



Research & **D**evelopment

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Research & Development

NEWSLETTER

VOLUME 20



Director's Message

I am very happy that the Research & Development Section of IIT Roorkee is publishing its R & D newsletter. I congratulate all the faculty members for disseminating research activities of IITR to all the stakeholders through this initiative. I wish that the research findings of IITR gets thoroughly dispersed across academic, research institutions and Industries in India and abroad.



Many R&D institutions are requested to involve with IITR for working in both advance and thrust areas of research. It is pertinent to mention that we need to increase our research project submission across the departments and centers. I strongly encourage multidisciplinary research initiatives across each and every departments and centres of IITR in order to fulfil the aspirations of all the stakeholders. I appeal to all faculty to ponder upon this suggestion and start preparing research proposals to various calls of the Govt agencies, industries and other international agencies. Research activities should be inclined in such a way that it reaches the common people of India and paves the pathway for upliftment of the society.

Prof. K K Pant

Dean SRIC Desk



The Institute has research guidelines in place for effective management of on-going research in the Institute. The research activities of the Institute are of strategic importance to the nation, catering to the needs of large/medium/small scale industries in the country, facilitating the needs of the rural sector by dissemination of technology for societal benefit including healthcare and training of the rural people and academic research.

IIT Roorkee is further focused on enhancing the industrial research ambience in the Institute through industry interventions. The Institute invites all stakeholders to collaborate with us for cutting edge fundamental and translational research.

Prof. Akshay Dvivedi

RECENT ACTIVITIES AND AWARDS



Glimpses of Startup Expo 2022



IIT Roorkee bags Questel IP Excellence Award 2022



IIT Roorkee bags Best Poster Award in Institute Innovation Council Regional Meet 2022, in Chandigarh



PREFABRICATED PREFINISHED VOLUMETRIC CONSTRUCTION USING RECYCLED PLASTIC

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The project is related to finding solution for providing affordable housing while eradicating large quantum of plastic waste that is suffocating our landfills. With the use of re-cycled plastic and light gauge steel frame construction the objective is to convert the idea of sustainable and affordable modular housing into reality. The concept of eco-friendliness will be also embedded into this technology with minimal to no use of materials like concrete and maximum use of re-cycled materials.

Sponsor: Ministry of Housing and Urban Affairs





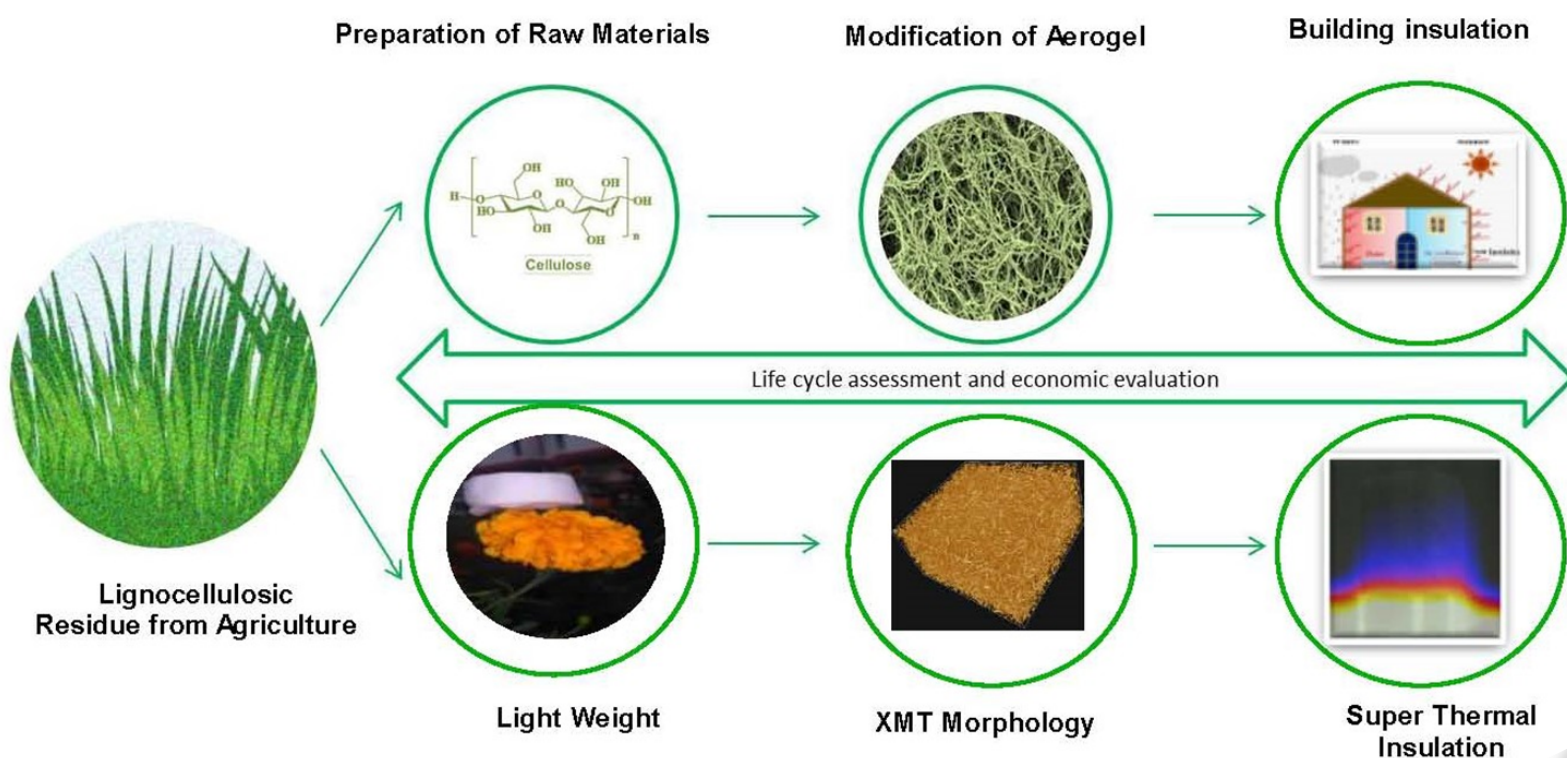
LIGHTWEIGHT THERMAL SUPER-INSULATING AEROGEL MADE BY USING HYBRID CELLULOSE NANOMATERIALS EXTRACTED FROM WASTE BIOMATERIALS FOR BUILDING AND ADVANCED APPLICATIONS

