces voltage stress [4, 5]. When integrating RES into the utility grid, numerous grid-connected issues may occur; islanding, harmonics, and inrush current being the major issues. Islanding is a condition in which the distributed generation (DG) continuously supplies power to the load even when the utility grid fails. This condition is hazardous to the system because there is an unbalance between generation and demand, and therefore, there is

a violation in frequency regulation. Frequency deviation is a major issue in the power generation system. Therefore, an islanding condition must be detected immediately to disconnect the DG from the grid. The islanding techniques are classified primarily as remote and local islanding detection methods. The remote islanding detection method is based on communication between the grid and DG. The main remote islanding detection methods are power line communication and supervisory control, and data acquisition methods. The islanding detection method is reliable, but requires expensive infrastructure. Furthermore, there is a risk of communication collapse. Therefore, local measurements are required for islanding detection. These local methods can be classified into passive and active islanding detection methods. The former is based on the point of common coupling voltage (PCC) measurement. Over/under frequency protection, rate of change of frequency, over voltage protection, phase jump detection, and so on are some of the passive islanding detection methods. This method detects the islanding situation by continuously monitoring the PCC parameters and is simple and reliable. However, at a perfectly matched load condition, i.e. when a minor power mismatch occurs, it is unable to detect the island or delay the islanding detection time. It also has a large non-detection zone (NDZ). Additionally, it is exceedingly difficult to set the threshold values for tripping the relay. It is, however, widely used in the synchronous DG. The active method is based on reactive power mismatch. In this method, a disturbance is added to the DG parameters and thereafter, the grid impedance, current, frequency, and reactive power for detect the islanding are observed.

It is well suited for inverter-based DGs. It is free from NDZ, but it affects the power quality of the system. It is also inconvenient to maintain the balance between the harmonic distortion and power quality in these methods [6]. Hence, estimation of signal parameters via rotational invariant technique aided support vector machine (ESPRIT-SVM) method is proposed in this paper to overcome the above limitations. The PEI may inject harmonics and interharmonics into the system, leading to adverse impacts on power quality [7]. Harmonics is the integer multiple of system frequency and interharmonics is the non-integer multiple of system frequency. Interharmonics with a frequency of a non-integer multiple can occur due to the intermodulation between the

APPLICATION OF HEURISTIC METHOD IN DUAL-HESITANT FUZZY TRANSPORTATION PROBLEM

G. JOTHILAKSHMI¹, S. KRISHNA PRABHA, AND P. THIRUMURUGAN

ABSTRACT. Different methodologies and theories were originated in long term research challenge to pact with ambiguity in factual world issues. To handle the ambiguity in various categories of problems, a broad assortment of tools are developed by fuzzy sets further with their expansions, corresponding as, interval-valued fuzzy sets, Atanassov's intuitionistic fuzzy sets and type-2 fuzzy sets etc are introduced. In order to covenant with the hesitant circumstances that are scarcely considered by the prior contrivances a novel extent of fuzzy set namely hesitant fuzzy sets has been established. Dual-hesitant fuzzy set is applied for handling imprecise, hesitant or imperfect facts and expertise circumstances in factual-existence effective investigate predicaments. So far many researchers have applied different methods like North West corner method, least cost method, Vogel's approximation method, allocation table method to solve various fuzzy transportation problems so as to find the optimum elucidation. In this work an innovative technique named as Heuristic Method for unraveling dual-hesitant fuzzy transportation problem is established. An arithmetical exemplar is illustrated with the new technique and the result obtained through this method is compared with the existing methods. This proposed method gives an optimum solution.

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Key words and phrases. score function, dual-hesitant fuzzy transportation problem, Heuristic Method, dual-hesitant fuzzy numbers.

Demonstration of a simple encapsulation technique for prototype silicon solar cells

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Abstract

The impact of encapsulation on solar photovoltaic (PV) modules includes insulation and protection, which alters the device performance as a function of wavelength of incoming light. Most lab-scale PV research ignores these features, but with a promising rise in front surface spectral conversion mechanisms, methods of optical enhancement and biomimetic layers makes this oversight unacceptable. To enable encapsulation of lab-scale PV, this study evaluates a simple encapsulation method. Multi-crystalline silicon (mc-Si) wafers were encapsulated using a pouch laminator and compared with a (poly)-methyl methacrylate (PMMA) front coated cell and an unencapsulated control cell. The cell's diffuse reflectance with the encapsulant exhibits better photon absorption in UV region, which is verified from improved external quantum efficiency. Despite the loss of a small percentage of visible



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Original research article

Facile Synthesis of ZnO/AC Nanocomposites using *Prosopis Juliflora* for Enhanced Photocatalytic Degradation of Methylene Blue and Antibacterial Activity

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ABSTRACT

A facile synthesis of ZnO/activated carbon (ZnO/AC) nanocomposites has been made using the stem of *Prosopis Juliflora* by one-pot synthetic method. These composite materials have been characterized by various techniques such as X-ray diffraction (XRD), Fourier transform-infrared spectroscopy (FT-IR), Scanning electron microscopy (SEM), Diffuse reflectance spectroscopy (DRS) and Photoluminescence (PL) respectively. The morphology of ZnO nanocrystal exhibits flower like architecture with controlled size and shape. The photocatalytic performance of ZnO/AC has been analyzed with different proportions (1%, 3%, 5%) on methylene blue (MB) dye under ultraviolet radiation. The photocatalytic activity is greatly influenced by band gap, crystal size and surface oxygen vacancies (SOV) of the nanocomposites. The rate of photodegradation is 92.2 % at 45 min for 3% carbon in ZnO/AC material and it is 10% higher than that of pristine ZnO. Moreover, the photo degradation of MB has been investigated with various pH like 2.5, 3.5, 7, 8.5, 9.5 and the adsorption efficiency of ZnO based on surface zero point charge in acidic and basic medium has been discussed. Additionally, the antibacterial activity of the ZnO/AC nanocomposites has been carried out against *Pseudomonas aeruginosa* and the result shows improved antibacterial activity with the increase in carbon percentage.

1. Introduction

The wastewater from various industries contains toxic organic pollutants which cause severe environmental pollution [1,2]. The organic dyes present in the effluents are hard to degrade, due to their chemical stabilities. Many processes, including adsorption [3], chemical oxidation [4], ion-exchange [5], reverse osmosis [6], precipitation [7], biological [8] and photocatalytic treatments have been developed to treat the organic dye contaminated in water [9]. Among the methods proposed so far, semiconductor based

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Photocatalytic removal of cationic and anionic dyes in the textile wastewater by H₂O₂ assisted TiO₂ and micro-cellulose composites

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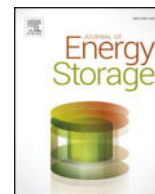
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Abstract

The present study investigated the photocatalytic degradation of cationic (Methylene Blue and Methyl violet) and anionic (Acid violet) dyes present in textile effluent. The banana pseudostem derived micro cellulose (MC) and titanium dioxide (TiO₂) composites were synthesized and characterised by X-Ray Diffraction (XRD), Fourier Transform Infrared (FT-IR), Diffused Reflectance Spectroscopy (DRS), Scanning Electron Microscope (SEM) and Transmission Electron Microscopy (TEM). The composite material showed microcrystalline anatase phase of TiO₂ with a crystallite size of ≈ 6 nm. The TiO₂ + MC composite were applied to batch reactor for the abatement of dyes in the presence of sunlight. The operational parameters such as pH and initial dye concentration were optimised for complete decolourization of dye molecules. The results of the study demonstrated that the combined hydrogen peroxide assisted photocatalytic degradation (TiO₂ + MC + H₂O₂) removed 99 % of Methylene blue (200 mg/L) dye in 150 min with 72% of COD reduction. Whereas, 6 and 7 hours reaction time was required for the complete degradation of Acid violet and methyl violet dyes. The synergy index of combined hydrogen peroxide assisted photocatalytic degradation was 3.54 which suggested positive synergism. The dye degradation mechanism is projected as through the combination of adsorption and direct photocatalytic oxidation by TiO₂ + MC composite and oxidation by hydroxyl radicals (OH•).

Keywords: Methylene Blue, Photocatalytic oxidation, Micro-cellulose, Titanium dioxide, Textile effluent



Characterisation and stability analysis of eutectic fatty acid as a low cost cold energy storage phase change material

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ABSTRACT

Phase Change Material (PCM) is one of the most promising material for storing thermal energy and supplying the stored energy for cooling applications but low cost, easily available PCM are quiet less. The present work focused on the development of a suitable eutectic PCM for low temperature applications like building cooling, based on organic fatty acids, capric acid (CA) and myristic acid (MA) in the mass ratio of 85:15 and investigating their thermal properties, chemical and thermal stabilities by using by using DSC, FT-IR, TGA and KD2 Pro. Thermal cycle test were also investigated through developed thermal cycle equipment. The properties were also compared with their individual fatty acids. From the DSC test, the latent heat capacity was determined as 156.99 J/g and the phase change temperature as 20.86 °C. Thermal conductivity of liquid CA-MA PCM was measured as 0.152 W/mK. Thermal gravimetric analysis results revealed that the eutectic PCM had high thermal stability. Fourier Transform Infrared spectroscopy (FT-IR) revealed that the binary eutectic mixture had good chemical stability. Thus, the new low-cost, CA-MA eutectic PCM possessed high latent heat for low temperature with good thermal and chemical stabilities making it a potential phase change material for cold energy storage applications.

1. Introduction

Globally fossil fuels are dominating the world energy market, and it is forecasted that fossil fuels will continue to produce 75–80% of the world's primary energy by 2030 [1]. Worldwide environmental concerns (climate change, global warming, etc.) due to fossil fuel usage and dwindling reserves of these fuels have increased attention to reduce their consumption in all economic sectors of the world. About 30–40% of the primary world energy are consumed by the building sector and it is responsible for one-third of greenhouse gas emissions (responsible for global warming) around the world [2].

For adaptation to climate changes, one must consider the significance of air conditioners (A/Cs) in mitigation of human vulnerability due to unpredictable global warming. percentage of households that have air-conditioning units will increase to nearly 99.9% by 2100, from its current 2% [3]. Less pollution of the environment and less CO₂ emissions lead to a decrease in global warming, scientists and engineers around the world are constantly exploring alternative energy sources to reduce the usage of fossil energy sources and their impact on the environment. Energy generation is equally important as the energy conservation and energy storage. The energy storage system offers a tangible solution to reduce the energy demand gap and supply, can also

increase the reliability of energy usage, it can also lead to better economics, reducing investment and running costs [4,5].

