



# COGNITION

Quarterly Research Newsletter of NIT Raipur  
VOLUME 1 , ISSUE 3, NOVEMBER 2021

**NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR**

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**NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR**

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# TABLE OF CONTENTS

<b>Editorial Note</b>	<b>01</b>
<b>Patent Granted to NIT Raipur</b>	<b>03</b>
<b>MOU Signed by NIT Raipur</b>	<b>04</b>
<b>Book &amp; Book Chapter Published</b>	<b>04</b>
<b>Sponsored Project</b>	<b>06</b>
<b>Research Papers Published</b>	<b>07</b>
<b>Faculty Development Programme Organized</b>	<b>18</b>
<b>Upcoming Conferences</b>	<b>19</b>
<b>Article of Prime Relevance</b>	<b>21</b>

# TABLE OF CONTENTS



# Editorial Note: COGNITION

Volume 1, Issue 3



Warm Greetings to everyone!

At the very outset, it is a wonderful opportunity to showcase the current research contributed in diverse areas of science and technology, multi-disciplinary insights as NIT Raipur brings out the quarterly research newsletter COGNITION (volume1, issue 3). The present issue carries the substantial research activities accomplished by the faculty members and research scholars in the third quarter (July-September 2021). The prime aim of this newsletter is to promote healthy research ambience and erudition in the institute.

It is immensely a great pleasure to receive wide range of research activities to make this issue stimulating and inspiring. As far as the current issue is concerned, the attempt is made to fabricate all significant events of academic research and innovation activities i.e. technical articles and showcases the abridged versions of the research papers, details of books and book chapters published, patents published/awarded, research projects undertaken, etc. from various departments as per the available source information during the respective quarter time period.

It is intensely believed that the recognition of any academic brilliance is the utmost value of teaching, research and innovation. Most importantly, the team, COGNITION expresses earnest thanks to our honorable Director Dr. A.M. Rawani, who has always been with us, to provide an amazing opportunity to nurture the talents.

We seize this opportunity to express our sincere thanks and warm wishes to all respected Deans, Heads of all Departments, Faculty members, Researchers, Students, Administrative and Non-teaching staff for extending help and constant support.

The editorial team, COGNITION makes an appeal to all stakeholders for precious advice and suggestion which will help to enhance the quality, readability and circulation of the newsletter in forthcoming times.

Kindly mail us at: [cognition@nitrrac.in](mailto:cognition@nitrrac.in)

We thank you all for granting this delightful opportunity for us and we wish you all a blissful reading!

Best regards

Editorial Team, COGNITION

**HEAD**



**Dr. Ayush Khare**  
Associate Professor  
Department of Physics

**MEMBER**



**Dr. Sanjeev Das**  
Assistant Professor  
Department of MME

**MEMBER**



**Dr. Y Vijaya Babu**  
Assistant Professor  
Department of HSS

**MEMBER**



**Dr. A. K. Dash**  
Assistant Professor  
Department of ME

Graphic Support by :

Rajan Kumar Sharma | Neha D. Naralkar | Sourabh B. Chavan





## PATENT GRANTED TO NIT RAIPUR

**TITLE : INTERNET OF THINGS (IOT) BASED SMART STAND FOR UTENSILS**

**NAMES OF INVENTORS : R. SHARMA, V. K. SRIVASTAVA, U. PANDEY, N. SHARMA, S. KHATAK, Dr. S. KUMAR, K. PANDEY, Dr. VIKAS KUMAR VIDYARTHI, A. PRAKASH, Dr. R. SHARMA**

**PATENT GRANTING AUTHORITY : DEPARTMENT FOR PROMOTION OF INDUSTRY AND INTERNAL TRADE, MINISTRY OF COMMERCE AND INDUSTRY, GOVERNMENT OF INDIA**

**STATUS (PUBLISHED/AWARDED) : PUBLISHED**

**PATENT NO : 202111035881 A**

**MONTH AND YEAR OF AWARD : SEPTEMBER 2021**

### Summary of Invention :

We always ignore to have a regular vision on kitchen utensil, which is very importance for a healthy family. In the proposed system, the IoT technology is used to provide a regular look over the kitchen utensils for any unwanted movements of insects, spiders, lizards and rats through the kitchen stand, which is indeed important for healthy practices. The proposed smart stand for kitchen utensil consists of sensors regularly sense the movements of the small creatures and inform the family members when they come around utensils and the stand. The proposed system also provides the information if a particular utensil would be safe for use or not by blinking the Green/Red indicator.

## MOUs SIGNED BY NIT RAIPUR

**NAME OF ORGANIZATION : Construction Industry Development Council (CIDC), Raipur**

**DATE OF MOU : July 24, 2021**

**PURPOSE OF MOU : To collaborate for initiating, developing and implementing programs of Internship, Faculty Development, Capacity Building and other short-term and long-term training programs for the students and faculty members.**

**NAME OF ORGANIZATION : Telecom Sector Skill Council**

**DATE OF MOU : July 28, 2021**

**PURPOSE OF MOU : For setting up a Centre of Excellence for imparting practical training in the domain of Information & Communications Technology, Cyber Security, Electronics & Communication including technical services and allied fields to enhance the employability of aspiring students.**

## BOOK PUBLISHED

**TITLE OF BOOK : Material Flow Analysis**

**PUBLISHER : IntechOpen**

**ISBN : 978-1-83962-957-0**

**MONTH & YEAR OF PUBLICATION : September 2021**

**AUTHOR: Sanjeev Kumar (Editor)**



### About the book

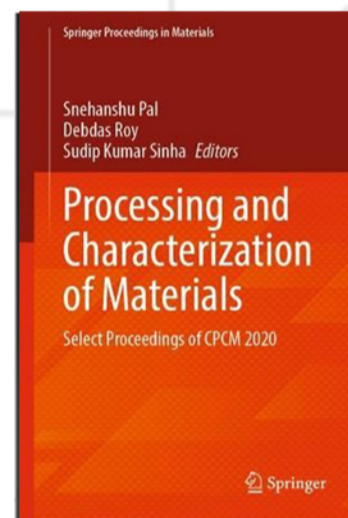
This book, titled "Material Flow Analysis", emphasizes the overview of various solid-state joining processes and grain refinement processes where plastic deformation is predominant. In addition, composite processes aimed at the strengthening between metal and polymeric materials for various environmental conditions have been incorporated, while advances in the extraction process for purification tri-n-butylphosphate (TBP)/inositol hexaphosphate (IP6) has been discussed in detail.





## BOOK CHAPTER PUBLISHED

**TITLE OF BOOK :** Data Science and its Applications  
**TITLE OF BOOK CHAPTER:** Crack Orientation Effects on Vibration Characteristics of Bi-directional Linearly Varying Thickness Partially Cracked Isotropic Micro-plate: An Analytical Approach  
**PUBLISHER :** Springer  
**ISBN :** 978-981-16-3937-1  
**MONTH & YEAR OF PUBLICATION :** September 2021  
**AUTHORS :** Bhupesh Kumar Chandrakar, Dr. Nitin Kumar Jain, Dr. Ankur Gupta



### About the book

The effect of crack orientation in a bi-directional linearly varying thickness isotropic plate is studied. The equilibrium principle is used to derive governing equation based on classical plate theory and the modified couple stress theory is used to consider the effect of microstructure. The line spring model is used to model the crack terms. The Berger's formulation introduces nonlinearity in the model. Galerkin's method was chosen to transform the derived governing equation into time-dependent modal coordinates, and the nonlinear Duffing equation was solved using an approximate solution technique. The effects of crack angle, crack size, taper constant, and length scale parameter variations are calculated for different boundary conditions for a cracked isotropic micro-plate.