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This research is driven by the need for a new class of sustainable, lightweight, robust, cost-effective, super thermal insulating 3D aerogels from hybrid cellulose nanomaterials for the next generation 'Zero Energy Buildings (ZEB)'. Energy saving in buildings has become a question of crucial importance in many countries, including India. About one-third of the total energy is being used in building sectors only. Hence, it is indispensable to reduce the energy consumption of buildings by finding more effective thermal insulation materials. The nanocellulose, precisely cellulose nanofibers (CNFs), the building block of the aerogel, will be isolated from rice and wheat straw, the two major agricultural residues of India, using our existing methodologies. Using of waste cellulose will not only reduce the cost of the product, also mitigate the burden of growing waste on the earth. Our proposed cellulose aerogel will be robust, ultralight, and able to withstand extreme cold and hot temperature so it can be a substitute for typical silica-based aerogel, which is highly brittle.

Sponsor: Science and Engineering Research Board, Govt of India





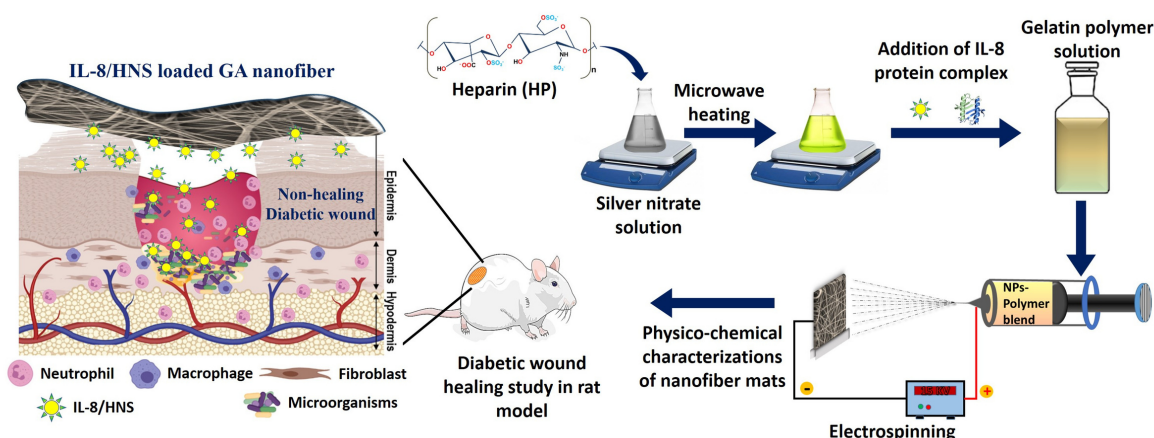
NANOSCALE INVESTIGATIONS INTO THE INTERACTIONS OF METAL/METAL OXIDES WITH GAGS FOR FUNCTIONAL APPLICATIONS

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Nanotechnology has garnered commercial attention in the modern era due to their unique applications. Metal and metal oxide nanoparticles possess unique structures, interesting redox and catalytic properties and are biocompatible. The metal/metal oxide based nanomaterials have been shown to have significant therapeutic potential. The mechanisms related to their interactions with animal and plant cells should be established to utilize them for versatile biomedical applications. The project outlines the potential functional applications of Glycosaminoglycan (GAG) based metal/metal oxide nanocomposites.

Sponsor: Esyantra Pvt. Ltd, Chennai, India





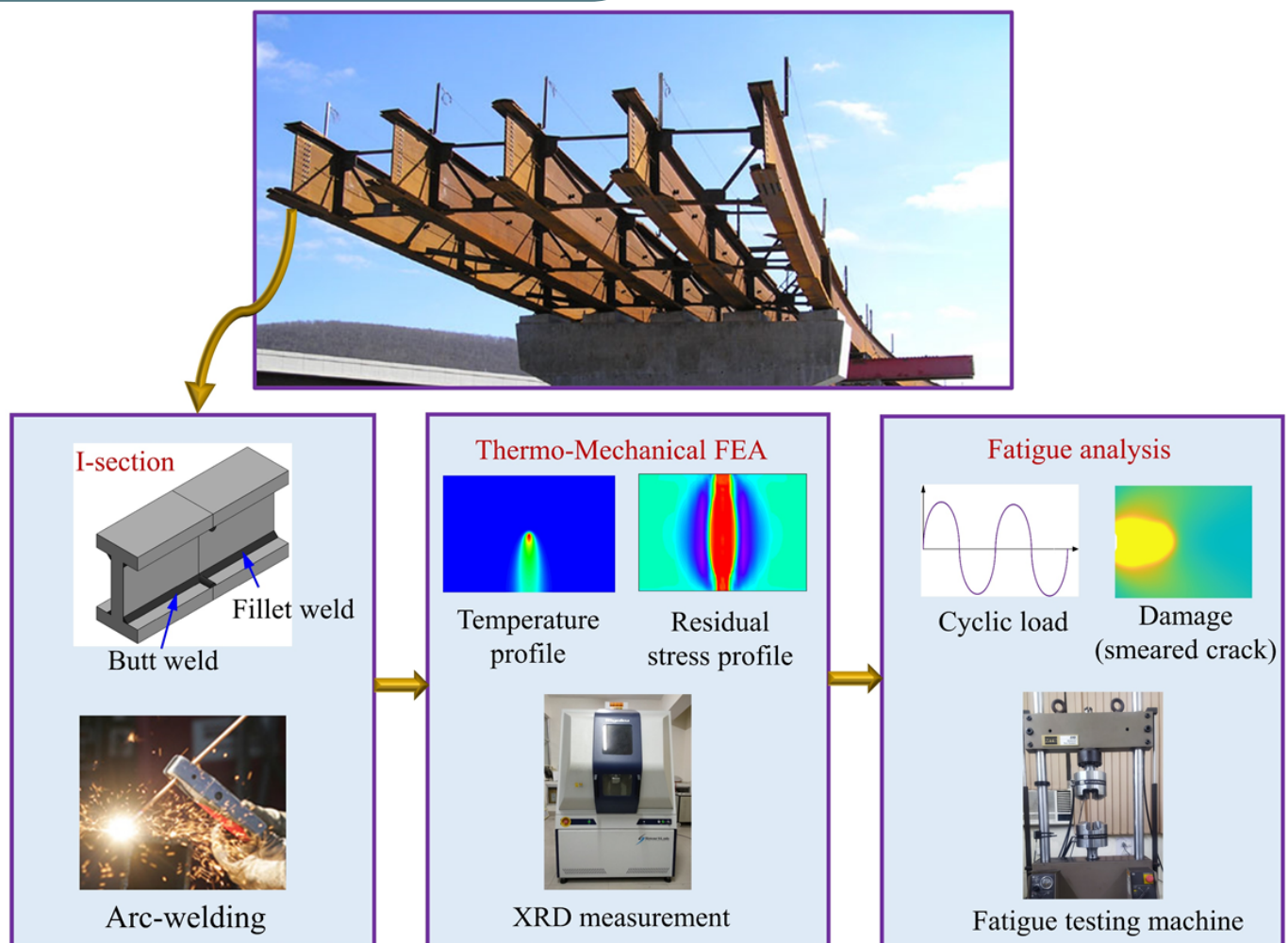
FATIGUE DESIGN OF WELDED JOINTS IN MILITARY BRIDGES: EXPERIMENTS AND SIMULATIONS