Reliable energy storage can be achieved by Thermal Energy Storage (TES), which uses a storage medium for storing excess thermal energy when available and releasing it whenever it needs. During the charging process, the available thermal energy can be accumulated into a storage medium by melting process and during the discharging process, the stored thermal energy is retrieved and supplied for the end-user from the storage material due to solidification [6]. Commonly used TES methods are sensible storage and latent storage. The sensible storage system is based on specific heat capacity and the temperature differences. The latent energy storage system is based on phase transition and is currently gaining more attention because of its high energy storage density of 5–14 times higher than sensible storage due to phase change at isothermal condition during energy storage and retrieval [7].

The latent Heat Thermal Energy Storage (LHTES) has the advantages of high energy storage density, small mass density, and small temperature variation. The use of PCM can provide higher heat storage capacity and more isothermal behaviour. PCM had been classified into: Organic, Inorganic and metallic compound. Organic compounds such as paraffin, fatty acids, etc. and are widely used in building, off-peak electricity load conditions and heat exchanger [5]. An Inorganic

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Preparation and Characterization of Low cost eco-friendly GAO grafted bio-carbon nanoparticle additive for enhancing the lubricant performance

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Abstract

Primary energy losses in any mechanical systems involving relative movements are due to friction. It is suppressed with the use of lubricating oils, but certainly not enough for effectively reducing the friction in the system. Therefore, it is necessary to increase the tribological characteristics of the lubricating oil. To enhance the tribological characteristics, it is necessary for the additives added to the lube oil have the antioxidant property. Considering this in mind, in the present research work, low cost and environmental friendly Green Antioxidant (GAO) grafted bio-carbon nanoparticles were prepared (high energy ball milling) and the structural and thermal properties were completely analyzed using FE-SEM with EDAX, XRD, ATR-FTIR, DLS, BET and TG-DTA. Based on the study, the 27 hours milled GAO grafted bio carbon nanoparticles were found to have larger surface area, non-polar functional group, better crystalline nature and longer thermal stability. As a result, it was chosen for further investigation of tribological characteristics in lubricant. At end of the tribological study, 0.3 wt. % of 27 hours milled GAO grafted bio-carbon nanoparticles mixed lubricant showed excellent enhancement in tribological performance than conventional lubricant by reducing the co-efficient of friction and wear about 195.23 % and 131.83 % respectively.

Keywords

Green antioxidant (GAO) grafted nanoparticles

Characterization

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Tribological effect



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Experimental investigation on thermal behavior of graphene dispersed erythritol PCM in a shell and helical tube latent energy storage system

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ABSTRACT

Thermal conductivity of the Phase Change Materials (PCMs) of latent heat storage systems is enhanced by dispersing nanoparticles in base PCM for increased heat transfer rate. Heat transfer characteristics of the newly developed erythritol PCM dispersed with 1 wt% graphene nanoparticles in a newly designed shell and helical tube storage tank during charging and discharging processes was investigated. Both melting and solidification fronts progressed from the outer wall of the shell towards the axis on either side of the axis of the shell due to the helical tube arrangement. At the middle and near the axis of the storage tank, NDPCM melting time was decreased by 21% when inlet temperature of the hot therminol oil was increased from 160 °C to 180 °C and by about 30% when the oil flow rate was increased from 0.5 kg/min to 2 kg/min. Further, NDPCM solidification time was reduced by 11% when the cold therminol oil inlet temperature was decreased from 45 °C to 30 °C and by 20% when the oil flow rate was increased from 0.5 kg/min to 2 kg/min. Complete charging and discharging periods of NDPCM was reduced respectively by 20% at an inlet temperature of 180 °C and by 6% at an inlet temperature 30 °C for 1 kg/min flow rate of therminol oil compared with pure erythritol. This research study confirmed that the helical tube flow of heat transfer oil facilitated more uniform and quicker phase transition of PCM and graphene nanoparticles dispersed erythritol (NDPCM) had superior heat transfer behavior as compared to base erythritol and it can be utilized as a potential PCM for medium temperature thermal energy storage applications.

1. Introduction

The increasing energy demand and decreasing conventional energy sources push the world to exploit new and renewable energy sources, and to conserve or store energy in every possible means; it amounts to saving equivalent amount of energy from any energy sources. Latent heat storage is one of the thermal energy storage methods which uses phase change materials (PCM) that can store/release a high amount of latent heat during the charging/discharging process [1]. The use of a latent heat storage system is an effective way for storing thermal energy and has the advantages of high-energy storage capacity with less volume and constant temperature heat storage process compared to sensible heat storage systems [2]. Solid-liquid PCMs had been widely applied in LHTES systems to store waste heat and adjust environmental temperatures. The use of solid-liquid PCMs in LHTES systems is regarded as an effective way to contribute energy efficiency solutions to solve the energy crisis [3]. Heat transfer rate is an important factor to determine the

efficiency of LHTES applications like solar energy system, buildings, cooling system, textiles and heat recovery system. The enhancement of thermal conductivity is an effective way to improve the overall performance of LHTES [4]. Studies of medium temperature latent heat thermal energy systems to be applied for hot-side thermal energy storage systems are few [5]. Though PCMs offer high energy density, they suffer from slower rates of melting and solidification due to low thermal conductivity [6]. The various techniques used to enhance the thermal performance of the LHTES system are [7] a) using extended surfaces, b) employing multiple PCM methods, c) thermal conductivity enhancement by high conductivity materials, d) micro-encapsulation of PCM. In order to design and develop energy-efficient LHTES, the nanoparticles are used to increase the thermal conductivity and heat transfer rate [8]. The temperature response in paraffin PCM with open-cell metal foam was much higher and temperature distribution was more uniform compared to pure paraffin and it also can dramatically enhance the efficiency of latent heat thermal energy storage system [9]. Embedding metal foam into phase change materials can improve the temperature

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Research Article

Photovoltaic Module with Uniform Water Flow on Top Surface

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Though the solar photovoltaic (PV) module is used for power production, it usually works at high temperatures, decreasing its efficiency and therefore its output. So if an effective cooling method is to be implemented, it would reduce the heat from the solar PV module and increase its power production. Significant research in water cooling on both top and bottom surfaces of the PV module widen the scope for uniform cooling with constant module temperature throughout at any instant. In this work, uniform flow is maintained by means of overflow water from a tank fitted on the top of the PV module. Experiments were carried out with and without cooling. Performance parameters in terms of power output and efficiency have been presented for the PV module without cooling and cooling with three different mass flow rates. The results show that there is a significant rise in efficiency of the PV module by reducing its temperature. An accelerated output power of 23 W has been observed for a higher mass flow rate of 5.3 kg/min which is 15% higher than the photovoltaic module operating without cooling. Results were compared with previous researchers' work and found to be a good enhancement. Theoretical results agree well with experiments.

1. Introduction

Photovoltaic module operating temperature, ambient conditions, band gap of the semiconductor, solar irradiation, and module materials are the key factors affecting its performance. During operations, only 15-20% of incident solar radiation is trapped for electricity, and the remaining is rejected as heat. Cooling of the PV panel would provide a good solution to this problem if it could be implemented efficiently and at reasonable cost. Air, water, refrigerant, and phase-change materials are the most common cooling mediums used so far. Research work was carried out on cooling on both the top surface and the bottom surface of the PV module using different fluids like air, water, and water mixed with nanofluids.

1.1. Bottom Cooling. Rahman et al. [1] discussed various parameters like dust, humidity, temperature, and irradiation

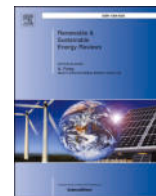
intensity which are the influencing parameters in the efficiency of the PV module. The authors used finned and tube-type heat exchangers on the back side of the PV module. Results showed that efficiency of the PV module is directly proportional to the cooling water flow rate and reduction in module temperature and inversely proportional to the reduction in humidity and dust accumulations. Results were compared between a PV module with cooling and one without cooling for different irradiance. It was found that the module efficiency decreases 0.06% for every 1°C rise in module temperature. Due to the effect of cooling, the output power increased to 8.04 W and efficiency increased to 1.23%.

Bahaidarah et al. [2] developed a numerical model to predict the effect of electrical and thermal parameters on performance of the PV module. An experimental study on performance of the PV module by means of bottom cooling was also conducted. The numerical model results were found



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Nano-enhanced phase change materials and fluids in energy applications: A review

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ABSTRACT

This paper provides a review of nano-enhanced phase change materials (NEPCM) and nanofluids incorporated in experimental systems, i.e. different applications. The effect of the added nanomaterials on the main thermal properties was also discussed and analyzed in detail. According to the provided review, it was found that the addition of nanoparticles improves specific thermal properties of nano-enhanced materials. The thermal conductivity can be increased by between 20% and 100%, with respect to the base fluid. Other general thermal properties are slightly reduced such as latent heat, while for specific heat capacity the results are variable. Regarding applications, thermal energy storage systems as well as cooling systems for photovoltaics (PV-NEPCM) were investigated the most based on the existing literature. The gained results revealed that important data are missing and are related to the general preparation process of nano-enhanced materials. The economic as well as environmental evaluation of nano-enhanced systems is not covered well and addressed in the existing research findings. Safety issues and guidelines for handling nano-enhanced materials are also not properly addressed in the existing literature. Specific issues and future research directions were also discussed and linked with implementation of nanomaterials for considered applications and circumstances.

1. Introduction

The application of nanomaterials has been intensively investigated in recent years since they have great potential for technical advancements, and more importantly, they provide benefits which can be linked with the implementation of nanomaterials for various purposes, [1]. Nanotechnology can be implemented in different technological fields such as IT technologies, medicine, novel materials, food safety, etc. Specifically, energy related field is one of the most interesting fields of nanotechnology, since applications of nanomaterials can lead to noticeable technological improvements in different useful engineering applications, such as production of biofuels [2], or for the cooling of the automotive radiators [3]. Nanoparticles and their applications have been widely investigated in recent years due to numerous potential implementation areas. Selected applications will be addressed in the continuation of this paper to get a deeper insight into the potential implementation area of nanotechnology. The main direction of the here

in conducted research work was focused on the energy related field.