## SPONSORED RESEARCH PROJECT

**TITLE OF RESEARCH PROJECT SANCTIONED:** Enhancing Brain Cognition Through Neuro-Feedback Model in India Children with Learning Disability  
**Sponsoring agency:** DST-SERB, New Delhi  
**AMOUNT SANCTIONED:** 27.25 Lakhs  
**PI:** Dr. Bikesh Kumar Singh, Department of Biomedical Engg.  
**CO-PI (IF ANY):** NIL

### SUMMARY

Learning disability (LD) refers to a group of neurodevelopmental disorders characterized by significant deficits in reading, writing, spelling, comprehension and arithmetic abilities in children despite normal intelligence and education. In India around 13-14% of all school children suffer from learning disorders. In school children the condition may go severe due to their social surroundings and interaction with other children at the same age. Such social constraints will cause the worst psychological condition and affect children's personality and characteristic development. LD is not a disease to cure rather it is a lifelong condition that needs special care, support, proper diagnosis and training to lead a flourishing and prolific life. With the existing needs and problems, our current research study aims at improving the brain cognition in Indian children with LD through Electroencephalogram (EEG) based neurofeedback training and studies its effect through functional connectivity study. Neurofeedback (NFB) is a brain-computer interface technique which trains users to gain self-control over specific goal oriented aspects of their brain activity. The following physiological signals will be acquired and considered for this analysis are EEG, single channel Electrocardiogram (ECG) and Respiration Rate. The brain functional connectivity measures will be estimated for validating pre-post neurofeedback sessions along with the measures of Heart rate variability and respiration rate. These measured parameters (Heart rate variability and respiration rate) will convey the influence of NFB on the central nervous system and autonomic nervous system. This method will allow deeper insights into the nature of individual differences, such as verbal, language and spatial ability, and their effect on learning.



# RESEARCH PAPERS PUBLISHED (JULY - SEPTEMBER 2021)

Title: Seasonal variability of LST-NDVI correlation on different land use/land cover using Landsat satellite sensor: a case study of Raipur City, India  
Authors: Subhanil Guha, Himanshu Govil  
Journal: Environment, Development and Sustainability  
Web: <https://doi.org/10.1007/s10668-021-01811-4>

Title: A machine learning -based classification of LANDSAT images to map land use and land cover of India  
Authors: Ram Kumar Singh, Prafull Kumar Singh, Martin Drews, Pavan Kumar, Hukum Singh, Ajay Kumar Gupta, Himanshu Govil, Amarjeet Kaur, Manoj Kumar  
Journal: Remote Sensing Applications: Society and Environment  
Web: <https://doi.org/10.1016/j.rsase.2021.100624>

Title: A long-term monthly analytical study on the relationship of LST with normalized difference spectral indices  
Authors: S. Guha, H. Govil  
Journal: European Journal of Remote Sensing  
Web: <https://doi.org/10.1080/22797254.2021.1965496>

Title: Using Remote Sensing Data and Geospatial Techniques for Watershed Delineation and Morphometric Analysis of Beas Upper Catchment, India  
Authors: Kumar Yogender, Sagar S Salunkhe, Mehtab Singh, H Govil  
Journal: Geographic Information Science for Land Resource Management  
Web: <https://doi.org/10.1002/9781119786375.ch17>

Title: Geoelectric Imaging to Assess Aquifer Conditions in Raipur City, Chhattisgarh, India, Using Schlumberger Method  
Authors: KC Mondal, DC Jhariya, HS Mandal  
Journal: Journal of the Geological Society of India  
Web: <https://doi.org/10.1007/s12594-021-1795-y>

Title: Mapping Hydrothermally Altered Minerals and Gossans using Hyperspectral data in Eastern Kumaon Himalaya, India  
Authors: Himanshu Govil, Gaurav Mishra, Neetu Gill, Ajay Taloor, P Diwan  
Journal: Applied Computing and Geosciences  
Web: <https://doi.org/10.1016/j.acags.2021.100054>

Title: Channel responses to flooding of Ganga River, Bihar India, 2019 using SAR and optical remote sensing  
Authors: Armugha Khan Himanshu Govil Haris Hasan Khan Praveen Kumar Thakur Ali P. Yunus Padmini Pani  
Journal: Advances in Space Research  
Web: <https://doi.org/10.1016/j.asr.2021.08.039>

Bio Medical Engineering  
Title: Improved pulmonary lung nodules risk stratification in computed tomography images by fusing shape and texture features in a machine-learning paradigm  
Authors: Satya Prakash Sahu, Narendra D Londhe, Shrish Verma, Bikesh K Singh, Sumit Kumar Banchhor  
Journal: International Journal of Imaging Systems and Technology  
Web: <https://doi.org/10.1002/ima.22539>

Title: Majority voting-based hybrid feature selection in machine learning paradigm for epilepsy detection using EEG  
Authors: Sunandan Mandal, Bikesh Kumar Singh, Kavita Thakur  
Journal: International Journal of Computational Vision and Robotics  
Web: <https://doi.org/10.1504/IJCVR.2021.116558>

Title: 20 Years of reconfigurable field-effect transistors: From concepts to future applications  
Authors: T Mikolajick, G Galderisi, M Simon, S Rai, A Kumar, A Heinzig, WM Weber, J Trommer  
Journal: Solid-State Electronics  
Web: <https://doi.org/10.1016/j.sse.2021.108036>

Title: Self-powered and reusable microbial fuel cell biosensor for toxicity detection in heavy metal polluted water  
Authors: Sweta Naik, Satya Eswari Jujjavarapu  
Journal: Journal of Environmental Chemical Engineering  
Web: <https://doi.org/10.1016/j.jece.2021.105318>

Title: Neural Network Methodology for the Identification and Classification of Lipopeptides Based on SMILES Annotation  
Authors: Manisha Yadav, Satya Eswari Jujjavarapu  
Journal: Computers  
Web: <https://doi.org/10.3390/computers10060074>

Title: Experimental and validation with neural network time series model of microbial fuel cell bio-sensor for phenol detection  
Authors: Sweta Naik, Jujjavarapu Satya Eswari  
Journal: Journal of Environmental Management  
Web: <https://doi.org/10.1016/j.jenvman.2021.112594>





Title: Utility of lignin-modifying enzymes: a green technology for organic compounds mycodegradation  
Authors: Swasti Dhagat, Satya Eswari Jujavarapu  
Journal: Journal of Chemical Technology & Biotechnology  
Web: <https://doi.org/10.1002/jctb.6807>

Title: Development, formulation, and analysis of fortified sattu beverage: Relationship between fortificant and additives  
Authors: Alok Sharma, Bidyut Mazumdar, Amit Keshav  
Journal: Journal of Food Processing and Preservation  
Web: <https://doi.org/10.1111/jfpp.15964>

Title: Synthesis and characterization of biocatalyst prepared from dairy waste for lactic acid esterification  
Authors: Amol A. Bhusari, Bidyut Mazumdar, Ajit P. Rathod  
Journal: International journal of Chemical Reactor Engineering  
Web: <https://doi.org/10.1515/ijcre-2021-0098>

Title: Role of Fok I VDR polymorphism in TB risk assessment; A Study in Central India population  
Authors: M Tiwari, MK Verma, PK Singh, D Bharti  
Journal: Meta Gene  
Web: <https://doi.org/10.1016/j.mgene.2021.100896>

Title: Novel local feature extraction for age invariant face recognition  
Authors: Rajesh Kumar Tripathi, Anand Singh Jalal  
Journal: Expert Systems with Applications  
Web: <https://doi.org/10.1016/j.eswa.2021.114786>

Title: Applicability of DDBD approach on low-rise RC buildings situated in Indian seismic regions  
Authors: Anurag Sharma, RK Tripathi, Govardhan Bhat  
Journal: Architecture, Structures and Construction  
Web: <https://doi.org/10.1007/s44150-021-00005-w>

Title: Pilot scale anaerobic co-digestion at tropical ambient temperature of India: Digester performance and techno-economic assessment  
Authors: Nupur Kesharwani, Sameer Bajpai  
Journal: Bioresource Technology Reports  
Web: <https://doi.org/10.1016/j.biteb.2021.100715>