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Welded joints, used in military bridges, are often subjected to cyclic or periodic loads, resulting in the formation of cracks. A major contributing factor which leads to early occurrence of cracks is the presence of tensile residual stresses in the heat affected zone of welded joints. Therefore, the present works aims to study the effect of residual stresses on Weldox-700 steel joints used in the military bridges through experimental and numerical techniques. The residual stresses induced due to arc-welding would be estimated through thermo-mechanical finite element simulations. The results obtained from the numerical simulations would be validated using X-Ray diffraction technique. The stress-life curve for the material would be experimentally obtained through fatigue-testing. A numerical framework would be developed using the concepts of damage mechanics and finite elements to estimate the fatigue strength, crack initiation and propagation, and the service-life of the welded joint. The present study would be useful for the reliable design and safe loadings on the military bridges.

Sponsor: ARMREB, DRDO, New Delhi





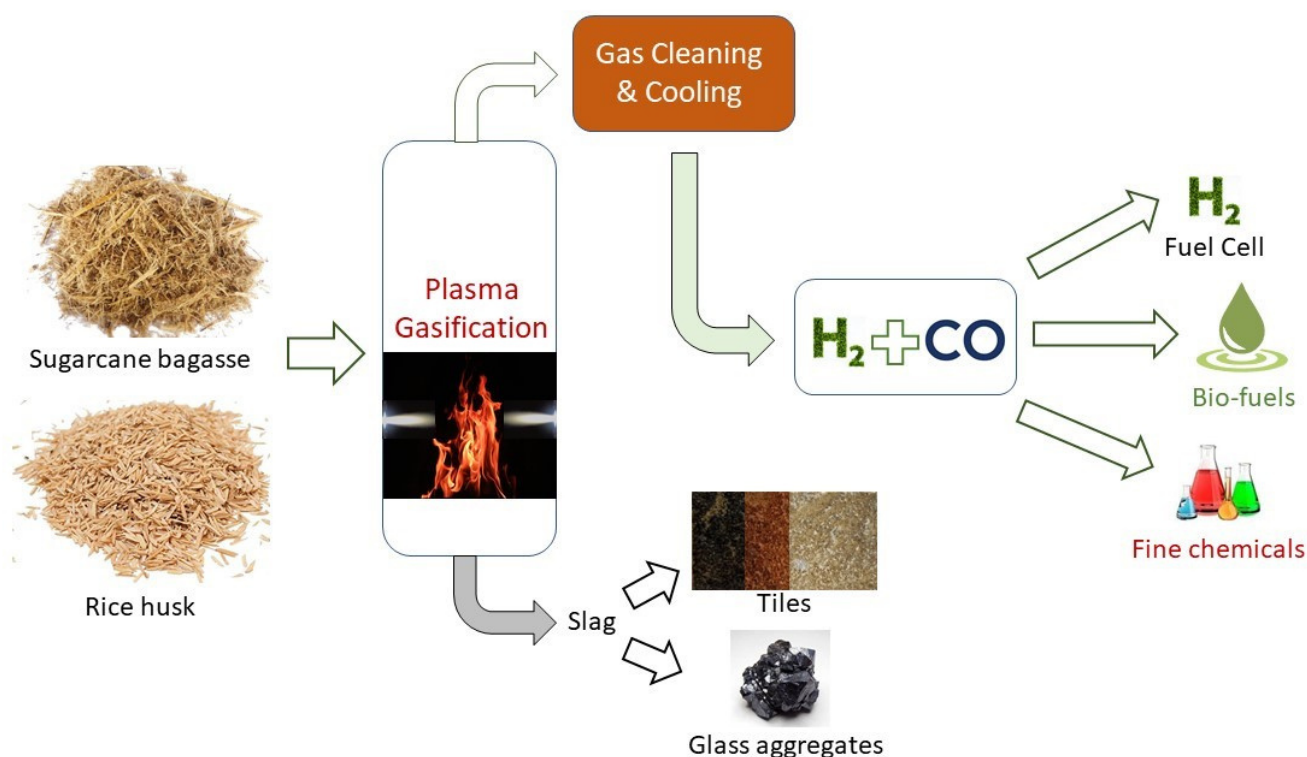
BIOMASS GASIFICATION THROUGH PLASMA PYROLYSIS TECHNOLOGY FOR CHEMICALS PRODUCTION

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A significant amount of biomass-waste is produced during post-processing of various crops such as: sugarcane, wheat, rice, etc. Sugar industry produces significant biomass-waste (bagasse), which is combusted into furnace to generate electric power for local use. This leads to production of fly ash, and also raises environmental concerns. There are »500 operational sugar mills in India, processing an average of 225 million tons of sugarcane every year. The total potential of biomass generated energy from these mills is estimated to be »5000 MW. In this project, it is proposed to carry out the plasma gasification of biomass into combustible gas mixture in an oxygen-starved environment using an external high heat source (plasma) to produce syngas. As a result of high temperatures and lack of oxygen in the plasma reactor, the yield of tars, dioxins or furans, NO_x and SO_x are much lower. Plasma gasification allows the production of synthesis gas with a recovery of up to 80% of the chemical energy contained in the organic matter initially treated. The current research aims to employ state-of-the-art arch torches operated with DC's current in a modular plasma reactor where temperatures in excess of 3000 K may be generated. The temperature is high enough to break down chemical bonds in the matter. In the future, the same reactor may be employed to gasify other types of waste such as MSW, hazardous waste, medical waste, and electronic waste.