The application of binary nanofluids for solar absorption refrigeration was reported in Ref. [4]. The investigation was focused on photo-thermal conversion efficiency in laboratory conditions with the utilization of a solar simulator. Nanoparticles in a concentration of 50 wt % lithium bromide with 50 wt% of water were considered. The results revealed that the addition of the previously specified nanoparticles can lead to the improvement of light trapping efficiency, and by that can cause an increase in the bulk temperature. The detected efficiency enhancement ranged from 4.9% to 11.9%, where it was concluded that the considered nanoparticles are suitable for solar absorption cooling applications. The potential application of nano-improved materials for thermoelectric generation was analyzed in study [5]. A nanostructured bulk alloy with added 0.1 vol% of SiC nanoparticles was considered with respect to the examination of the Seebeck and Thomson effect. The heat conduction and heat transfer loss into the surroundings were also investigated. According to the provided analysis, it was confirmed that

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Online coding event as a formative assessment tool in introductory programming and algorithmic courses—An exploration study

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Abstract

Information technology is an integral part of current education, even in non-computer disciplines. As the role of Information technology-based education tools is recognized as significant in the education of millennial learners, there is a development of different types of tools and techniques in education. Usage of such tools in content delivery and assessment has been found to improve student engagement and active learning. When looking for unique tools to practice and assess computer programming and algorithmic courses, online coding events launched by popular forums have been identified as a tool for practice and assessment. These forums have been introducing new computing problems specified in a professional language, so that students get trained in programming these complex problems rather than the conventional problems. This article explores the possibility and success measure of integrating online coding events as a part of formative assessment. A study has been performed with two consecutive offerings of a course. The results obtained from the various forms of assessment are analyzed and presented in terms of correlation with summative and formative assessment scores and improved student performance. The results of the experimental study are found encouraging, thereby appreciating the usage of online coding platforms for introductory programming and algorithmic courses.

KEYWORDS

formative assessment, online coding, pedagogy, programming, student performance

1 | INTRODUCTION

Current technical education for millennial learners is expected to be supported with technology, as the learners are tech-savvy in nature [28]. Information Communication Tools and various pedagogical techniques have been the need of the hour when it comes to education. There is a large-scale development of different tools and techniques pertaining to education, such as Learning Management Systems (LMS), Student-responsive systems (SRS), and Quizzing Systems (QS).

These systems manage information in a centralized manner, store contents that can be readily accessible, and produce relevant analysis based on the performance. Usage of such systems reduces the manual effort required in managing classroom environments in terms of content delivery and assessment for any learning discipline, and it is hence promoted in higher education institutes. Active learning strategies like Poll, Think Pair Share, and One Minute paper, when practiced through the relevant tools, form a strong basis for formative assessments.

Quality Assessment of Standard and Customized COTS Products

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ABSTRACT

Software quality is a very important aspect in evolving strategy for IT vendors involved in commercial off-the-shelf (COTS) (also referred as packaged software) product development. Software metrics are widely accepted measures for monitoring and managing the quality in software projects. Enterprise resource planning (ERP) systems are COTS products and attempt to integrate data and processes in organizations and often require extensive customization. Using software quality metrics already established in literature, software quality attributes defined by the quality model ISO/IEC 9126 were evaluated for a standard and a customized ERP product. This will help the ERP team to identify the specific quality attributes that were affected owing to customization. This research study infers that there exists a considerable impact of ERP system customization over the quality of ERP product. The implications of the findings for both practice and research are discussed, and possible areas of future research are identified.

KEYWORDS

Commercial Off-the-Shelf (COTS), Customization, Metrics, Quality, Statistical Data Analysis

1. INTRODUCTION

Software quality is a very important aspect in evolving strategy for Information Technology (IT) vendors involved in Commercial Off-The-Shelf (COTS) (also referred as packaged software) products development. Software metrics are widely accepted measures for monitoring, and managing the quality in software projects. Enterprise Resource Planning (ERP) systems are such COTS products and attempt to integrate data and processes in organizations and often require extensive customization. Ensuring quality in an ERP system implementation is a major collective effort by the implementation partner, hosting provider, software vendor, and business and technical teams. Software quality metrics from the literature has been applied to a module of customized ERP in this study. The quality metrics of

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Document details - Dam break analysis of mullaiperiyar reservoir for environmental protection – A numerical approach

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Dam break analysis of mullaiperiyar reservoir for environmental protection – A numerical approach(Article)

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Abstract

We report here a computational model for the Mullaiperiyar dam (Kerala, India) and its dam-break phenomena. A total of 13 spillway gates were studied by Smoothed Particle Hydrodynamics (SPH) method. The hydrological computational parameters such as change in water velocity and pressure with distribution of flow have been studied and accordingly flood inundation mapping when the dam fails has also been plotted. The results of SPH reveal that the maximum pressure exerted on the dam for the full storage capacity is 610×10^5 Pa and the flow of water into the reservoir after dam failure is 45.152 l/s. From the flood mapping, it is evident that the total affected area is 91.41 km² which is huge promoting cataclysmic harm to the biotic and abiotic conditions. This Mullaiperiyar reservoir failure influenced a biological ecosystem of value of 11.41 billion. These outcomes are the first mesh free particle based approach to study spillway flow in three dimensions at Mullaiperiyar dam. Finally, we can conclude that SPH modelling approach could be a promising simulation tool for practical dam-break flow in engineering scale as a part of disaster and environmental protection program. © 2020, Scifulcom Ltd.. All rights reserved.

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Risk and its impacts on time and cost in construction projects

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ABSTRACT

The construction process is inherently prone to risks. Risk management is an essential and integral part of project management on all construction projects. Risk analysis is one of the core components of risk management that enables professionals to quantify and analyze risks that may pose potential threats to project performance in terms of various parameters. This research was conducted to identify and analyze risks associated with residential construction in Bangalore. In this study, risk and its impact on time and cost was identified and analyzed. Schedule impacts of project risks were supplemented by conducting quantitative risk analysis such as Monte Carlo simulation and sensitivity analysis using the Primavera risk analysis software. In case of cost, the cost variance was found out and mitigation measures were given. Thus, by effectively managing the risks, organization has more timely, comprehensive and deeper understanding of risks which in turn facilitates better decision making and confidence to take on new ventures or even to accept higher level of risk.

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1. Introduction

In the era of progressive globalization, it is hard to avoid risk, which has become an indispensable part of everyday life. Risk is present everywhere, in every aspect of our life (Mahendra et al., 2013; Mahamid & Dmaidi, 2013). One of such aspects is the construction industry, where risk is an inherent element. Construction projects are always unique, and risks arises from a number of different sources (Lachapelle & Hundozi, 2018). Risk is defined as any action or occurrence which will affect the achievement of project objectives. Risks and uncertainties inherent in the construction industries are more than any other industries (Chileshe & Kikwasi, 2014). Many industries have become more proactive about using risk management techniques in project. Risk is an integral component of any project (Szymański, 2017). Risk is present in all projects irrespective of their size or sector. No project is totally free from risks. If risks are not properly analyzed and strategies are not trained to deal with them, the project is likely to lead to failures (Darshan et al., 2017; Choudhry et al., 2014). Thus, Effective risk management does not mean the removal of risk, which would seemingly be the cheapest option (Befrouei & Taghipour, 2015).

There are various types of risks based on internal and external categories. The process of risk management was risk identification by historical data, theoretical analysis, expert options, etc., risk analysis by qualitative and quantitative methods, risk evaluation, risk treatment, and risk monitoring and control (ISO 31000-2018). Various literatures were conducted and reviewed. Eskander (2018) conducted a case

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Research Article

Investigation on Calcined Magnesium-Based Mineral Powder and Its Behavior as Alternative Binder

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This paper investigates the behavior of calcined powder made of natural magnesite and natural steatite. The magnesite and steatite are made into a powder of ratio 3 : 1 by weight proportion, and the combination is thermally decomposed at a temperature of 1200° Celsius. The calcined powder along with and without Sodium Tripolyphosphate (STPP) salt is tested for its microscopic structural development, consistency, initial setting time, final setting time, and heat of hydration. The powder is made into paste with water/powder ratio as 0.25 and the hardened samples are tested for its compressive strength, drying shrinkage, pH value, SEM analysis, and XRD analysis. The results show that adding phosphate salt increases the hydration process, setting time, and strength aspects. The test samples are found with hydration products such as magnesium hydroxide and struvite. Thus, the present work shows that natural metamorphic magnesite and natural metamorphic steatite can be the potential alternative resource for the production of magnesium-based binder.

1. Introduction

There is an increasing concern over environmental impact of existing binders, such as ordinary portland cement. There are a lot of studies made to find the effective alternative binders. Alternative binders are a type of manmade mineral material which can react with water and/or CO₂ and get hardened and can be later used to concrete or mortar as binder. The magnesium-based binders are considered to be the carbon negative as the water usage is reduced in comparison to Portland cement and the energy spent on preparing the magnesium-based cement will be lesser than calcium-based cement. This is due to lesser calcination temperature of magnesium-based cement with 650°C to 1200°C [1], when compared to calcium-based cement which has reacting temperature above 1300°C [2]. The magnesium from reject desalination brine is studied and found that it can react with CO₂ in atmosphere at 25°C to 65°C which is a breakthrough in carbon capture and utilization [3]. With this observation,

it is understood that even with little higher emission of carbon dioxide during calcination, this reactive magnesium can capture the CO₂ in atmosphere, ensuring eco-friendliness. The raw materials are varied in production of cement to reduce the stress on single raw material which can cause stress to the resource and resource depletion. Magnesium-based minerals are good alternative to calcium-based minerals which influence the strength development, microstructure, and pH of binders [4, 5]. The magnesium oxychloride cement has higher strength due to the formation of magnesium hydroxide [6], and the mechanical behavior of magnesium oxysulfate cement is based on the relative contribution of porosity, pore size, and higher interparticle bonds [7]. The magnesium phosphate cement (MPC) has rapid setting, light weight properties, and also higher strength gain, and the MPC has a potential future of replacing the conventional cement [8]. The early studies show that the calcined magnesite has hydration reaction and this calcined magnesite can even replace 50% of ordinary portland cement [9]. The



ANFIS-Based Accurate Estimation of the Confinement Effect for Concrete-Filled Steel Tubular (CFST)

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Abstract This research is mainly focused on the accurate estimation of the confinement effect for the concrete-filled steel tubular (CFST) that makes it possible to evaluate the interaction between various parameters that affect the confinement effect. To do that, the CFST is analyzed with concrete and steel properties using ANFIS method. With respect to the shape of the CFST, both the circular and rectangle shapes are considered. Only then, the D/t ratio is increased and reduced the hoop stress, self-stress in the steel tube. To analyze the D/t ratio, the confinement effect and axial load capacity is determined. After that, the concrete strength is also analyzed according to their statistical measures like output target ratio (OTR), precision, efficiency, mean value (MV), mean square error (MSE), standard deviation (SD), etc. The proposed method is implemented in MATLAB platform and compared with the Artificial Neural Network (ANN) method. The proposed ANFIS method achieved a good prediction of the confinement effect and axial load capacity of the CFST.