Title: Modeling and Forecasting of Relative Humidity in an Indian Region  
Authors: Vikas Kumar Vidyarthi, Pragya Mukherjee, and Shikha Chourasiya  
Journal: Int. J. of Hydrology Science and Technology

Title: Augmented sequence features and subcellular localization for functional characterization of unknown protein sequences  
Authors: Saurabh Agrawal, Dilip Singh Sisodia, Naresh Kumar Nagwani  
Journal: Medical & Biological Engineering & Computing  
Web: <https://doi.org/10.1007/s11517-021-02436-5>

Title: Automated FBSE-EWT based learning framework for detection of epileptic seizures using time-segmented EEG signals  
Authors: Arti Anuragi, Dilip Singh Sisodia, Ram Bilas Pachori  
Journal: Computers in Biology and Medicine  
Web: <https://doi.org/10.1016/j.combiomed.2021.104708>

Title: BLADE: Robust malware detection against obfuscation in android  
Authors: Vikas Sihag, Manu Vardhan, Pradeep Singh  
Journal: Forensic Science International: Digital Investigation  
Web: <https://doi.org/10.1016/j.fsidi.2021.301176>

Title: A hybrid ensemble-filter wrapper feature selection approach for medical data classification  
Authors: Namrata Singh, Pradeep Singh  
Journal: Chemometrics and Intelligent Laboratory Systems  
Web: <https://doi.org/10.1016/j.chemolab.2021.104396>

Title: Rice Crop Disease Prediction Using Machine Learning Technique  
Authors: Bharati Patel, Aakanksha Sharaff  
Journal: International Journal of Agricultural and Environmental Information Systems (IJAEIS)  
Web: 10.4018/IJAEIS.20211001.0a5

Title: Spam Message Detection using Danger Theory and Krill Herd Optimization  
Authors: Aakanksha Sharaff, Chandramani Kamal, Siddhartha Porwal, Surbhi Bhatia, Kuljeet Kaur, Mohammad Mehendi Hassan  
Journal: Computer Networks  
Web: <https://doi.org/10.1016/j.comnet.2021.108453>

Title: An enhanced authentication scheme for Internet of Things and cloud based on elliptic curve cryptography  
Authors: Pallavi Bhuarya, Preeti Chandrakar, Rifaqat Ali, Aakanksha Sharaff  
Journal: International Journal of Communication Systems  
Web: <https://doi.org/10.1002/dac.4834>

Title: Prospecting the Effect of Topic Modeling in Information Retrieval  
Authors: Aakanksha Sharaff, Jitesh Kumar Dewangan, Dilip Singh Sisodia  
Journal: International Journal on Semantic Web and Information Systems (IJSWIS)  
Web: 10.4018/IJSWIS.2021070102

Title: A QoS aware optimal node deployment in wireless sensor network using Grey wolf optimization approach for IoT applications  
Authors: Kavita Jaiswal, Veena Anand  
Journal: Telecommunication Systems  
Web: <https://doi.org/10.1007/s11235-021-00831-9>





Title: Fault-resilient localization using fuzzy logic and NSGA II-based metaheuristic scheme for UWSNs  
Authors: Sangeeta Kumari, Pavan Kumar Mishra, Veena Anand  
Journal: Soft Computing  
Web: <https://doi.org/10.1007/s00500-021-05975-z>

Title: Multicore based least confidence query sampling strategy to speed up active learning approach for named entity recognition  
Authors: Ankit Agrawal, Sarsij Tripathi, Manu Vardhan  
Journal: Computing  
Web: <https://doi.org/10.1007/s00607-021-01000-1>

Title: WITHDRAWN: Scaling up Detection Rate in Intrusion Detection using Self-Adaptive Swarm Intelligence Mechanism  
Authors: Shubhra Dwivedi, Manu Vardhan, Sarsij Tripathi, Alok Kumar Shukla  
Journal: Swarm and Evolutionary Computation  
Web: <https://doi.org/10.1016/j.swevo.2021.100962>

Title: Detecting Product Review Spammers Using Principles of Big Data  
Authors: Jitendra Kumar Rout, Anmol Dalmia, Santanu Kumar Rath, Bhabendu Kumar Mohanta, Somula Ramasubbareddy, Amir H Gandomi  
Journal: IEEE Transactions on Engineering Management  
Web: [10.1109/TEM.2021.3097805](https://doi.org/10.1109/TEM.2021.3097805)

Title: An Ensemble-Based Scalable Approach for Intrusion Detection Using Big Data Framework  
Authors: Santosh Kumar Sahu, Durga Prasad Mohapatra, Jitendra Kumar Rout, Kshira Sagar Sahoo, Ashish Kr Luhach  
Journal: Big Data  
Web: <https://doi.org/10.1089/big.2020.0201>

Title: Gas sorption and luminescence properties of activated forms of a cd(II)-coordination polymer  
Authors: Somnath, Lovely Tyagi, Ravindra Singh, Prem Lamab, Kafeel Ahmad Siddiqui  
Journal: Journal of Coordination Chemistry  
Web: <https://doi.org/10.1080/00958972.2021.1950699>

Title: On the Convergence Theory of Double K-Weak Splittings of Type II  
Authors: Vaibhav Shekhar, Nachiketa Mishra, Debasisha Mishra  
Journal: Applications of Mathematics  
Web: <https://doi.org/10.21136/AM.2021.0270-20>

Title: On C-tensor and its application to eigenvalue localization  
Authors: Krushnachandra Panigrahy, Debasisha Mishra, Juan Manuel Peña  
Journal: Linear and Multilinear Algebra  
Web: <https://doi.org/10.1080/03081087.2021.1952153>

Title: Delay-induced Hopf and double Hopf-bifurcation in plankton system with dormancy of predators  
Authors: Archana Ojha, Nilesh Kumar Thakur  
Journal: Nonlinear Dynamics  
Web: <https://doi.org/10.1007/s11071-021-06617-7>

Title: Thermal boundary resistance enhancement through interfacial polarization electric field induced in GaN/InxGa1-xN superlattice  
Authors: Subhranshu Sekhar Sahu, Bijay Kumar Sahoo  
Journal: Superlattices and Microstructures  
Web: <https://doi.org/10.1016/j.spmi.2021.107035>

Title: Thermal conductivity reduction by interfacial electric field of GaN/InGaN/GaN superlattice  
Authors: Subhranshu Sekhar Sahu, Bijay Kumar Sahoo  
Journal: Materials Science and Engineering: B  
Web: <https://doi.org/10.1016/j.mseb.2021.115394>

Title: Role of interfacial electric field in thermal conductivity of indium-rich GaN/InxGa1-xN/GaN superlattices ( $x \geq 0.7$ )  
Authors: Subhranshu Sekhar Sahu, Bijay Kumar Sahoo  
Journal: Indian Journal of Physics  
Web: <https://doi.org/10.1007/s12648-021-02141-x>

Title: Detection of symmetrical fault and discrimination from power swing using MOPSV approach  
Authors: Kumar Raja Andanapali, Monalisa Biswal  
Journal: International Journal of Emerging Electric Power Systems  
Web: <https://doi.org/10.1515/ijeeps-2021-0072>

Title: Swarm intelligence based directional relaying approach for power network  
Authors: Ch Durga Prasad, and M. Biswal  
Journal: Journal of Institution of Engineers, Springer  
Web: <https://doi.org/10.1007/s40031-021-00665-8>

Title: Swarm Evaluated Threshold Elimination Approach for Symmetrical Fault Detection during Power Swing  
Authors: Ch Durga Prasad, and M. Biswal  
Journal: IETE Journal of Research, Taylor and Francis  
Web: <https://doi.org/10.1080/03772063.2021.1986150>