Sponsor: Ministry of New and Renewable Energy, Government of India





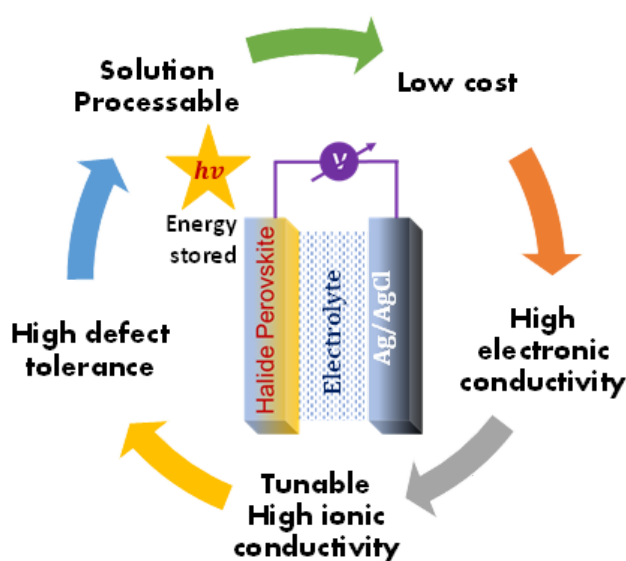
HYBRID-HALIDE PEROVSKITES FOR EFFICIENT SUPERCAPACITOR APPLICATION

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Halide perovskite have been the materials of the decades due to extraordinary optical and electronic properties. These materials have been widely used in energy photovoltaic, light emitting diodes, detectors, sensors and many other optoelectronic applications. Due to mixed electronic-ionic conduction these halide perovskites can be utilized as photo-active porous electrode for photo-rechargeable supercapacitor application. Recent developments in this field indicates that porous halide perovskites can have very high energy density if suitable electrolytes are used. The major challenge is the instability of the electrode materials under working condition due to leaching of halide ions which will be the key study in this project.

Sponsor: Science and Engineering Research Board , DST, India





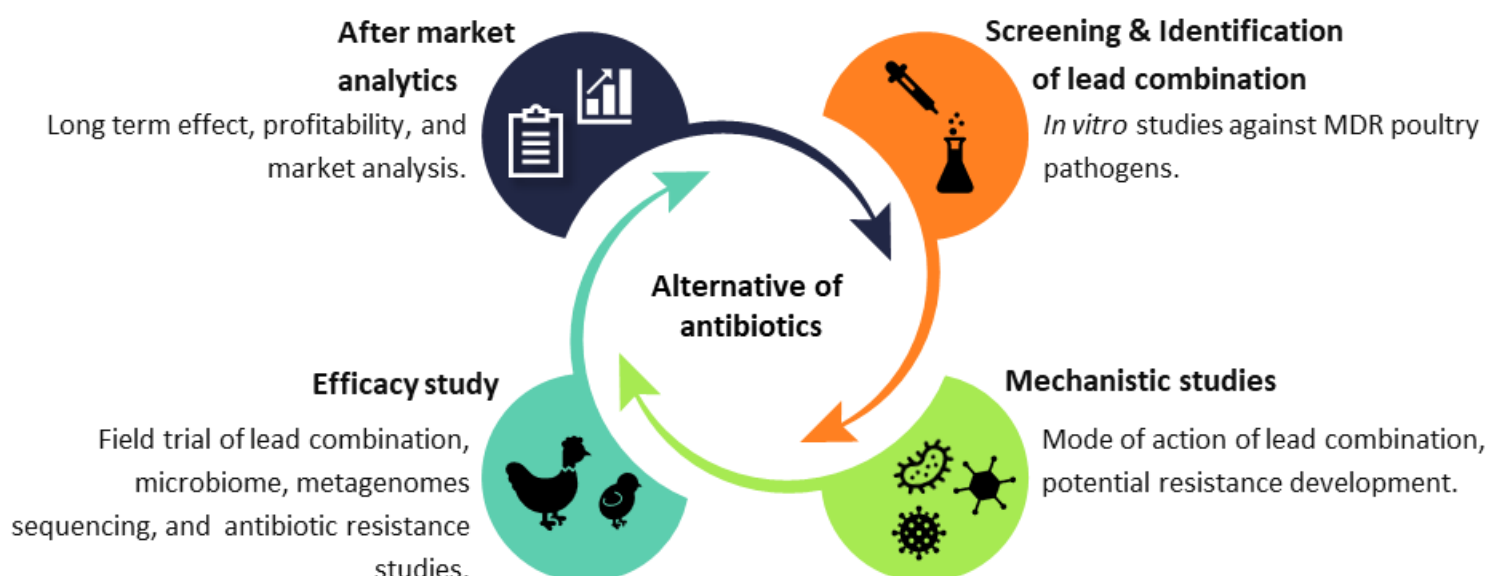
A COMPREHENSIVE STRATEGY FOR ENHANCING PRODUCTION AND ALLEVIATING AMR BURDEN ON POULTRY SECTOR VIA PROBIOTICS AND ALTERNATIVE OF ANTIBIOTICS.

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Antimicrobial resistance has become a global health problem. The current project aims to develop potent antimicrobial combinations based on plant secondary metabolites and generally recognized as safe (GRAS) status chemicals. The alternatives developed in this project will be tested at farmer's level for their efficacy towards prevention of infection and growth enhancement. Different physiological parameters such as body weight, immune status, stress levels, feed conversion ratio, toxicity and bio compatibility will be evaluated. This project will also evaluate total microbial signature across different feed groups using next-generation sequencing. This study will be of immense importance at field level implementation and India's National Action Plan to combat Antimicrobial Resistance.