Keywords Concrete-filled · ANFIS · CFST column · Short and long · D/t ratio · ANN · Load capacity · OTR · SD · MV

1 Introduction

Recent years, Concrete-filled steel tubular (CFST) is widely used in many large-span constructions. The mutual merits of concrete and steel materials with outstanding performance are documented using the member of concrete-filled steel tubular (CFST) [1]. Therefore, the girder steel and floor slabs contain the dependable relation in CFSTs and the architecture of side seismic load system resisting is included. The well suitable ductility production, more energy absorption, high axial load capacity, and low strength degradation become the main effect in mechanical performances [2–5]. Generally, the structural columns are most important due to the growing up of taller, lighter and well quick building up of structure. In the earliest lengthy civilization become dependent on the well-known columns because of the high load sustainability of masonry octagonal columns, such as high and big temples. The beam CFST columns are the key amalgamation application of concrete members and steel members individually. Increasing popularity gaining can be obtained from the various constructive space usage of CFST [6–9]. This is the most popular kind of constructive composites with more engineering compensation practices [10].

Similarly, the concrete core of confinement is obtained from the steel tube as well as the duplicity and strength has risen. Therefore, the possibility of steel wall local buckle can be reduced because of the concrete. The process of construction does not need any extra valuable merits. Enlargement development of structural CFSTs members with understanding of fire effect requirement is increased itself also which delivers the confinement type of post-fire repair [11–13]. The entire structure security background is basically attractive to solve the popular balance enhancement to the member protection and cost or expensive due to

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An improved zero-voltage zero-current transition boost converter employing L-C-S resonant network

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ABSTRACT

An improved zero-voltage zero-current transition boost converter (IZVZCTBC) is introduced. This converter is basically a fourth-order DC-DC converter wherein a L-C-S (Inductor-Capacitor-Switch) resonant circuit is embedded for soft-switching. L-C-S tank network is the modified version of conventional ZVZCT switch cell. The main feature of L-C-S tank circuit is to enhance the performance of zero-voltage zero-current transition boost converter in terms of eliminating the high current stress, decreasing the switching losses and increasing the efficiency of converter. This converter exhibits both zero-voltage turn on and zero-current turn off switching characteristics based on the gating signals applied to switches. The principle of operation and time domain expressions of IZVZCT boost converter with L-C-S cell are presented. For the closed loop operation, digital controller is designed and the performance of the controller has been validated through simulation for different line and load variations. The mathematical and theoretical analysis is verified accurately by a 12-24 V, 30 W converter through PSIM simulation software and the results ensure that overall efficiency of the converter has improved to 97% along with elimination of current stress.

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1. INTRODUCTION

Modern era deals with new power electronic technologies to satisfy the needs and requirements of industries. High frequency DC-DC converters are predominantly utilized to serve industrial needs. Converters with high frequency has more advantages compared to low frequency operations, increased frequency provides large power density, quick response, reduction in physical size, cost and weight of reactive elements. Besides these merits, it also offers demerits such as high switching losses and stress, poor efficiency and electromagnetic interference noise. These difficulties can be rectified with soft-switching technologies and they are of mainly four types, i) Zero-Voltage Switching, ii) Zero-Current Switching, iii) Zero-Voltage Transition, iv) Zero-Current Transition. Among the four, first two switching techniques mainly deals with increasing efficiency and reducing the losses but it does not account on switch stress, but the second two transition techniques provides high efficiency, reduced losses and switch stress. Apart from the



Hexagonal Clustered Trust Based Distributed Group Key Agreement Scheme in Mobile Ad Hoc Networks

V. S. Janani¹ · M. S. K. Manikandan¹

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Abstract

Secure and efficient group communication among mobile nodes is one of the significant aspects in mobile ad hoc networks (MANETs). The group key management (GKM) is a well established cryptographic technique to authorise and to maintain group key in a multicast communication, through secured channels. In a secure group communication, a one-time session key is required to be shared between the participants by using distributed group key agreement (GKA) schemes. Due to the resource constraints of ad hoc networks, the security protocols should be communication efficient with less overhead as possible. The GKM solutions from various researches lacks in considering the mobility features of ad hoc networks. In this paper, we propose a hexagonal clustered one round distributed group key agreement scheme with trust (HT-DGKA) in a public key infrastructure based MANET environment. The proposed HT-DGKA scheme guarantees an access control with key authentication and secrecy. The performance of HT-DGKA is evaluated by simulation analysis in terms of key agreement time and overhead for different number of nodes. Simulation results reveal that the proposed scheme guarantees better performance to secure mobile ad hoc network. It is demonstrated that the proposed scheme possesses a maximum of 2250 ms of key agreement time for the higher node velocity of 25 m/s and lower key agreement overhead. Also, the HT-DGKA scheme outperforms the existing schemes in terms of successful message rate, packet delivery ratio, level of security, computation complexity, number of round, number of exponentiations and number of message sent and received that contribute to the network performance.

Keywords Mobile ad hoc networks · GKM · Security · Key agreement · Trust · Hexagonal clusters · Group communication

1 Introduction

Many potential applications of mobile ad hoc network (MANET) such as military battlefield, emergency rescue operations, teleconferences, personal area network (PAN) and other civilian applications involve multicast group communication rather than a

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Path optimization of box-covering based routing to minimize average packet delay in software defined network

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Abstract

A routing algorithm plays a major role in Data communication across an inter-network. Software-Defined Networking (SDN) is a new era of computer networking that separates Data plane from Control plane which controls, changes and manages the network behavior dynamically via open interfaces with the help of SDN Controllers. In SDN, the networking devices route packets in the form of flows with the help of flow rules given by the controllers and the flow rules are stored in the corresponding flow tables of the networking devices. The Box-Covering (BC) algorithm is an existing algorithm used in SDN for achieving renormalization of networks by calculating the fractal dimension of networks and covering the network with the minimum possible number of boxes and Dijkstra's algorithm is used for calculating shortest paths. The proposed work focuses on Path Optimization in the Box-Covering-Based Routing (BCR) algorithm, which is an existing algorithm used in large-scale SDN. In the proposed work, a Link-Weight system has been used for bounding the Link Utilization of the shortest path between the Source and the Destination to minimize the Average Packet Delay in the Network. The results show that the proposed work reduces the Average Packet Delay compared to the existing algorithms such as Dijkstra's algorithm, Graph Compression algorithm and BCR algorithm and also improves the performance of the network.

Keywords Software defined network · SDN controller · Box-covering based routing · Dijkstra's algorithm · Path optimization · Link utilization

1 Introduction

The infrastructure of the traditional network, which has become unable to cope up with the rapid development of the Internet, increases the operational complexity of the network with added cost. Software-Defined Network (SDN) is an emerging networking technology, which is aimed at making network agile and flexible as well as virtualizing the server and storage infrastructures of modern Datacenter. It can programmatically initialize, control, change and manage the network behaviour. The SDN Controller makes a logical

separation of control plane from the data plane and makes use of standard API's (Application Programming Interface) in the northbound and southbound for the purpose of communicating with the applications and the networking devices, respectively. The controller calculates the routing entries on the basis of global network view and forwards it to the router or switches, which do not bother about routing computation. Hence, the Routing mechanism is an important aspect of network technology and the centralized controller of SDN manages the network resources efficiently and support network traffic control. Thus, the efficiency of the network is improved [1–4].

Network Communication today is hardened, due to the integration of many contributing devices such as router, switches, gateways and middle boxes etc. which are vendor dependent as well as the complex configuration of their Access Control List (ACL). The emerging network concepts such as Big Data, mobile application, cloud computing, IoT and vehicular networking enforce the need of new concepts in networking such as routing, QoS and data transmission etc. The application of SDN technology in Big Data, mobile application, cloud computing and IoT facilitates to allocate the

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Energy efficient bidirectional relay network with spatial modulation

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Summary

Spatial modulation is a potential candidate for 5G wireless communication systems that provides high spectral efficiency with high reliability and low complexity. Spatial modulation conveys information in the index of transmitting antenna along with conventional modulation scheme. Also, energy efficiency communication plays a vital role in 5G wireless communication. In this article, energy efficiency and spectral efficiency are focused on a bidirectional relay network. In the proposed bidirectional relay network, the energy consumption burden at the relay node is reduced by placing a power splitter that coordinates the energy harvesting and information processing at the relay node. Spatial modulation is employed at all nodes to reduce the effect of inter-channel interference and synchronization problem in the receiver. The combined effect of spatial modulation in all nodes and energy harvest at the relay node are analyzed in the bidirectional relay network. The end-to-end outage probability expression for the bidirectional relay network is derived in terms of power splitting factor at relay node. Analytical simulation results have been verified by Monte-Carlo simulations. The overall performance of the proposed system is compared with an existing literature and found that the proposed system is having better spectral efficiency and energy harvesting.

KEYWORDS

decode and forward, energy harvesting, index selection, power splitter, spatial modulation

1 | INTRODUCTION

Higher spectral efficiency and energy efficiency (EE) are the major expectation from 5G wireless communication networks. Massive MIMO, nonorthogonal multiple access (NOMA), spatial modulation (SM), energy harvesting (EH), and filter bank multicarrier (FBMC) modulations are some of the key technologies in 5G systems.¹ In this paper, the performance of SM technique in EH bidirectional relay networks is analyzed. SM is a new MIMO technique in which one does modulation over space. It improves the spectral efficiency and at the same time it reduces the number of RF chains. Mathematically, the SM can be expressed as $\log_2(N_t) + \log_2(M)$, where N_t is the number of transmit antennas and M is the structure of the constellation pattern that relies on modulation scheme. This scheme carries two units of information—one is the antenna indices and the other is the normal modulation scheme—thus increasing the overall



Three-dimensional analytical modeling for small-geometry AlInSb/AlSb/InSb double-gate high-electron-mobility transistors (DG-HEMTs)

T. Venish Kumar¹ · N. B. Balamurugan²

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Abstract

A simple physics-based three-dimensional (3-D) analytical model for AlInSb/AlSb/InSb double-gate high-electron-mobility transistors (DG-HEMTs) is presented. The model accurately predicts the short-channel effects (SCEs) in the channel region for various device dimensions, viz. channel length and width, by solving the three-dimensional Poisson equation. The effects of the barrier layer (AlInSb) thickness and the high doping concentration on the threshold voltage are also considered. Analytical expressions for the surface potential and threshold voltage are derived, and the analytical results closely match those obtained from Sentaurus technology computer-aided design (TCAD) simulations. The drain current and transconductance of the AlInSb/AlSb/InSb double-gate HEMT device are compared with experimental data obtained for a quantum-well field-effect transistor (QWFET). The proposed AlInSb/AlSb/InSb double-gate HEMT shows excellent properties for use in high-speed and low-power applications.