Title: A passive communication-based islanding detection technique for AC microgrid  
Authors: Ruchita Nale, Monalisa Biswal, Nand Kishor  
Journal: Journal of Electric Power and Energy System, Elsevier  
Web: Article reference: JEPE\_107657

Title: Computer aided pain detection and intensity estimation using compact CNN based fusion network  
Authors: Ashish Semwal, Narendra D Londhe  
Journal: Applied Soft Computing  
Web: <https://doi.org/10.1016/j.asoc.2021.107780>





Title: Robust discriminative feature subspace analysis for kinship verification  
Authors: Aarti Goyal, Toshnalal Meenpal  
Journal: Information Sciences  
Web: <https://doi.org/10.1016/j.ins.2021.07.046>

Title: Vertically extended drain double gate Si1- xGex source tunnel FET: proposal & investigation for optimized device performance  
Authors: Anand Raj, Sangeeta Singh, Kumari Nibha Priyadarshani, Rajeev Arya, Alok Naugarhiya  
Journal: Silicon  
Web: <https://doi.org/10.1007/s12633-020-00603-1>

Title: High temperature analysis of strained superjunction vertical single diffused MOSFET  
Authors: Onika Parmar, Alok Naugarhiya  
Journal: International Journal of Modern Physics B  
Web: <https://doi.org/10.1142/S0217979221501964>

Title: A Lead-Free Spiral Bimorph Piezoelectric MEMS Energy Harvester for Enhanced Power Density  
Authors: Vicky Butram, Ashutosh Mishra, Alok Naugarhiya  
Journal: IETE Technical Review  
Web: <https://doi.org/10.1080/02564602.2020.1799876>

Title: Optimized fuzzy based symbiotic organism search algorithm for engineering design problem  
Authors: Sudeepa Das, Tirath Prasad Sahu, Rekh Ram Janghel  
Journal: Evolutionary Intelligence  
Web: <https://doi.org/10.1007/s12065-021-00650-6>

Title: Investigating Feature Ranking Methods for Sub-Band and Relative Power Features in Motor Imagery Task Classification  
Authors: Samrudhi Mohdiwale, Mridu Sahu, GR Sinha, Humaira Nisar  
Journal: Journal of Healthcare Engineering  
Web: <https://doi.org/10.1155/2021/3928470>

Title: Deep Convolution Neural Network Based System for Early Diagnosis of Alzheimer's Disease  
Authors: R R Janghel, YK Rathore  
Journal: IRBM  
Web: <https://doi.org/10.1016/j.irbm.2020.06.006>

Title: Effective forecasting of stock market price by using extreme learning machine optimized by PSO-based group oriented crow search algorithm  
Authors: Sudeepa Das, Tirath Prasad Sahu, Rekh Ram Janghel, Binod Kumar Sahu  
Journal: Neural Computing and Applications  
Web: <https://doi.org/10.1007/s00521-021-06403-x>

Title: Cardiac Arrhythmia Detection and Classification From ECG Signals Using XGBoost Classifier  
Authors: Saroj Kumar Pandeyz, Rekh Ram Janghel, Vaibhav Gupta  
Journal: Machine Learning Algorithms and Applications  
Web: <https://doi.org/10.1002/9781119769262.ch8>

Title: A Deep Learning-Based Transfer Learning Framework for the Early Detection and Classification of Dermoscopic Images of Melanoma  
Authors: Lokesh Singh, Rekh Ram Janghel, Satya Prakash Sahu  
Journal: Biomedical and Pharmacology Journal  
Web: <https://bit.ly/3jPFwJc>

Title: A distributed ensemble design-based intrusion detection system using fog computing to protect the internet of things networks  
Authors: Prabhat Kumar, Govind P Gupta, Rakesh Tripathi  
Journal: Journal of Ambient Intelligence and Humanized Computing  
Web: <https://doi.org/10.1007/s12652-020-02696-3>

Title: Deep Privacy-Encoding based Federated Learning Framework for Smart Agriculture  
Authors: Prabhat Kumar, Govind P Gupta, Rakesh Tripathi  
Journal: IEEE Micro  
Web: 10.1109/MM.2021.3112476

Title: Optimized coverage-aware trajectory planning for AUVs for efficient data collection in underwater acoustic sensor networks  
Authors: Vrajesh Kumar Chawra, Govind P Gupta  
Journal: Evolutionary Intelligence  
Web: <https://doi.org/10.1007/s12065-021-00667-x>

Title: P2SF-IoV: A Privacy-Preservation-Based Secured Framework for Internet of Vehicles  
Authors: Randhir Kumar, Prabhat Kumar, Rakesh Tripathi, Govind P Gupta, Neeraj Kumar  
Journal: IEEE Transactions on Intelligent Transportation Systems  
Web: 10.1109/TITS.2021.3102581

Title: A Privacy-Preserving-Based Secure Framework Using Blockchain-Enabled Deep-Learning in Cooperative Intelligent Transport System  
Authors: Randhir Kumar, Prabhat Kumar, Rakesh Tripathi, Govind P Gupta, Neeraj Kumar, Mohammad Mehedi Hassan  
Journal: IEEE Transactions on Intelligent Transportation Systems  
Web: 10.1109/TITS.2021.3098636

Title: An efficient chaotic salp swarm optimization approach based on ensemble algorithm for class imbalance problems  
Authors: Rekha Gillala, Krishna Reddy Vuyyuru, Chandrashekar Jatoth, Ugo Fiore  
Journal: Soft Computing  
Web: <https://doi.org/10.1007/s00500-021-06080-x>





Title: Vital Sign Monitoring System for Healthcare Through IoT Based Personal Service Application  
Authors: Manju Lata Sahu, Mithilesh Atulkar, Mitul Kumar Ahirwal, Afsar Ahamad  
Journal: Wireless Personal Communications  
Web: <https://doi.org/10.1007/s11277-021-08892-4>

Title: A lightweight key management scheme for key-escrow-free ECC-based CP-ABE for IoT healthcare systems  
Authors: K Sowjanya, Mou Dasgupta, Sangram Ray  
Journal: Journal of Systems Architecture  
Web: <https://doi.org/10.1016/j.sysarc.2021.102108>

Title: jForge: An adversarial method to deceive JPEG forgery localization schemes  
Authors: Arkaprava Bhaduri Mandal, Tanmoy Kanti Das  
Journal: Multimedia Tools and Applications  
Web: <https://doi.org/10.1007/s11042-021-11265-5>

Title: Risky decision under laboratory deadline with experience and indirect self-selection  
Authors: Priyodorshi Banerjee, Tanmoy Das  
Journal: Journal of Behavioral and Experimental Finance  
Web: <https://doi.org/10.1016/j.jbef.2020.100445>

Title: A Reconstructive Model for Identifying the Global Spread in a Pandemic  
Authors: Debasish Pattanayak, Dibakar Saha, Debarati Mitra, Partha Sarathi Mandal  
Journal: International Conference on Distributed Computing and Internet Technology  
Web: [https://doi.org/10.1007/978-3-030-65621-8\\_12](https://doi.org/10.1007/978-3-030-65621-8_12)

Title: Industry oriented quality management of engineering education: an integrated QFD-TOPSIS approach  
Authors: Ajit Kumar Singh, A M Rawani  
Journal: International Journal of System Assurance Engineering and Management  
Web: <https://doi.org/10.1007/s13198-021-01360-z>

Title: Performance analysis of melting behavior of phase change material encapsulated within differently shaped macro-capsule  
Authors: Ankur Sharma, Satish Kumar Dewangan  
Journal: International Journal of Energy and Environmental Engineering  
Web: <https://doi.org/10.1007/s40095-021-00431-y>

Title: Effect of collector roof cum chimney divergence and exhaust fan on solar chimney power plant performance  
Authors: Satish Kumar Dewangan  
Journal: International Journal of Energy and Environmental Engineering  
Web: <https://doi.org/10.1007/s40095-021-00426-9>