Sponsor: Department of Biotechnology, Government of India





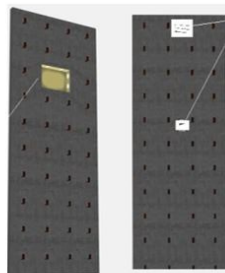
EXPERIMENTAL INVESTIGATIONS ON PRECAST REINFORCED CONCRETE PLANKS

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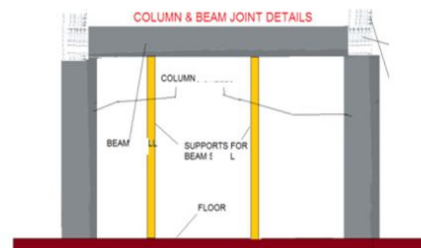
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A significant proportion of houses in India are constructed with reinforced concrete (RC) structural elements. The construction activities rely heavily on in-situ construction methods involving the use of formworks and a huge amount of wet trades. A large number of site activities delay the construction process. Precast RC planks are a sacrificial form shuttering for the construction of RC elements. The precast RC planks (25 to 30 mm thick) are manufactured in a casting yard. Off-site manufacturing helps in reducing site activities and improving the construction process. The precast planks are useful to enhance the gravity and lateral capacities of RC elements through composite action. The objective of the project is to study composite action between precast plank and RC elements. The developed composite Precast plank-RC elements will be tested under monotonic loading to understand force transfer between precast and RC elements. Seismic performance parameters (ductility and energy dissipation capacity) and design procedures for composite sections will be established from quasi-cyclic, pseudo-dynamic, and shake table testing of the wall, and beam-column joint specimens.

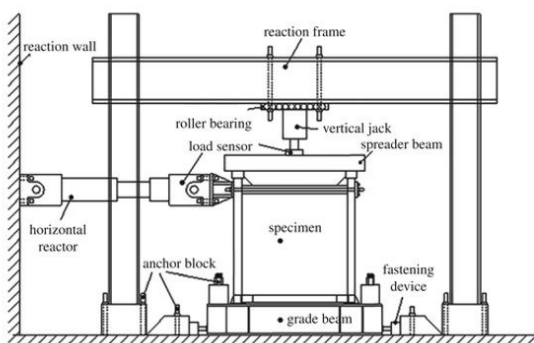
Sponsor: Ministry of Housing and Urban Affairs



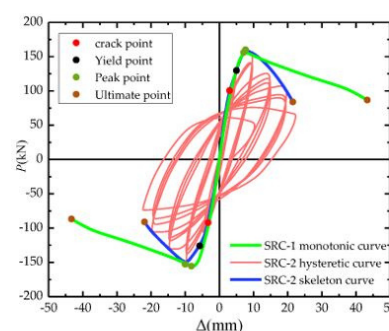
a. Precast planks



b. Use of precast plank as sacrificial formwork



c. Quasi-cyclic testing of the composite element



d. Determination of seismic performance parameters of the composite element

Meta-flowchart of use of precast planks and experimental output



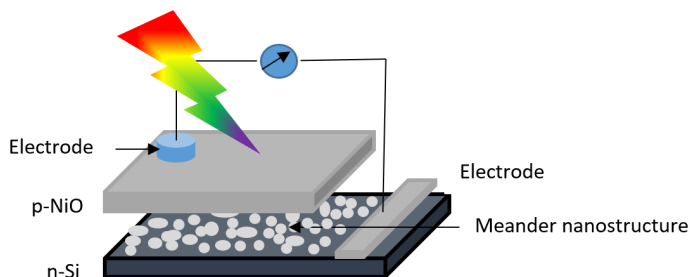
DEVELOPMENT OF LATTICE-BASED ENCRYPTION AND DIGITAL SIGNATURE ALGORITHMS FOR QUANTUM - SAFE CRYPTOGRAPHY

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Due to the invention of quantum computers, the threats to IoT systems become a major internet security concern nowadays. The primary objective of this project is to develop new quantum-safe cryptographic primitives that realize trusted and secure communication in IoT ecosystems. Many IoT devices operate in a constrained computing environment that requires lightweight solutions. In this project, we will need lightweight quantum-safe versions of asymmetric ciphers. Among the several proposals for quantum-safe cryptographic primitives, the arguably most promising approach is via lattices. Our main objectives of this proposed project include the exploration and development of lattice-based encryption and signature algorithms.

Sponsor: DRDO, Bengaluru



In this proposal we would like to fabricate UV-visible self-powered photodetectors by using NiO as the primary semiconductors. Initially we will fabricate p-NiO/plasmonic nanostructure/n-Si heterostructure by using Pulsed Laser Deposition (PLD) technique. Meander Ag-Au metal nanostructure will be fabricated by using thermal evaporation and Pulsed Laser Deposition (PLD) technique along with post annealing. Another well known heterostructure for UV detection is p-NiO/n-ZnO heterostructure. By modifying this nanostructure it is possible to efficiently absorb the lower energy photons with efficient generation of Hot electrons using plasmonic metal nanostructure.

Sponsor: Science and Engineering Research Board , DST, India



SELF POWERED WAVELENGTH SELECTIVE NIO BASED PLASMONIC UV-VISIBLE PHOTODETECTOR

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IR RADIATION PROPAGATION STUDY THROUGH MONO-CENTRIC LENS(MCL) ASSEMBLY

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IIT Roorkee is supporting the project through two major tasks. We are applying unsupervised and semi supervised machine learning algorithms developed by other teams in this project (from CU Boulder) to the Indian datasets and develop the high temporal and spatial resolution load, solar, and wind datasets. We are also evaluating the value that these datasets will provide to long term power systems planning. Using either synthetic or actual network model of the Indian power grid, capacity expansion and production cost simulation studies are being performed to compare the benefits of using the climate change informed datasets vs using historical datasets as is the practice today. We are also supporting the project through publications and research dissemination activities such as conference participation, online/in-person meetings with sponsors, among others.

**Sponsor: University of Colorado
Boulder, Colorado, USA**

Some of the imaging systems require difficult to achieve combination of wide field of view, high angular resolution and large light collection. This puts a challenge in optical system design. One of the solution to the wide-angle imaging is "monocentric" lenses. In the present project we provide such a solution by combing a system of three lenses in infra-red domain.