Keywords AlInSb/AlSb/InSb · 3-D Poisson equation · Heterostructure · Analytical model · HEMTs

1 Introduction

Metal–oxide–semiconductor field-effect transistors (MOSFETs) are the most promising electronics devices, and have been proved to offer power and operational efficiency [1]. However, high-speed low-power electronic device are still required for use in many digital and future communication applications [2]. The high-electron-mobility transistor (HEMT) is used in both high-speed and microwave applications [3]. In the HEMT, two dissimilar materials form a quantum well, and electrons from donors are confined in the heterojunction by a modulation doping technique [4]. Many semiconductor combinations are available to form heterojunctions, including AlGaAs/GaAs, AlGaN/GaN, AlGaAs/InGaAs, and AlInSb/InSb. These materials provide electron

confinement at the interface and have received considerable attention for the design of high-electron-mobility transistors [5–8].

A double-gate high-electron-mobility transistors (DG-HEMT) design based on AlInSb/AlSb/InSb is presented herein. The first transistor based on an InSb quantum well with an AlInSb barrier layer (InSb/AlInSb) was fabricated in 2004, achieving a mobility above $30,000 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ with a sheet charge density $1 \times 10^{12} \text{ cm}^{-2}$ [9, 10]. Such transistors based on indium antimonite (InSb) offer excellent performance because of its highest electron saturation velocity ($5 \times 10^7 \text{ cm s}^{-1}$) and mobility for use in high-speed and ultralow-power digital logic circuits [11–14]. For modern communication systems, many attempts to scale HEMT device horizontally and vertically have been made. However, if the thickness of the device and the gate length are continuous scaled down, short-channel effects (SCEs) arise and affect the device performance. Moreover, continuous shrinking of the gate length results in loss of control over the channel. Double-gate HEMTs offer good control over the channel due to the placement of a gate on both (top and bottom) sides of the conducting channel. Wichmann and Vasllo have compared the performance of single- and double-gate HEMTs with similar structure. The results confirmed that

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A 1-V, 5 μ W, Atto Current Bulk-Driven CMOS Based Operational Transconductance Amplifier for Biosensor Applications(Article)(Open Access)

Gifta, G., Rani, D.G.N., Nirmal, D.

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Abstract

There is an advent need in health industry, for an Implantable Medical Device (IMD) with lower power consumption, noise and area as much as possible, which aims at extending the life-span of the device by enhancing the performance of battery to avoid additional surgery and does not affect the tissue cells. The existing IMD detects a single disorder and consumes high power resulting in need of replacement within a period of time. Furthermore there is a sheer need to reduce the noise factor to achieve an uninterrupted signal. This paper proposes a novel Operational Transconductance Amplifier (OTA) which is used in the biosensors of IMD. The proposed OTA is designed in a 0.18 μ m CMOS (Complementary Metal Oxide Semiconductor) technology, the operational frequency is in the range of 0.36 Hz to 50 KHz and capable of measuring the gain in 60 dB. It consumes a negligible amount of (5 μ W) power per OTA from 1-V single power supply and achieves minimal input referred noise of 1.24 μ Vrms, which is highly acceptable for biosensor used in IMD. The post layout simulation of the proposed integrated circuit has been performed successfully. © 2020 The Author(s). Published on behalf of The Electrochemical Society by IOP Publishing Limited.

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Target detection in SAR images using Bayesian Saliency and Morphological attribute profiles

A. Shakin Banu^a , P. Vasuki^b , S. Md Mansoor Roomi^c 

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Abstract

The Synthetic Aperture Radar (SAR) images have become a considerable and vital application in the optical satellite images due to their ability of function in all kinds of weather situations. In synthetic aperture radar (SAR) images Target detection is a demanding task to check presence of targets in images and to exactly locate that target. This paper propose a process for the detection of automatic target in SAR images which has three different steps, that is super pixel segmentation, Morphological attribute profiles and Bayesian Saliency Map. In first stage the SAR input image is then segmented into small regions by super pixels after that the clustering procedure is followed. In the second stage Bayesian saliency map is used to highpoint the clear objects including target and shadow. In the third stage the morphological attribute profile is used to suppress the shadow and highlight the target. The experiment results on MSTAR dataset are compared with some popular existing algorithms (Super pixel CFAR, local CFAR, PR, Global CFAR, MS, BS) which will proves that the proposed mechanism is effective and robust.

Full Text

Help

Introduction

Automatic Target Recognition is the active research area which uses computer processing to recognize and detect targets from sensor data. The data sensor is usually obtained from Synthetic Aperture Radar. It has different applications like remote sensing, navigation, resource monitoring, military and positioning commanding, remote sensing for mapping of high-resolution, rescue and search, detection of mine, surveillance of surface and automatic target recognition. Target Detection is the first pace of entire SAR ATR system, which has immense influence on consecutive processing. In SAR imagery case, target denotes to the object(s) of interest in imaged prospect.

The algorithms CFAR have been extensively functional for targets detection in SAR images. On the other hand, the performance detection of CFAR is affected easily through the speckle noise, as CFAR is a detection method that is pixel-based. Saliency detection, is an effective way employed for targets detection in the optical images. Both local and global contrast models of detection of saliency models for optical images have been presented that consider the intensity, orientation, or color dissimilarity among the salient object and their adjacent background. These models are effectual for standardized background; though, they are not vigorous in production with assorted background. To resolve this difficulty, the Bayesian saliency detection model was proposed that merge the previous map attained through the super pixel-level technique of local contrast by means of the two likelihood maps that can highpoints salient regions uniformly and restrain the non-salient regions. Morphological profiles perform decomposition of multi-scale image

ENHANCED RECOMMENDER SYSTEM FOR MANAGING SPARSE DATA IN SECURED CLOUD FOR E-BUSINESS MANAGEMENT

K. INDIRA¹ AND M.K. KAVITHA DEVI

ABSTRACT. Nowadays, Cloud Computing is a compelling paradigm for all enterprises where different services such as the server, storage, and application are delivered through the internet to the organization's computer and devices. It serves computing needs for both enterprise and end-user, so it became on-demand services as all enterprises emerging to cloud computing technology. So the cloud platform is incorporated in recommender a system that is mainly used for sorting a massive amount of data to identify user's interest by rating or feedback and makes item search easier for the end-user. Therefore, the Cloud-based Recommender system applied in a variety of applications to increase sales and user satisfaction in the market. Despite advances in recommender, the system still issues like sparsity, capability, and accuracy are needed to be addressed. In this paper, the cloud-based approach addresses the serious sparse data and capability issue by constructing a trustworthy recommender system. The proposed technique increases the density of the similarity matrix and coverage for accurate prediction. At the simulation result, the accuracy of recommendation is analyzed using evaluation metrics shows that the framework is useful and better prediction achievement.

1. INTRODUCTION

Cloud computing is a big scale distributed computing with the advancement of the internet; it becomes emerging technology. Here Cloud computing called

¹*corresponding author*

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Key words and phrases. Cloud Computing, Recommender system, Sparsity, User preference, Trust, Rating, Hadoop.



Multi Cloud Based Service Recommendation System Using DBSCAN Algorithm

K. Indira¹ · M. K. Kavitha Devi²

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Abstract

The historical collaborative filtering based recommendation system has become the most essential one in cloud computing environment. The recommender system which has been depends on collaborative filtering easily identify the user references and allow to learn relationship items—past users from the user group who exhibit similar preferences. Hence, the recommendation system has been considered as the most powerful tool for cloud providers and users. This paper proposed the clustering recommendation system executed in cloud environment. The accuracy of the system reduced when irrelevant features presents in data. So that in this proposed scheme, an effective feature selection approach named as modified LDA has been utilized for acquiring the relevant information only. The LDA technique defined as Linear Discriminant Analysis which decreased features numbers to expected value before classification process. DBSCAN is utilized as a clustering approach which provides better quality in terms of segregating the number of movies. Based on the genre, the similar movies are clustered together with the user ratings. DBSCAN elaborated as Density Based Spatial Clustering of Applications with Noise termed as famous method of learning or clustering which detached the high density clusters from low density clusters. The LDA technique has been utilized to accomplish the appropriate user reviews with categorized ratings. In this paper, the main challenge described as to analyze the reviews of the user with ratings using best clustering approach. The evaluation results proved the highest accuracy of 92.56% when compared with various methods of accuracy. This proposed method also has minimum execution time.

Keywords DBSCAN density based · LDA · Recommender system · Clustering

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An e-health decision support framework to predict the heart disorders(Article)

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Abstract

The current evolutionary usage of data mining techniques can be imparted for the development of medical applications to analyse the health metric. The web-based decision support framework proposed in this work would provide the pre-guidance report based on the decision generated by Bayesian network analysis over the disease dataset. The report is generated in adherence to the mined disease patterns over the patient's non-medical and medical factors which are obtained from the past medical records and predict the possibility of getting the disease for the given similar health metrics. The Bayesian model builds a decision model by analysing the casual intervention effects of the non-medical and medical factors of each individual. The decision model would generate a pre-guidance health report based on the analysed probabilistic chances of getting the heart disorder. The predicted report is a prognostic analysis of the health metric of the individual and suspects their possibility of getting affected by heart disease. © 2020 Inderscience Enterprises Ltd.