Title: Numerical assessment of heat transfer coefficient for preterm infant nursed under a radiant warmer  
Authors: Devesh Kumar Baghel, Shobha Lata Sinha, Satish Kumar Dewangan  
Journal: Heat Transfer  
Web: <https://doi.org/10.1002/htj.22097>

Title: Design of multi-objective sustainable food distribution network in the Indian context with multiple delivery channels  
Authors: Vinay Surendra Yadav, AR Singh, Rakesh D Raut, Naoufel Cheikhrouhou  
Journal: Computers & industrial engineering  
Web: <https://doi.org/10.1016/j.cie.2021.107549>

Title: Development of a conceptual method for sustainability assessment in manufacturing  
Authors: Vikas Swarnakar, AR Singh, Jiju Antony, Anil Kr Tiwari, Elizabeth Cudney  
Journal: Computers & Industrial Engineering  
Web: <https://doi.org/10.1016/j.cie.2021.107403>

Title: Modeling critical success factors for sustainable LSS implementation in hospitals: an empirical study  
Authors: Vikas Swarnakar, Anthony Bagherian, A R Singh  
Journal: International Journal of Quality & Reliability Management  
Web: <https://doi.org/10.1108/IJQRM-04-2021-0099>

Title: Evaluation of key performance indicators for sustainability assessment in automotive component manufacturing organization  
Authors: Vikas Swarnakar, AR Singh, Anil Kr Tiwari  
Journal: Materials Today  
Web: <https://doi.org/10.1016/j.matpr.2021.04.045>

Title: Centrifugally cast A356/SiC functionally graded composite: Fabrication and mechanical property assessment  
Authors: Amrit Mallick, Srinivasu Gangi Setti, Raj Kumar Sahu  
Journal: Materials Today: Proceedings  
Web: <https://doi.org/10.1016/j.matpr.2021.07.155>

Title: Role of heat inputs on microstructure and mechanical properties in coarse-grained heat-affected zone of bainitic steel  
Authors: Sanjeev Kumar, Pradeep Kasyap, Chandan Pandey, B. Basu, S.K. Nath  
Journal: CIRP Journal of Manufacturing Science and Technology  
Web: <https://www.sciencedirect.com/science/article/pii/S1755581721001565>

Title: Impact of Subsequent Pass Weld Thermal Cycles on First-Pass Coarse Grain Heat-Affected Zone's Microstructure and Mechanical Properties of Naval Bainitic Steel  
Authors: Sanjeev Kumar, Ashutosh Sharma, Chandan Pandey, B. Basu, S. K. Nath  
Journal: Journal of Materials, Engineering and Performances  
Web: <https://link.springer.com/article/10.1007/s11665-021-06177>

Title: Performance Analysis of Adsorption Refrigeration System Using Silica gel/Methanol Pair: Experimental & Analytical  
Authors: Soni P, Gaba V. K.  
Journal: Journal of Thermal Engineering  
Web: <https://doi.org/10.18186/thermal.977913>





Title: Performance analysis of Adsorption Refrigeration system working on Activated Carbon- Methanol Pair using Finned Tube type Adsorber Bed  
Authors: P. Soni, S. Lolalis, B. Mazumdar, S. Bhowmick, V. K. Gaba  
Journal: International Journal of Heat & Technology  
Web: <https://doi.org/10.18280/ijht.390433>

Title: Fiber orientation effects on the non-linear vibrations for a microstructure-dependent tapered plate containing an arbitrarily located crack  
Authors: Bhupesh Kumar Chandrakar, Nitin Kumar Jain, Ankur Gupta  
Journal: Mechanics Based Design of Structures and Machines: An International Journal  
Web: <https://doi.org/10.1080/15397734.2021.1966305>

Title: Investigating the effects of rainfall and groundwater on coal mine waste dump stability: a case study  
Authors: P K Nayak, A K Dash, P Dewangan  
Journal: Journal of Mines, Metals and Fuels  
Web: <https://doi.org/10.18311/jmmf/2021/28542>

Title: Blockchain-Based Attack Detection on Machine Learning Algorithms for IoT-Based e-Health Applications  
Authors: Thippa Reddy Gadekallu, MK Manoj, Neeraj Kumar, Saqib Hakak, Sweta Bhattacharya  
Journal: IEEE Internet of Things Magazine  
Web: [10.1109/IOTM.1021.2000160](https://doi.org/10.1109/IOTM.1021.2000160)

Title: Process-Property Correlation of Friction Stir Welding of Marine Grade Aluminium Alloy 5083 Using Finite Element Analysis  
Authors: M Sahu, A Paul, S Ganguly  
Journal: International Journal of Maritime Engineering  
Web: <https://doi.org/10.5750/ijme.v163iA2.757>

Title: On the Prediction of Grain Refinement Mechanism in Direct Chill Casting of Aluminum and Its Alloys under Low Degree Mechanical Forced Convection  
Authors: Deepak Patel, Prasenjit Biswas, Anil Kumar, Hiren R. Kotadia, Archana Mallik, Sanjeev Das  
Journal: Metals and Materials International  
Web: <https://doi.org/10.1007/s12540-021-01048-w>

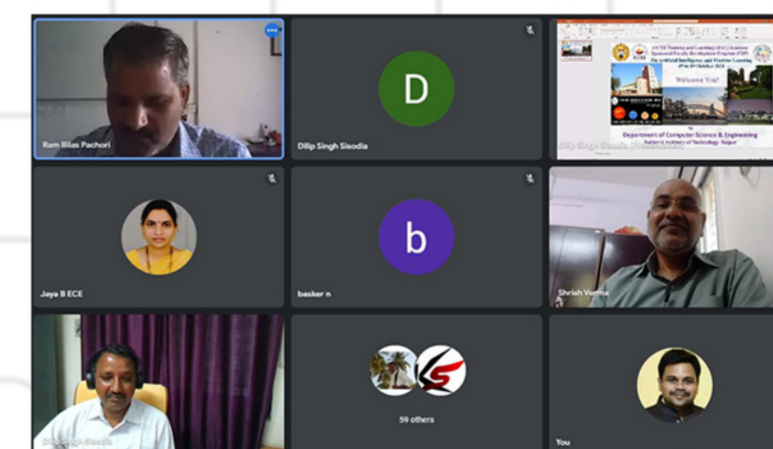
Title: Electrochemically functionalized graphene as an anti-corrosion reinforcement in Cu matrix composite thin films  
Authors: Akhya kumar Behera, Amlan Das, Sanjeev Das, Archana Mallik  
Journal: International Journal of Minerals, Metallurgy and Materials  
Web: <https://doi.org/10.1007/s12613-020-2124-y>

Title: In-house design of forced convection direct chill casting simulator for casting immiscible Al-Sn alloys  
Authors: Deepak Patel, Amrik Kundu, Arjun Kundu, Prasenjit Biswas, Hiren R Kotadia, Archana Mallik, Sanjeev Das  
Journal: International Journal of Cast Metals Research  
Web: <https://doi.org/10.1080/13640461.2021.1970937>

## FACULTY DEVELOPMENT PROGRAM (FDP) ORGANIZED

**TITLE :** Faculty Development Program (FDP) on Artificial Intelligence and Machine Learning  
**ORGANIZING DEPARTMENT :** Computer Science and Engg.  
**DURATION :** October 4 - 8, 2021  
**COORDINATOR :** Dr D.S Sisodia.