Sponsor: IRDE (DRDO)



MACHINE LEARNING-BASED DYNAMIC CLIMATE PROJECTIONS FOR POWER SYSTEM PLANNING DATASETS

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DEVELOPMENT OF A PROTOTYPE TERRITORIAL EARLY WARNING SYSTEM FOR PRECIPITATION-INDUCED SEDIMENT DISASTERS (I.E., LANDSLIDES AND DEBRIS FLOWS) IN INDIA.

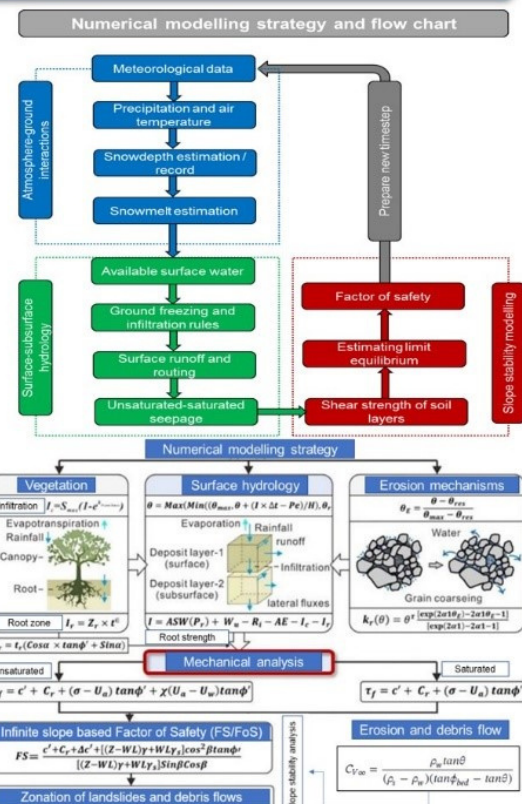
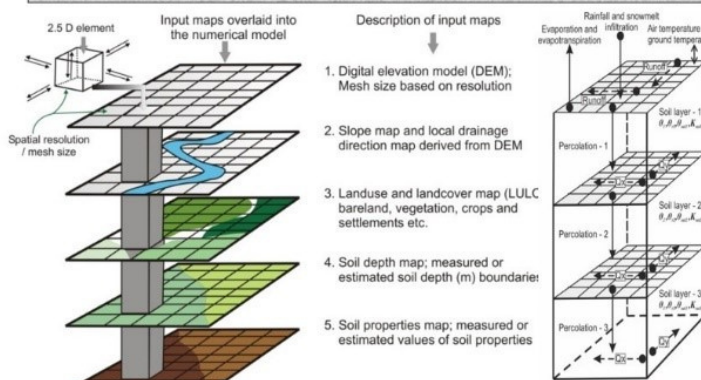
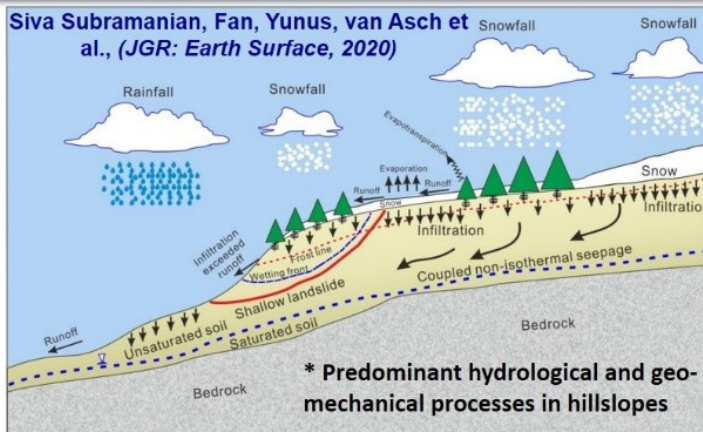
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Territorial Landslide Early Warning Systems (Te-LEWS) are cost-effective non-structural disaster mitigation measures. With limited historical events and precipitation records, implementing Te-LEWSs in India is very challenging. Novel spatiotemporal numerical modelling approaches help to bridge the gap of limited historical records of landslides. Pre-identifying landslide-triggering thresholds is essential and can be achieved by simulating occurrences of landslides under various precipitation magnitudes. Through performing spatiotemporal numerical simulations, this research will create a landslide database. By generating synthetic landslide events under different weather, the study will derive early-warning thresholds. Implementing revised thresholds will help improve the precision of the existing TeLEWS of ISRO.

Sponsor: Indian Institute of Remote Sensing, Indian Space Research Organisation (ISRO), Dehradun, India

Development of a prototype territorial early warning system for precipitation-induced sediment disasters (i.e., landslides and debris flows) in India.



Developing a database of landslides through Resourcesat-2 LISS-IV imagery and CartoDEM based spatiotemporal numerical simulations to improve the predictive capacity of ISRO's (Indian Space Research Organisation) Experimental Territorial Early Warning System (TeLEWS) for Rainfall Triggered Landslides in India.