Author keywords

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Parkinson Data Analysis and Prediction System Using Multi-Variant Stacked Auto Encoder

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ABSTRACT Parkinson Disease (PD) is a kind of neural disorder that affects a range of people. This disease has continuously growing stages to halt entire neural activities of any people. There are many techniques proposed to detect and predict PD using medical symptoms and measurements. The medical measurements provided by different experiments must be effectively handled to produce concrete results on the detection of PD. This saves many people from PD at earlier stage itself. Recent technologies focus on Machine Learning (ML) and Deep Learning (DL) techniques for effective PD data analysis for making efficient prediction system. They are concentrating to build complex artificial neural systems using effective learning functions. However, the existing systems are lacking to attain multi-attribute and multi-variant data analysis to predict PD. To attain multi-variant Parkinson symptom analysis, the artificial neural systems must be equipped with more characteristics. In this regard, the Proposed system is developed using Multi-Variant Stacked Auto Encoder (MVS AE). The MVS AE based PD Prediction System (MSAE PD) helps to analyze more PD symptoms than existing systems. This article provides four different variants of SAE construction procedures to predict PD symptoms. The MSAE PD is implemented and compared with existing works such as MANN, GAE and UMLBD. This comparison shows the MSAE PD system gives 5% to 10% better results than existing works.

INDEX TERMS Parkinson disease, detection, machine learning, accuracy and auto encoder.

I. INTRODUCTION

Parkinson's Disease creates neural system disorder for various people. The disease affects the people at different age groups around the world. Medical research works collaborate with computational intelligence techniques for predicting Parkinson symptoms. PD has numerous types based on the human abnormalities. Mostly it disturbs the nature of neural activities and the body movements. Researches evolved in recent years use Machine Learning (ML) and Deep Learning (DL) approaches for finding early stages of PD [1], [2]. The research works used different types of medical observations such as voice levels, handwriting variations, body movements, brain signal variations and protein aggregations. These kinds of observations are measured using various medical apparatuses. The devices like acoustic sensors, ultrasonic sensors, motion sensors, wearable sensors and

Electro Encephalo Graph (EEG) are mainly used for gathering Parkinson measurements. ML and DL techniques found from various research works are encouraged to evaluate these medical data [3]. The newly developed PD detection techniques are always requiring more accuracy in detection [4]. The requirement is achieved by using effective ML and DL approaches, which are adaptable to the data features. Many works have been identified for detecting Parkinson symptoms from various datasets. Each existing work is implemented using specific learning and detection techniques. However, these techniques are mainly using limited set of Parkinson features and less effective ML techniques [5]. A few researches are using ML and DL based Parkinson detection with real-time sensor datasets. But they are limited to certain observation ranges. This is a kind of research problem which is to be resolved.

To resolve these issues, the Proposed system uses Stacked Auto Encoder (SAE) variants on huge Parkinson dataset. SAE is the technique of Artificial Neural Network (ANN), that

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Semi-Supervised Learning based Security to Detect and Mitigate Intrusions in IoT Network

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Abstract—Our world is moving towards an Internet of Things (IoT) era by connecting billions of IoT. There are several security loopholes in the IoT network. Intrusion can lead to performance degradation and pose a threat to data security. Hence, there is a need for a method to detect intrusion in the IoT networks. Existing solutions use supervised learning based intrusion detection methods that need a huge labeled dataset for better accuracy. It is not easy to source out a huge labeled dataset because the size of the IoT network is huge.

To overcome some of the impediments in the existing solutions, we propose a novel SDRK Machine Learning (ML) algorithm to detect intrusion. SDRK leverages supervised deep neural networks and unsupervised clustering techniques. The intrusion detection and mitigation algorithms are placed in the fog nodes that are between IoT and cloud layers. We test our proposed methodology against the Data Deluge (DD) attack in the testbed. SDRK model is tested on the benchmark NSL-KDD dataset. We compare the results with state-of-the-art solutions. When testing with the NSL-KDD dataset, we find that SDRK detects the attacks with improved accuracy of 99.78%.

Index Terms—Internet of Things, Semi-Supervised Learning, Intrusion, Security, Data Deluge Attack, Fog Computing

LIST OF ABBREVIATION

DD	Data Deluge Attack
DFNN	Deep Feed forward Neural Network
K	Number of clusters
R	Number of runs
RRS	Repeated Random Sampling
SDRK	SSML DFNN- RRS- K means
SSML	Semi Supervised Machine Learning
ζ	Error Probability

I. INTRODUCTION

INTERNET of Things (IoT) are resource-constrained devices that sense the environment and transmit the sensed data. IoT finds its application in latency-critical automated use cases such as healthcare, autonomous driving, mining, chemical factory, power grid, emergency alarm system, autistic children aid system, etc [1]. There are security loopholes in the IoT network which can stop the users from accepting the IoT use cases [2]. Dyn lost 8% of customers due to the Mirai attack [1]. Security breaches can create performance degradation. Degraded service in healthcare may be life-threatening [3].

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Food and Drug Association in the US have affirmed the security risk due to unauthorized access to medical IoT [1]. Thus, it is necessary to provision rich security modules that can identify the attacks early, so that the use cases can bounce back from the effects of the attack and resume the normal operation at the earliest. But the resource constraints in IoT make it difficult to provision rich security modules in IoT. The diverse IoT brands and user requirements also make it difficult to implement cross-device security solutions [4].

The attackers' strategy is improving greatly. Thus, intrusion detection systems based on attack signatures cannot provide efficient security. A Machine Learning (ML) approach can learn the nooks and corners of the threats [3] and identify even small malicious mutations in traffic [5]. Hence, an appropriate ML model with low attack detection time and better levels of accuracy is needed for IoT networks. Some existing solutions use supervised ML [6], [7]. IoT is a huge network and so, it generates a large volume of data. It is laborious to label the big dataset and is prone to human error. Some existing solutions use unsupervised ML [8]. Unsupervised ML results in low attack prediction accuracy [9]. The fact that intrusion in IoT leads to degraded performance, it is not easy to provision security modules in IoT, and there are issues in using supervised and unsupervised ML for IoT motivates us to find suitable intrusion detection and mitigation methodology. We focus on developing a methodology that will have better attack detection time and better accuracy levels. While probing the ML models, we find that the Semi-Supervised ML (SSML) can avoid the pitfalls of supervised and unsupervised ML and provide improved accuracy of attack detection [10]. So, we propose a novel SSML model named Deep feed-forward neural network- Repeated random sampling- K-means (SDRK) model for detecting intrusion in IoT networks. We give a mitigation methodology to mitigate the attack. The whole methodology is deployed in the fog nodes of fog-IoT architecture.

The key contributions of our work are:

- We propose a novel SDRK model to detect intrusion in IoT networks.
- We probe into the hardness of the K-means algorithm in provisioning security for IoT. We find it to be NP-complete. We propose a novel randomized solution named Repeated Random Sampling- K-means (RRS- K-means) for the NP-complete problem. We prove the lower bound of the error probability of RRS- K-means.
- We assess our methodology in IoT-fog testbed against DD attack to verify its working in the real network.
- We evaluate SDRK with the benchmark NSL-KDD

BALANCE: Link Flooding Attack Detection and Mitigation via Hybrid-SDN

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Abstract—Link Flooding Attack (LFA) is a genre of Distributed Denial of Service (DDoS) attack. LFA can cut off a target area from the network, without directly attacking the target. The attacker chooses links which when cut off will disconnect the target area and instruct the bots to flood those links with small packets. Some of the existing solutions are suitable for specific routing methods like shortest path routing or need cooperation between Autonomous Systems (AS). To overcome certain hitches of existing solutions, we have proposed a novel mechanism named BALANCE. It detects and mitigates LFA via hybrid-Software-Defined Network (SDN). SDN splits the control and data plane using OpenFlow protocol. Hybrid SDN has both legacy and SDN nodes, with a controller in the control plane. We have used Service Based Hybrid SDN (SBHS), which is a type of hybrid-SDN. BALANCE begins with an algorithm that chooses nodes in an AS to be SBHS enabled in such a way that the controller can get statistics of all the links in the AS. Next, congestion detection and location algorithms are implemented in the controller to find the congested links. Finally, LFA bot detection and mitigation algorithms are implemented in the controller to mitigate LFA. BALANCE was evaluated in testbed and emulator. We compared the results with state-of-the-art solutions. BALANCE was able to detect LFA bots at a precision of 97.64% and had HTTP response time of 2 seconds during the LFA attack.

Index Terms—Link flooding attack, distributed denial of service, hybrid-software-defined network, security.

I. INTRODUCTION

DISTRIBUTED Denial of Service (DDoS) is a well-known attack and has various genres. This is due to the worst effects DDoS can create. DDoS attackers can make the services unavailable to the users. They mostly do this by choking the servers or network controllers with malicious traffic. Link Flooding Attack (LFA) is a type of DDoS attack. LFA can disconnect the target areas from the network, without directly attacking the target. The target area may be servers or networks of banks, hospitals, military stations, etc [1], [2].

LFA attacker employs a large number of bots. He examines the path from the bots to the public servers or the decoy servers (servers around the target area) in the chosen target area using route finding tools (e.g., traceroute, traceroute

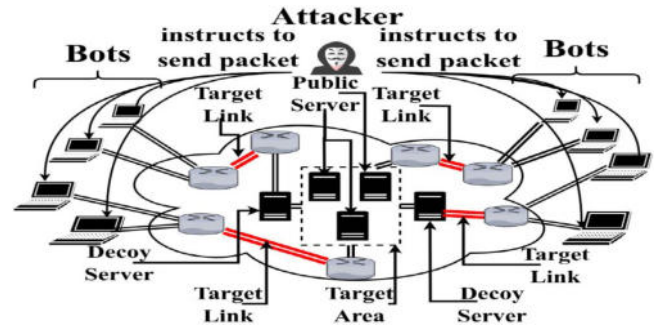


Fig. 1. LFA Threat Model Example.

NG, open visual traceroute). He constructs a link map with bots as the source and servers as the destination. He chooses persistent links in the link map that when cut off will automatically disconnect the target area from the network. He instructs the bots that have routes via the chosen links to send persistently small-size malicious packets without spoofing their IP to the servers. This floods the chosen links and successfully isolates the target area. Figure 1 illustrates the LFA model.

LFA has various characteristics [1], [3]:- **1.** Since LFA is not directly on the target area, the victim may not know that it is subject to attack. **2.** Since the attacker uses non-spoofed traffic, it is difficult to identify it as LFA traffic. **3.** The attacker need not choose links in the target area's Autonomous System (AS), thereby giving no hint to the target area that it is pinned down. **4.** The attacker can instruct the bots to change the traffic pattern periodically, thereby showcasing that it is a traffic burst. **5.** The attacker can periodically change the bot-server pairs to avoid repetitive traffic giving clues to the intrusion detectors.