A one week AICTE Training and Learning (ATAL) Academy Sponsored Faculty Development Program (FDP) on Artificial Intelligence and Machine Learning was conducted by National Institute of Technology (NIT) Raipur during October 4-8, 2021. This FDP was organized by the Department of Computer Science and Engineering and coordinated by Dr. Dilip Singh Sisodia. The FDP was inaugurated on 4<sup>th</sup> October in the presence of Dr Shrish Verma, (Dean Academics), NIT Raipur and Dr Rambilas Pachori, IIT Indore. More than 167 participants attended this FDP and most of them were faculty members of various engineering institutes from all over India. During these five days, a total of 14 sessions of theory and hands-on training were conducted. Resource persons from IITs, NITs, IIITs and leading Universities shared their expertise with the participants. On the inaugural day, sessions were conducted by Prof. Dr. Rambilas Pachori, IIT Indore, Prof. Lalit Garg, University of Malta, Malta and Dr Deepak Singh, NIT Raipur. The topics covered during the programme include introduction to AI, machine learning, extended intelligence, data visualization, supervised learning, unsupervised learning, ensemble learning, feature engineering, deep learning, and their applications in designing various learning models for solving real life problems. The last session of this FDP was devoted to spirituality and happiness. At the end of the FDP, an online MCQ based assessment session was conducted for all participants and 132 participants qualified for certificate.





# UPCOMING CONFERENCES

**TITLE :** 3<sup>rd</sup> National Conference on Advanced Materials and Applications (NCAMA-2021)

**DURATION:** November 25-26, 2021

**ORGANIZING DEPARTMENT :** Physics

**CHAIRPERSON :** Dr. Sadhana Agrawal

**ORGANIZING SECRETARIES:** Dr. Ayush Khare and Dr. K. S. Ojha

**PARTICIPANTS:** PhD students , faculty members and persons from industries

**REGISTRATION FEES:** PhD students- Rs 2360, faculty members- Rs 2950 and persons from industries- Rs3540

After the successful organization of the first and second versions of NCAMA [NCAMA-2019 and NCAMA-2020], Department of Physics is going to organize 3<sup>rd</sup> National Conference on Advanced Materials and Applications (NCAMA-2021) during November 25-26, 2021 through online mode. The objective of the conference is to bring people from various fields of materials science to a common platform and to make researchers aware of the latest developments in the related fields. The speakers (tentative) are being invited from IITs, NITs and reputed research laboratories. All the presented papers will be considered for publication in SCI indexed journal: European Physical Journal Special Topics (a Springer Publication). The last date for submitting abstract was November 15, 2021. For more details kindly visit: <http://ncama2021.nitrac.in>.

**TITLE :** 3<sup>rd</sup> International Conference on Machine Learning, Image Processing, Network Security and Data Science (MIND-2021)

**DURATION :** December 11-12, 2021

**ORGANIZING DEPARTMENT :** Information Technology

**CHAIRPERSON :** Dr. Rajesh Doriya

**ORGANIZING SECRETARIES:** Dr. Sanjay Kumar, Dr. Gyanendra Kumar Verma and Dr. Rekh Ram Janghel

**PARTICIPANTS:** UG, PG and PhD students , academicians and persons from industries

**REGISTRATION FEES:** Attendees- Rs 500, UG, PG and PhD students- Rs 2500 , academicians and persons from industries- Rs 4000

Department of Information Technology is going to organize 3<sup>rd</sup> International conference on Machine Learning, Image Processing, Network security and Data Science (MIND-2021) during December 11-12, 2021 through virtual mode. MIND-to provide a floor for deliberations on strategies, recent trends and innovative approaches of different domain of Computer/Electronics/Communication Engineering like Machine Learning, Digital Signal Processing, Networks, and Information Security, etc. The previous two editions of MIND conference have been successfully organized at NIT Kurukshetra and NIT Silchar, respectively. Original contributions are being invited in machine learning and computational intelligence, image processing and computer vision, network and cyber security, Data Sciences and Big Data, etc. The MIND-2021 conference proceeding will be published by prestigious SCOPUS indexed "Lecture Notes in Electrical Engineering (LNEE)" series (A Springer Publication). The last date for submitting papers was November 01, 2021. For more details kindly visit: <http://www.nitrac.in/conference.php>

**TITLE :** International Conference on Advances in Chemical and Environmental Engineering (ACEE-2021)

**DURATION :** December 16-17, 2021

**ORGANIZING DEPARTMENT :** Chemical Engg.

**CHAIRPERSON :** Dr. P. K. Chaudhari

**ORGANIZING SECRETARIES:** Dr. A. K. Poonia, Dr. Prabir Ghosh and Dr. C. Thakur

**PARTICIPANTS:** UG, PG and PhD students , academicians and persons from industries

**REGISTRATION FEES:** UG, PG and PhD students- Rs 500 , faculties/academicians- Rs1000, persons from industries- Rs 1500 and foreign delegates- USD100

Department of Chemical Engg. is going to organize International Conference on Advances in Chemical and Environmental Engineering (ACEE-2021) during December 16-17, 2021 through virtual mode. ACEE-2021 aims to bring together scientists, researchers, and industrialists from the academic and industrial sector to exchange knowledge and share their experiences and latest research outcomes about all aspects of Chemical and Environmental Engineering. The topics to be covered include Application of Catalyst in wastewater treatment for sustainable development, Advanced Separation/Oxidation Processes, Electrochemical processes in remediation of wastewater; Sustainable Development for Cleaner Production, Environmental Engineering, Biochemical Engineering in environmental application, Fluidization, Environmental Chemistry, Chemical Engineering in environmental application, Green Technology. All the presented papers will be considered for publication in SCI indexed journal: Environmental Science and Pollution Research (a Springer Publication). The last date for submitting abstract was November 10, 2021. For more details kindly visit: <http://acee2021.nitrac.in>.

**TITLE :** International Conference on Materials and Technologies (MaterialTECH 2022)

**DURATION:** January 28-29, 2022

**ORGANIZING DEPARTMENT :** Metallurgical and Materials Engg. and Mechanical Engg.

**CHAIRPERSON :** Dr. M. K. Manoj

**ORGANIZING SECRETARIES:** Dr. N.V. Swamy Naidu, Dr. Neha Gupta and Dr. Jagadish

**PARTICIPANTS:** UG, PG and PhD students , academicians and persons from industries

**REGISTRATION FEES:** UG, PG and PhD students/NIT Raipur faculty- Rs 472 , faculties/researchers/persons from industries- Rs 944 and foreign UG, PG, PhD students- USD10 and foreign faculties/researchers/persons from industries- USD15

Department of Metallurgical and Materials Engg. and Mechanical Engg. are going to organize 2<sup>nd</sup> International Conference on Materials and Technologies (MaterialTECH 2022) during January 28-29, 2022 through virtual mode . MaterialTECH 2022 aims to proclaim knowledge and share new ideas amongst the professionals, industrialists and students from research areas of Metallurgy, Materials Science and Mechanical Engineering to share their research experiences and indulge in interactive discussions and technical sessions at the event. The topics to be covered include advanced materials, characterization and testing techniques, processing and manufacturing, Science and Engineering, Computational Methods and Materials, Surface Engineering, etc. Accepted and registered full papers after peer review process will be published in Materials Today: Proceedings (An Elsevier Publication). The last date for submitting abstract/full paper is November 25, 2021. For more details kindly visit: <http://materialtech2022.nitrac.in>.





# ARTICLE OF PRIME RELEVANCE

## SOLAR ACTIVITY AND SPACE WEATHER

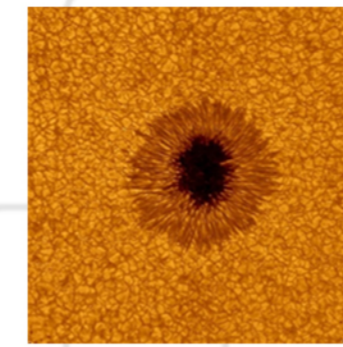
Abhishek Johri  
Department of Physics  
National Institute of Technology, Raipur

Naked-eye observations of the Sun show as if it is very calm and appears the same on the human life-time scale. But the reality is opposite to what it appears to be. Ground- and space-based observations of the Sun reveal that it is continuously active. Solar activity refers to a number of phenomena observed on the Sun, namely sunspots (Figure1 a), the chromospheric network (Figure1 b), prominences, solar flares (Figure1 c), coronal mass ejections (CMEs) (Figure1 d), etc.