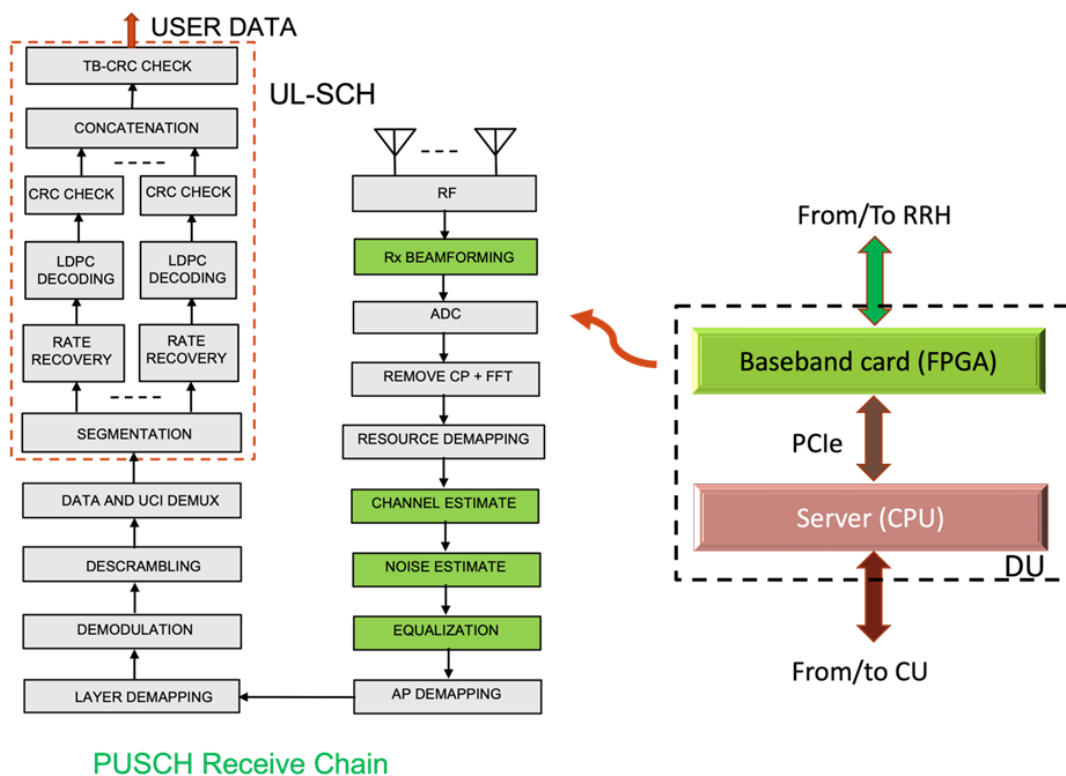
5G ADVANCED ORAN MASSIVE MIMO BASE STATION

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Design and development of open radio access network (ORAN) based distributed unit (DU) to support 5G and beyond applications. DU will be comprised of a baseband card and a server, where baseband card consists of state-of-the-art Xilinx SoC to ensure sufficient processing resources on the board to support functions required by 3GPP specifications for 5G and beyond applications. It supports both sub-6 GHz (410 MHz – 7.125 GHz) and mmWave (24.25 GHz – 52.6 GHz) bands. The PHY algorithms will include the implementation of building block mentioned in the 3GPP standards such as channel coding, rate matching, modulation, etc, and also the propriety algorithms such as channel estimation, equalization, time & frequency synchronization, beamforming, noise estimation, etc.

Sponsor: IIITB COMET Foundation





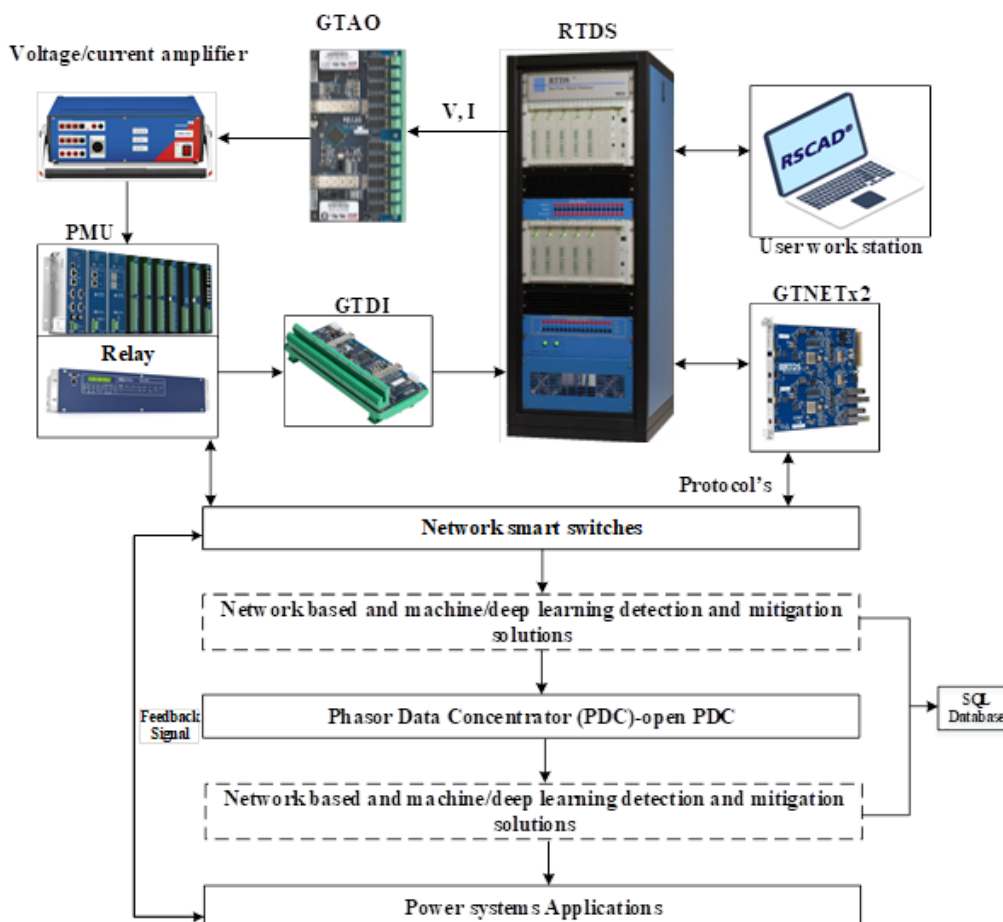
DEVELOPMENT AND VALIDATION OF SECURITY SOLUTIONS AGAINST VARIOUS CYBER-ATTACKS AT SUBSTATION/TRANSMISSION LEVEL FOR INDIAN POWER GRID NETWORK.

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Cyber-attacks have become an issue due to the connection of legacy power infrastructure with complex computer networks and the integration of communication devices. These can be increased even further as more Intelligent Electronic Devices (IEDs) and communication links are deployed. Several types of cyber-attacks, like False Data Injection, Denial of Service, replay attacks, etc., can be used to compromise the integrity and availability of data in power grids. Such attacks can degrade the performance of industrial applications or even cause a blackout due to erroneous decisions made by system operators or automated algorithms. It can also cause a country's social and economic problems. Therefore, as shown in Figure, there is a need to develop attack detection and mitigation strategies for different possible cyber-attacks at substation level and transmission level of the grid.