Some of the traditional DDoS mitigation measures are [4] filtering, D-WARD, re-routing, etc. The filtering technique filters out spoofed IP addresses [4]. LFA does not spoof the IP and hence filtering may not detect LFA. D-WARD compares the traffic against the attack signatures. LFA sends small, non-spoofed traffic and hence signature-based methods may not detect LFA. Re-routing diverts the traffic through alternate links during congestion. This will flood the alternate links without handling LFA. Thus, traditional DDoS defense measures are not suitable for LFA mitigation [1]. Some of the existing LFA mitigation solutions [5], [6] need cooperation among the ASs. We cannot expect the AS to cooperate

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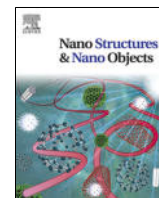
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Enhanced electrochemical performance by facilitating Li-ion diffusion in $\text{LiNi}_{0.1}\text{Mg}_x\text{Co}_{0.9-x}\text{O}_2$ ($0 \leq x \leq 0.2$) – for high energy Li-ion batteries

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ABSTRACT

Layered nano-sized $\text{LiNi}_{0.1}\text{Mg}_x\text{Co}_{0.9-x}\text{O}_2$ ($0 \leq x \leq 0.2$) cathode materials for Li-ion batteries with very low nickel content were prepared by a self-sustaining solution combustion method. The structural and morphological properties were examined by various characterization techniques such as X-ray Diffraction (XRD) technique, Scanning Electron Microscopy (SEM) and Infrared Spectroscopy. The experimental outcomes portray that the synthesized cathode materials show evidence of α - NaFeO_2 structure despite doping of the electrochemically inactive metal (Mg) element. Electrochemical experiments revealed that $\text{LiNi}_{0.1}\text{Mg}_{0.2}\text{Co}_{0.7}\text{O}_2$ electrode delivered a discharge capacity of 236 mAhg^{-1} at its initial stage and exhibited high cycling stability. The stable electrochemical reversibility of the $\text{LiNi}_{0.1}\text{Mg}_{0.2}\text{Co}_{0.7}\text{O}_2$ electrode is clearly evident from the cyclic voltammogram and the electrode was found to exhibit a significantly low charge transfer resistance of 57.40 ohms. The Li-ion diffusion coefficient of the electrode was found to increase from $7.78 \times 10^{-14} \text{ cm}^2 \text{ s}^{-1}$ to $5.70 \times 10^{-13} \text{ cm}^2 \text{ s}^{-1}$ with Mg doping. The partial substitution of Co with Mg enhanced the electrochemical behavior of $\text{LiNi}_{0.1}\text{Mg}_x\text{Co}_{0.9-x}\text{O}_2$ ($0 \leq x \leq 0.2$) cathode materials.

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1. Introduction

To curb air pollution and solve the problems related to climate changes, extensive research is being conceded to replace diesel and gasoline powered automobiles with electric vehicles. In continuing to optimize the properties of the cathode material, the electric powered automobile helps in the reduction of CO_2 emissions. However, the bottlenecks of these electric vehicles are limited driving range and high cost. To overcome these limitations, not only invention of the novel materials need breakthrough, but also sustained and systematic process modes are the prerequisites for their fabrication. Intensive research in lithium-ion batteries with higher energy density and lower cost predominantly for automobiles focus on layered cathode materials [1]. In the present scenario, lithium transition metal oxides of form LiMO_2 are extensively used in lithium-ion batteries [2]. Owing to its low cost and high specific capacity, LiNiO_2 finds its application as a potential 4 V positive electrode in lithium ion batteries. The detrimental effect of mixing of Li^+ and Ni^{2+} cations in the LiNiO_2 electrode hamper the lithium diffusion, causing structural instability and capacity loss on its cycle life. As a result,

the practical discharge capacity is limited when compared to its theoretical capacity [2]. Also, LiNiO_2 suffers from irreversible phase transitions and safety issues due to exothermic release of oxygen in the highly delithiated state [3].

Huang et al. [4] reported that the cation substitution method reduces cation mixing. The partial replacement of nickel with cobalt had a positive effect and favored the formation of layered cathode structures. The goodwill to rise above these bottlenecks encouraged prevalent research on the doping of cations and its influence on the battery properties. In this regard, a series of metal elements have been explored for doping, such as Mg, Al, Ti, Ga, Ca, Nb [5–10]. On overall comparison, the divalent Mg^{2+} ions maintain the structural stability of electrodes by limiting Li^+ ions insertion and deinsertion from and into the layers of electrode material [11]. Also, Mg cations maintain the layered pattern during Li^+ deintercalation at high voltages acting as a pillar in averting further migration, controlling the capacity fading and improving the Li-ion diffusion process [12].

Electrochemical performance of the synthesized electrode material robustly depends on the physical and chemical nature of the elements, which is highly subjective to the fabrication methods and on the control parameters of the experimental method [13]. Therefore, experimental preparative methods play a vital part in the fabrication of cathode materials [14]. Nahm et al. [6] reported

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Hybrid Multilayer Network Traceback to the Real Sources of Attack Devices

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ABSTRACT With the advent of the Internet of Things (IoT), there are also major information security risks hidden behind them. There are major information security risks hidden behind them. Attackers can conceal their actual attack locations by spoofing IP addresses to attack IoT devices, law enforcement cannot easily track them. Therefore, a method to trace stealth attacks is required. Conventional IP traceback methods that traceback only attackers on the network layer and cannot infer the path information of a packet traversing the switch. This article proposes a method to simultaneously traceback attack sources at the network layer and the data link layer with only one single packet. Even if the core network contains a switch or if multiple attackers launch attacks from different locations, the method can correctly traceback the true devices responsible for the attacks, and its achievements include a zero false negative rate and a low false positive rate.

INDEX TERMS IP traceback, DDoS attack, attack mitigation, layer 2 traceback, autonomous system, attack detection, IP spoofing, advanced persistent threats.

I. INTRODUCTION

Many manufacturers have connected applications required in our daily lives to the Internet. Using the cloud to centralize storage and analysis systems, they provide various monitoring and management services to render our lives more comfortable and convenient. However, if a system design is not robust or if consumer habits are poor, threats to information security arise. In particular, attacks on equipment related to security and privacy such as automobile driving control, electronic door locks, and Internet of things (IoT) devices security monitors can have disastrous consequences [1], [2].

Incidents of cyberattacks have increased, both in terms of number and scale, and damage time and effects have also intensified. Due to the anonymity of the Internet, cybercrime is difficult to detect, especially for the common distributed denial of service (DDoS) for IoT systems. Moreover, the major challenges remain in dealing with a DDoS attack is to differentiate between normal and malicious packets [3].

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The attacker can easily conceal or falsify the true source of the attack using technologies such as a proxy, VPN, fake IP, public network or wireless network, or zombie computers, thereby becoming difficult to trace [4]. This has caused the present-day frequent occurrence of cyberattacks and the continuous emergence of cybercrime, especially the advanced persistent threats (APTs) attacks [5]. However, even an APT attack was detected, to effectively curb cybercrime, the development of packet analysis that easily traces the source of an anonymous attack is a key priority for the present-day development of information security and network forensics [6].

Current methods of tracing back anonymous attacks primarily comprise methods such as packet marking, packet logging traceback, and hybrid IP traceback. The packet-marking method can be divided, according to the frequency of packet marking, into the following: deterministic packet marking, which marks all packets passing through the ingress router of a network [7]–[13], and probabilistic packet marking, which marks passing packets probabilistically [14]–[22]. Furthermore, Liu *et al.* [23] proposed a trust-aware probability marking traceback scheme. The marking rate in is depends



Document details - Effects of annealing on phase structure and magnetic characteristics of sputter deposited Ni₂FeGa/Si (100) thin films

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Effects of annealing on phase structure and magnetic characteristics of sputter deposited Ni₂FeGa/Si (100) thin films(Article)

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Abstract

This paper investigates the effects of post-deposition annealing on the evolution of phase structure and magnetic properties of magnetron sputtered Ni₂FeGa/Si (001) thin films. The results revealed that the as-deposited film was partially crystallized in an fcc structure, i.e. γ phase. Crystallization of the amorphous structure into the γ phase was greatly encouraged following annealing at 723 K for 1 h. Annealing at higher temperatures for the same period triggered the formation of the bcc austenitic phase, which competed with the γ phase simultaneously for crystallization and grain growth. The evolution of phase structure and grain size also influenced the nanomechanical properties of the films according to the nanoindentation measurement. The film annealed at 873 K for 1 h showed high hardness and elastic modulus values of 11.1 GPa and 156 GPa. The γ phase showed stronger ferromagnetic characteristics relative to the bcc austenite due to the richer Fe content. This leads to the saturation magnetization to be maximized at 80 emu/g when annealed at 773 K for 1 h attributed to the enhanced film crystallinity and dominant volume fraction of γ phase in the thin film. © 2020 World Scientific Publishing Company.

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Fabric Defect Detection Using the Sensitive Plant Segmentation Algorithm

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Abstract

Fabric quality control and defect detection are playing a crucial role in the textile industry with the development of high customer demand in the fashion market. This work presents fabric defect detection using a sensitive plant segmentation algorithm (SPSA) which is developed with the sensitive behaviour of the sensitive plant biologically named "mimosa pudica". This method consists of two stages: The first stage enhances the contrast of the defective fabric image and the second stage segments the fabric defects with the aid of the SPSA. The SPSA proposed was developed for defective pixel identification in non-uniform patterns of fabrics. In this paper, the SPSA was built through checking with devised conditions, correlation and error probability. Every pixel was checked with the algorithm developed to be marked either a defective or non-defective pixel. The SPSA proposed was tested on different types of fabric defect databases, showing a much improved performance over existing methods.

Key words: external stimulation, fabric pattern, sensitive behaviour, texture.

Introduction

Fabric is produced from textile fibres of natural materials, like cotton. Defects on the fabric are due to flaws on the surface of the fabric. Defect detection is highly important for fabric quality control. Traditionally, defects are detected by human eyes. However, the efficiency of this manual method is low and the missed rate high because of eye fatigue. Hence, an automatic inspection system is necessary for textile industries.

Method proposed

This work proposes a defect detection model which is developed based on the sensitive behaviour of the sensitive plant biologically named mimosa pudica. First, all images are pre-processed through grey-level transformation to enhance image contrast. The second step involves the segmentation process, developed on the basis of the sensitive behaviour of mimosa pudica, to segment the various patterns of fabrics. The conditions were derived for different patterns of fabric to easily segment and isolate the defects with a higher degree of precision and accuracy.

This plant gives unusual quick responses to stimulation and comes back to normal after several minutes. It droops in a sense to defend itself against herbivores. The leaves of the plant also droop in response to darkness and reopen with the daylight, known as nyctastic movement (Figure 1).