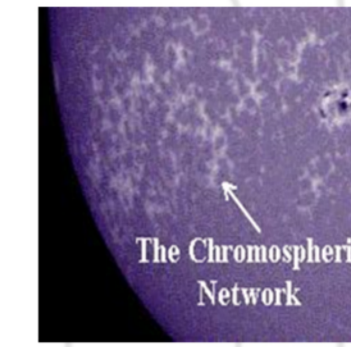
All the solar activities are due to the magnetic field produced by the dynamo processes happening in the interior of the Sun. The overall strength of the solar magnetic field changes periodically from a minimum state to a maximum and then gradually to the minimum in an approximate 11-year period, which is known as the solar cycle. The phase of maximum solar activity is called solar maximum, whereas the minimum activity phase is referred as solar minimum.

A solar flare is a sudden, rapid, and intense brightening of electromagnetic (EM) radiation observed near the surface of the Sun. The radiation coming from a solar flare almost covers the entire EM spectrum. But, the majority of the flares go undetected in the visible region as their energy is being spread over frequencies outside the visible range. A flare occurs due to the restructuring (reconfiguring) of large scale magnetic field by topological changes. This phenomena of magnetic reconfiguration is termed as magnetic reconnection. In the process of magnetic reconnection, energy as large as  $10^{25}$  J can be released. The magnetic reconnection in the solar atmosphere is not only responsible for solar flare eruptions but also for coronal mass ejections (CMEs). CMEs are violent explosion in the solar atmosphere which carry magnetized solar plasma into the interplanetary medium. The typical mass and speed of CMEs lie in the range of  $\sim 10^{10}$ – $10^{13}$  kg [Vourlidas et al., 2002] and  $\sim 30$ – $2600$  km/s [Yashiro et al., 2004], respectively. The occurrence rate of CMEs follows the solar cycle activity. During the solar minimum, one CME is observed once in about five days, whereas during the maximum phase of solar cycle, 4 CMEs are observed in a day. During the solar flare and/or CME eruption, charged particles (e.g., electrons, protons, and heavy ions) in the solar atmosphere (chromosphere or corona) are accelerated from tens of keV to GeV energies and observed in the near-Earth region. Being energetic and having their origin in the near-Sun region, these particles (specially protons) are termed as solar energetic particles (SEPs). The fastest among them can reach  $\sim 80\%$  of speed of light.

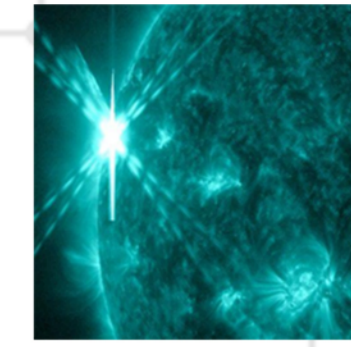
The internal magnetic energy of the CME play an important role in CME evolution but their relative importance is still not understood. Moreover, CME-CME interaction also affects their travel time. Therefore, it is interesting and scientifically necessary to understand the propagation effects on CMEs evolution in the Sun-Earth distance. Moreover, predicting the arrival of associated shocks/ICME at the Earth's magnetosphere are important from space weather perspectives.



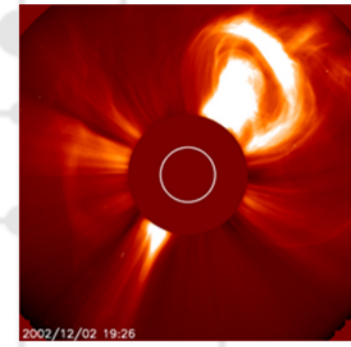
(a) A Sunspot



(b) The Chromospheric Network



(c) Solar Flare



(d) Coronal Mass Ejection

These solar activities can affect the dynamics conditions in the Earth's outer space and referred as "Space Weather". Space weather includes all the physical conditions and events on the sun and in the upper atmosphere of the Earth that can affect space- and ground-based technological systems. For example, electromagnetic radiation produced during solar flares changes the ionization content of ionosphere which can severely affect the radio communication. The interaction between solar magnetic field associated with CMEs and Earth's magnetic field is responsible for spectacular auroral lights. Moreover, if the magnetic field associated with the CME is directed southward it interacts strongly with the oppositely oriented magnetic field of the Earth. This interaction can be strong enough to produce a power grid failure causing a complete blackout (e.g., the Great Quebec Blackout of March 13, 1989). It is also important to mention that high energy charged particles produced during solar flares/CMEs/solar-wind are sever threat to space technologies as well as to astronauts. For example, the stream of charged particle can damage the solar panels, microelectronics of a satellite which ultimately reduces the life of a costly space program. Moreover, the drag produced by these particle can cause to shift the orbit of the satellite. A slight shift in the orbit of a GPS satellite can leads to large navigation errors.

It has been observed that fast and wide CMEs are the major cause of transient interplanetary disturbances such as shock-waves and geo-magnetic storms (e.g., Gosling et al. [1991]). Numerous studies, including models, have been made to understand evolution of CMEs in the inner heliosphere (e.g., Dryer et al. [2004]; Manoharan et al. [2001]; Bisi et al. [2010]). CMEs can evolve considerably in size and speed on their way from the Sun to Earth and propagation effects are important to understand CME evolution as well as predicting their arrival at 1 AU. However, the evolutionary process can differ from one event to other and it depends on the solar wind conditions along the path of propagation and physical characteristics of the CME (e.g., Gosling et al. [1998]; Gopalswamy et al. [2001a]; Manoharan et al. [2001]). For example, it has been observed that fast CMEs tend to decelerate in the interplanetary medium due to the drag force of ambient solar-wind and vice-versa. However, in some cases, the drag force of the ambient solar-wind is likely to be compensated (partially or completely) by the internal magnetic energy of the CME [Démoulin, 1998; Manoharan and Mujiber Rahman, 2011; Johri and Manoharan, 2016]. These results suggest that the drag force of the ambient solar-wind as well as the internal magnetic energy of the CME play an important role in CME evolution but their relative importance is still not understood. Moreover, CME-CME interaction also affects their travel time. Therefore, it is interesting and scientifically necessary to understand the propagation effects on CMEs evolution in the Sun-Earth distance. Moreover, predicting the arrival of associated shocks/ICME at the Earth's magnetosphere are important from space weather perspectives.



Dr. Abhishek Johri , Temporary Faculty



## A THREE-DIMENSIONAL MATHEMATICAL GROUNDWATER FLOW MODEL IN RAIPUR CITY AREA, CHHATTISGARH, INDIA

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National Institute of Technology Raipur-492010 (CG), India

High demand of groundwater for the swiftly growing population has increased the rate of requirement and triggers the effective management of available groundwater resources. The management of water resources needs a proper assessment and visualization of its overall structure and is effectively visualized with the help of groundwater modeling software. The groundwater modeling has been considered as a multidisciplinary management tool that can carry out multiple functions like furnishing a framework for arranging hydrological data, assessing the behavior and properties of aquifer system and allowing both quantitative and qualitative prediction of responses of the system on applied stress condition (Senthilkumar and Elango, 2004; Rojas and Dassargues, 2007).

As the city Raipur (Fig.1) is experiencing a rapidly growth, the consumption of groundwater in the city has noticeably been increased to satisfy the growing demand of groundwater on domestic and agricultural purposes. Due to the over extraction of groundwater, the water table in the area is showing a trend which is gradually falling with time to time (CGWB, 2012; Khan and Jhariya, 2018). This study has been designed by considering this scenario by investigating the aquifer condition with present stress conditions and as a result suggests a possible management strategy to overcome the withstanding groundwater related issues. The objectives of the study that has considered to solve the problem are; development of flow model to assess the flow pattern and budget, development of transient flow model to assess the water table and to forecast for 14600 days, fixing a suitable pumping rate and to decide recharge site as management strategy for groundwater extraction without harming the natural aquifer condition.