With this sensitive behaviour, conditions were derived for various patterns of fabric to extract defective pixels. Three different patterns of fabrics: plain, twill and satin, were checked with conditions derived for each to find defective pixels. The texture pattern and pixel formation of the fabric are given in Figures 2 and 3.

Generally, Weaving is the process of combining the two set of threads weft and warp together to produce fabric. The thread weft runs horizontally on the loom and weaved in front and behind the warp fabric. In finding defective pixels in every pattern of the fabric, first the pixel is randomly chosen for its intensity checking and its 8 neighborhood pixels are checked with respect to the conditions derived for each pattern. The 8 neighbor-

hood pixel and its places are represented in the Figure 4.

Segmentation process

The segmentation process was used to detect the sensitiveness of the mimosa pudica plant. The image chosen for detection was in MxN pixels. A random pixel p(x,y) was chosen to check the mimosa plant, and the intensity of the corresponding pixel was denoted as I {(px,y)}. The pixel chosen has to satisfy two conditions derived to detect defects in the plain pattern. The conditions are compared with the normal environmental condition of the mimosa pudica plant. If the pixel chosen (plant) satisfies the conditions, the plant is in a normal state and the fabric is considered as non-defective (also the plant has no droops). If the fabric does not obey the condition, the pixel chosen is considered as defective. (Plant was induced by external stimuli).

Non-uniform pattern

In non-uniform patterned fabric, its structure is woven with different complex patterns, and hence the image of such fabrics have a wide range of pixel intensity. In fabric, defect detection needs the original image i.e. a non-defective image of the sample taken to find defects.

The original image X and sample image Y are expressed as:

$$X = \sum_{M=1}^x \sum_{N=1}^y P_{x,y}, \quad (1)$$

$$Y = \sum_{M=1}^x \sum_{N=1}^y P_{x,y}$$

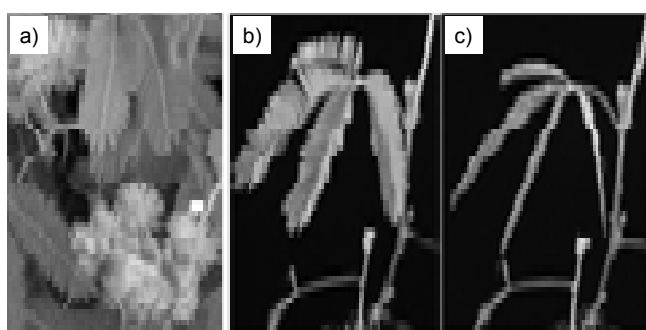


Figure 1. a) Mimosa pudica plant, b) leaves of the plant in normal condition, c) leaves drooped in response to the external stimuli.

FEEDBACK RESOLVING SETS IN GRAPHS

M. RAJESWARI¹, A. ANITHA, AND I. SAHUL HAMID

ABSTRACT. For an ordered subset $W = \{w_1, w_2, \dots, w_k\}$ of vertices in a connected graph G and a vertex v of G , the *metric representation* of v with respect to W is the k -vector $r(v/W) = (d(v, w_1), d(v, w_2), \dots, d(v, w_k))$. The set W is a *resolving set* for G if $r(u/W) \neq r(v/W)$ for every pair of distinct vertices u and v of G . A resolving set D such that $\langle V - D \rangle$ is acyclic is called a *feedback resolving set*. The minimum and maximum cardinality of a minimal feedback resolving set are denoted by β_* and β_+^* respectively. This paper initiates a study on these parameters.

1. INTRODUCTION

By a graph $G = (V, E)$, we mean a connected, finite, undirected graph with neither loops nor multiple edges. The order and size of G are denoted by n and m respectively. For graph theoretic terminology we refer to Chartand and Lesniak [3].

The *distance* $d(u, v)$ between two vertices u and v in a connected graph G is the length of a shortest $u-v$ path in G . For an ordered subset $W = \{w_1, w_2, \dots, w_k\}$ of vertices in a connected graph G and a vertex v of G , the *metric representation* of v with respect to W is the k -vector $r(v/W) = (d(v, w_1), d(v, w_2), \dots, d(v, w_k))$. The set W is a *resolving set* for G if $r(u/W) \neq r(v/W)$ for every pair of distinct

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Key words and phrases. resolving set, feedback resolving set.

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Prediction of Lean Blowout Limits for Methane-Air Bluff Body Stabilized Combustion using a Temperature Gradient Method in a Model Gas-Turbine Afterburner

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Abstract: In the present work, LBO limits for methane-air combustion stabilized by a V-Gutter have been predicted by a hybrid method using numerical simulation and empirical relations. The numerical simulations have been carried out to study the stable methane-air combustion and temperature gradients at exit and recirculation region in a model gas turbine afterburner with a planar V-Gutter as a bluff body for four inlet air pressure conditions and three V-Gutter angles. The calculated average exit gas temperature (AEGT) and the average gas temperature in recirculation region have been used for predicting the blowout conditions. An empirical method based on Feature Section Criterion has been used to determine Fuel-Air Ratio (FAR) at blowout conditions very accurately from the numerically calculated average temperature in the central recirculation zone (CRZ). The predicted Fuel-Air Ratio (FAR) at lean blowout conditions has been compared with the experimental results obtained for the same conditions and are found to be in good agreement.

Keywords: methane-air, V-Gutter, combustion, flame stability, recirculation region, lean blowout (LBO)

PACS: 47.70.pq, 47.27.E-

Introduction

In aircraft engines, the high-speed flame is stabilized with a bluff body in the afterburner. The bluff body

provides a stagnant high-temperature region to sustain the combustion of high-velocity gases entering the afterburner where additional fuel is injected to increase the thrust during takeoff and also during maneuvering and combat operation. A flame will lift off from the flame holder, if the exit velocity is sufficiently high. The lift-off height, the distance between the burner port and base of the flame, will increase with an additional increase in velocity until the flame blowout occurs. The blowout occurs at a flow rate where the turbulent burning velocity falls more rapidly with distance downstream than the local velocity at the position of maximum laminar flame speed. This shows the sudden occurrence of a blowout just beyond a critical lift off height, even though the mixture is still within the flammable limit at the flame base.

The blow off limit has been predicted by many researchers using empirical methods like Lefebvre method or Damköhler number method from the experimental results obtained using Particle Image Velocimetry (PIV), Planar Laser-Induced Fluorescence (PLIF), etc. Recently, LES simulation is being used for predicting the lean blowout conditions, without conducting exhaustive experiments. However, Large Eddy Simulation (LES) requires more computational time. Very few attempts have been made to use the advantages of numerical simulation and empirical relation in predicting the LBO without conducting experiments and computational techniques require more computational time. A new method for predicting the lean blowout conditions with an accurate result for the realistic situation is to be developed.

Chaudhuri et al. [1] studied the blow-off dynamics of bluff body stabilized turbulent premixed flames and found that near blow-off condition, the columnar flame front, and shear layer vortices overlap to induce high local stretch rates which exceed the extinction limit instantaneously. The extinction and re-ignition occur several times before final blow-off occurs. They used PIV and OH PLIF simultaneously. Dawson et al. [2] examined the confined and unconfined turbulent methane-air lean premixed flame stabilized by an axisymmetric cylindrical bluff body to study the blow-off limit with OH-

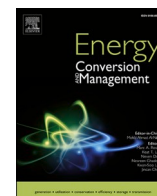
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Thermal performance of nano-enriched form-stable PCM implanted in a pin finned wall-less heat sink for thermal management application

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ABSTRACT

Integrated and efficient circuitry has become a crucial part of modern technology which urged the necessity in development of efficient and robust Thermal Management (TM) system for its steady operation under higher heat dissipation. Thus the research work aims to analyse the heat transfer performance of a novel wall-less heat sink packed with highly stable synthesised Hexamethylene Diisocyanate cross-linked Polyethylene Glycol-6000 based Form-Stable Phase Change Material (FS-PCM) for its suitability in passive TM systems with chemical and thermal stability till 1000 thermal cycles. An inclusion of 1 wt% (Multi-Wall Carbon Nano Tubes /Graphene nano Platelets) in FS-PCM improved its thermal conductivity by 61.73% (0.448 W/m-K) and 84.48% (0.511 W/m-K) respectively. The characterisation was carried out for its micro and nano structural morphology, elemental composition, chemical composition and thermal properties like thermal degradation, phase transition attributes, specific heat and thermal conductivity via Field Emission Scanning Electron Microscope, Energy Dispersive X-ray Spectroscopy, Carbon Hydrogen Nitrogen analyser, Fourier Transform Infrared Spectroscopy, Thermogravimetric Analysis, Differential Scanning Calorimetry and KD2 pro analyser respectively. The transient heat transfer study of square pin finned heat sink was performed under a set of ON/OFF duty cycles for various heat rates with different aspects of FS-PCMs. In addition, the effect of nanoparticle reduced the thermal difference of FS-PCM in heat sink. Furthermore, involvement of FS-PCM in energy storage characteristics was improved reducing the heat sink base temperature to a maximum of 9.77%. Finally, the experimental results were numerically validated using COMSOL software establishing its reliability for real-time avionics TM application.

1. Introduction

The technological evolution and advancements of mankind has shifted the trend from invention to innovation in every field, especially, the avionics field have developed drastically from simple mechanical systems to complex electronics system as the main driving source. Over the last few decades, the prime focus of any device is miniaturisation of electronics with higher packaging densities [1] which were also adopted in the avionics system. Eventually, the avionic device suffers from the drawback such as heat dissipation from the components that came along from the beginning [2]. Additionally, the critical factors like direct solar irradiation, IR reflection from Earth and albedo challenges the smooth operation of avionics which proposes the higher heat flux cooling of

avionics systems is the need of the hour [3]. Hence, the necessity of TM in avionic application has to be addressed effectively. Thus, many advanced technologies were proposed in such electronic devices to maintain them below the safe working temperature. Therefore, systems like molecular cooling fan which acts as a heat dissipation source [4], loop heat pipe in cooling high heat dissipative components of electronic module of satellites and spacecraft [5], mini vapour cycle system for electronic TM in avionic applications [6] are few technologies used successfully. Avionics always has a pre-requisite of light weight and highly reliable cooling system with negligible effect of convection makes the design and fabrication complicated. Due to such constraints that the avionics exerts [7], the pre-requisites could be best accomplished by thermal energy storage (TES) system.

TES comprises of latent heat storage which are highly effective than

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