The hydrogeological system of the study area is conceptualized according to the overall picture that developed from the detailed study of geology geomorphology, borehole lithology, well location and data of water-level fluctuation. Based on the collected information, the model is conceptualized as a single layered unconfined aquifer having variable thickness from 80 m to 190 m. The study area is surrounded by Kharun River in the North and West side and Chhokra Nala is in

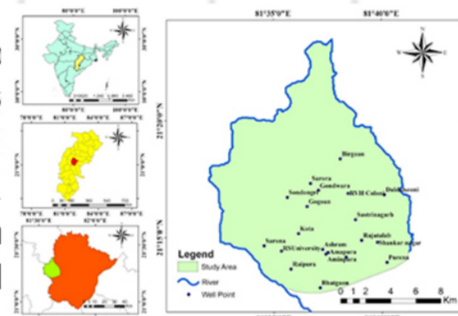


Fig.1 Study area Location map

Eastern side. Both rivers are considered as constant head boundaries. The third boundary is the southern one, considered as specified flux boundary. Initial groundwater head is one of the important parameters uses in the groundwater modeling has been collected during seasons of Pre monsoon and post monsoon during the years of 1998-2000. The water level data of twenty numbers of wells from different location of study area has been processed and converted in to water table data for assigning the initial head value. Major aquifer parameters like hydraulic conductivity (K), transmissivity (T), storativity (S) and specific yield (Sy) were gathered from groundwater exploration report of Chhattisgarh state (CGWB 2016) and assigned in the model. The major utilization groundwater withdrawal in Raipur city is for the agriculture and domestic use. The rate of discharge of groundwater in average is determined as 13400m<sup>3</sup>/day.

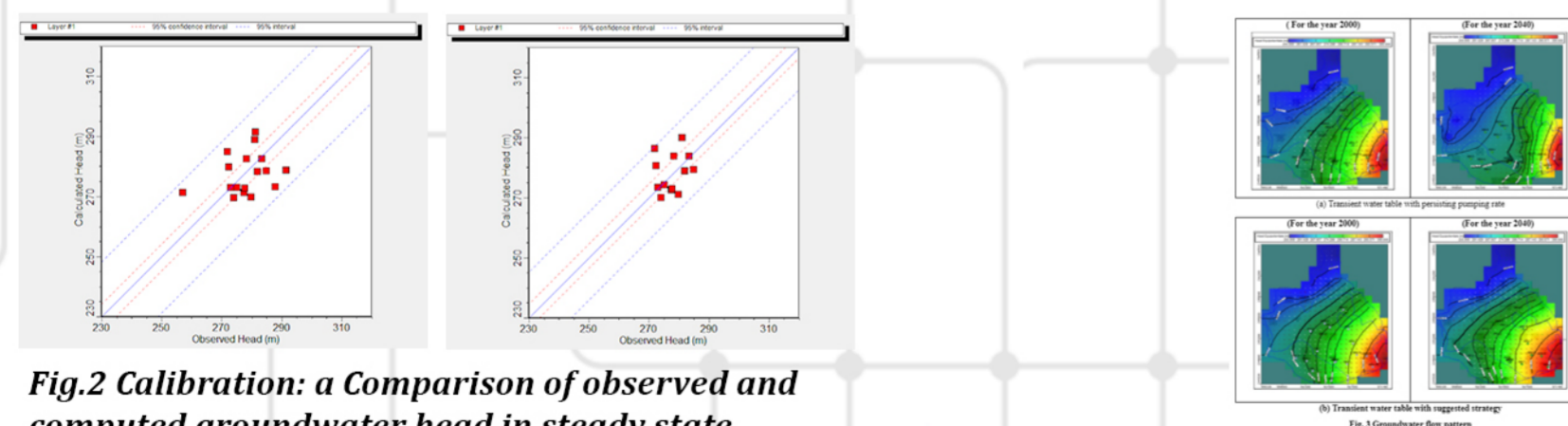


Fig.2 Calibration: a Comparison of observed and computed groundwater head in steady state  
b Comparison of observed and computed groundwater head in transient state

It shows an increasing trend with 5% in each successive year. Groundwater extraction was calculated based on the population report of census 2001 & 2011, is about 22 liters per capita per day (lpcd). Rainfall is main source of groundwater recharge of the area. Infiltration capacity is ranges from 15 to 20 %. The developed model is an anisotropic and heterogeneous three-dimensional groundwater flow model. The model is developed by considering; equivalent porous media (EPM) approach.

After model development, model calibration can simply be achieved by minimization the error in the final result. Model has been calibrated to reduce the difference between computed value and the observed/field value by changing the influencing factors such as aquifer parameters and stress value for both steady and transient state (Vetrimurugan et al., 2017; Akbariyeh et al., 2018). Calibration targets for steady state are defined as: normalized root mean squared (NRMS) 3.63%, absolute residual mean (ARM) 1.3 m, root mean squared (RMS) 1.996 m & for transient state NRMS is 4.87%, ARM 1.67 m, RMS 1.999 m (Fig.2). Model simulation was operated out under transient state for duration of 14600 days from the year 2000 to 2040. The PEST & trial-and-error method were used for the calibration of transient model.

The developed steady and transient flow model have provided an idea about the present and transient groundwater conditions like flow direction, water table changing pattern with reference to existed stress, water budget and pumping strategy as a mitigation plan for future water table decline, to protect the aquifer of the study area for a long duration. While considering groundwater flow direction, the water table is higher in south-east part and sequentially lower down towards north-west side, is generally flowing from south-east to north-west by following the general topographic trend.

The steady state -transient state flow model output implies that the water table will deplete near about 7meter from 2001 to 2040 in this persisting stress condition (Fig. 3a). Flow budget is not balanced by total inflow with total outflow. Total outflow is higher than the total inflow in this aquifer system. So, to mitigate this upcoming problem the promising management plan is to reduce the pumping rate by 22% than the persisting pumping rate and establishment of the three recharge wells in Ashram, Hatband and Urla area with average recharge rate of 110m<sup>3</sup>/day to 25m screen depth. The transient flow model with the prescribed suggestion is shown with different duration (Fig. 3b).

Akbariyeh, S., Hunt, S.B., Snow, D., Li, X., Tang, Z. and Li, Y. (2018) Three-dimensional modeling of Nitrate-N transport in Vadose Zone: Roles of soil heterogeneity and groundwater flux. Journal of Contaminant Hydrology, pp.15-25.

Central Ground Water Board (2012) Groundwater Brochure of Raipur District, Chhattisgarh.

Central Ground Water Board (2016) Aquifer mapping in Bemetara and Saja blocks, Bemetara district, Chhattisgarh. Central Ground Water Board, pp. 22-25, 37-39, 62.

Khan, R., Jhariya, D.C. (2018) Hydrogeochemistry and Groundwater Quality Assessment for Drinking and Irrigation Purpose of Raipur City, Chhattisgarh. journal geological society of India, v.91, pp.475-482.

Rojas, R., Dassargues, A. (2007) Groundwater flow modelling of the regional aquifer of the Pampa del Tamarugal, northern Chile Hydrogeology Journal, v.15, pp. 537-551.

Senthilkumar, M. and Elango, L. (2004) Three-dimensional mathematical model to simulate groundwater flow in the lower Palar River basin, Southern India Hydrogeology Journal, v.12(4), pp.197-208.

Vetrimurugan, E., Senthilkumar, M. and Elango, L. (2017) Solute transport modelling for assessing the duration of river flow to improve the groundwater quality in an intensively irrigated deltaic region. International Journal of Environmental Science and Technology.



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Research Scholar



D. C. Jhariya  
Assistant Professor