Sponsor: Central Power Research Institute (CPRI), Bangalore





DEVELOPMENT OF SPECIFICATIONS FOR USE OF WASTE PLASTIC IN ASPHALT MIXTURES: A MAJOR STEP TOWARDS BUILDING SUSTAINABLE ROAD INFRASTRUCTURE

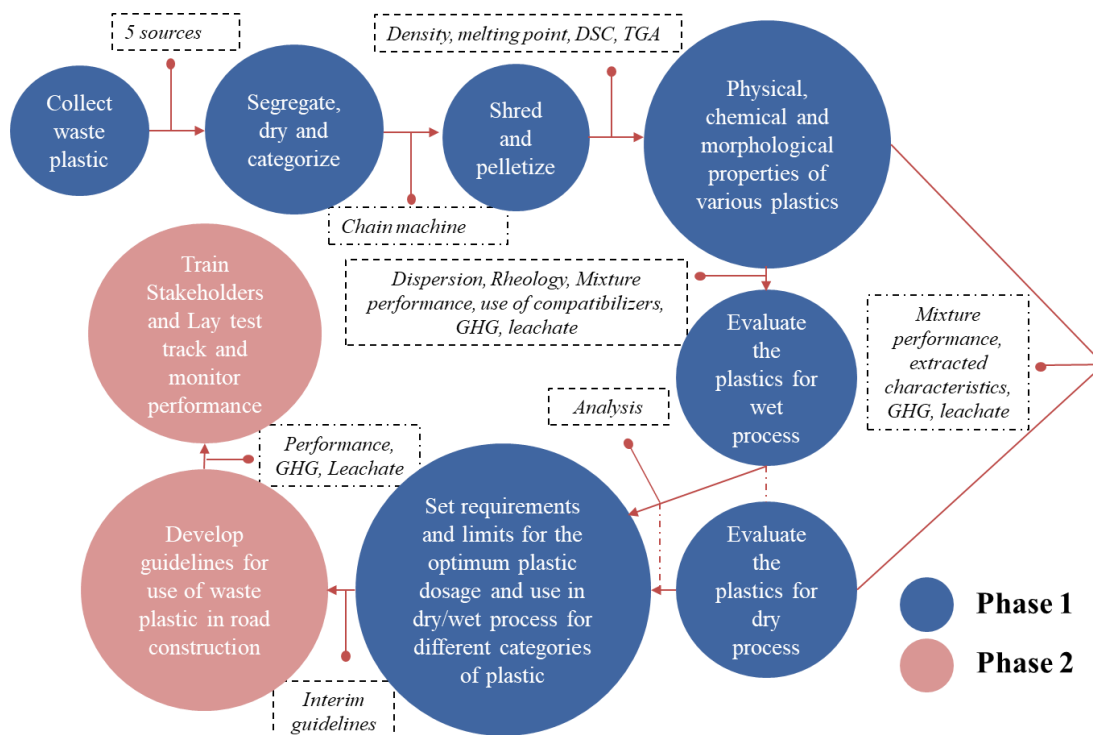
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Amongst various avenues being searched for solving the menace of increasing amount of plastic accumulation, its use in hot mix asphalt (HMA) is becoming popular. Several researches have been conducted since 1980s on the use of different types of waste plastics in asphalt mixtures through dry and wet processes. While it may sound 'simple' and 'attractive', incorporation of waste plastic in asphalt mixture has many challenges.

The main objective of this study is to develop specifications for use of waste plastic in pavement construction. To achieve this, the chemical, physical and morphological properties of various type of waste plastics generated commonly in India will be studied. Pelletized plastics will be used to evaluate its suitability for wet and/or dry modification process. Finally, a standard manual for use of waste plastic based on short- and long-term performance of bituminous mixtures will be developed.

Sponsor: National Rural Infrastructure Development Agency





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INVESTIGATION AND CHARACTERIZATION OF IONOSPHERIC TWO-DIMENSIONAL PLASMA STRUCTURES OVER THE GEOMAGNETIC LOW-MID LATITUDE TRANSITION REGION USING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Sponsor: Science and Engineering Research Board , New Delhi

The proposed research on the exploration of Earth's ionosphere offers a unique opportunity to the research community for understanding the spatio-temporal distribution of the ionospheric plasma processes in the F region. It is extremely important in the context of satellite-based communication and navigational applications in L-band. Although investigations of plasma irregularity processes over low, mid and high latitudes have been extensively carried out globally, a very less attention has been paid over the geomagnetic low-mid latitude transition region. The proposal is aimed towards the characterizing and understanding the plasma irregularities processes in this region using optical imaging techniques. The existing O(1D) 630.0 nm images from an all-sky airglow imager installed over Hanle, Leh Ladakh found the occurrence of mid-latitude plasma structures over that transition region on many occasions. In addition, several intriguing observational evidences of mid-latitude field aligned structures and Medium Scale Traveling Ionospheric Disturbances were also recorded by the imager. Intelligent algorithms are needed to identify and characterize these different types of plasma structures from the large imaging data set of more than 1000 nights over this location. The proposed research will provide a platform towards utilizing the neural network based Artificial Intelligence and Machine Learning which has not been attempted, so far, for the characterization of plasma structures from airglow images to the best of our knowledge. It will also lead to the understanding the relationship of the plasma distribution between low and mid-latitude plasma irregularities over the geomagnetic low-mid latitude transition region in the Indian sector. The results will be useful to understand the physical mechanisms responsible for the interaction among themselves.



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OPTIMAL CONTROL OF DOUBLY DIFFUSIVE FLOWS: THEORETICAL STUDIES AND NUMERICAL ANALYSIS

Sponsor: Science and Engineering Research Board , New Delhi

In science and engineering, there are many applications based on Double-diffusive flows, for example: chemical pollutants in saturated soil, subsurface drilling and petroleum extraction, crystal growth, chemical and food processing. Specifically, these types of models arise in a situation in which the process of heat and mass transfer interact with flow in porous structures. One important observation is that the boundary layer is originated due to coupled thermal and compositional mechanisms. An another observation of this model is based on cross diffusion in which the flux of the solute is effected due to temperature gradients. This phenomena is known as Soret effect. It usually coexists with the reciprocal phenomenon, called as the Dufour effect. Control of fluid motions and turbulence inside a flow in a given physical domain for the purpose of some desired objective, with known initial data and by means of body forces, boundary data, temperature are well-studied optimal control problems in fluid mechanics.

After the mathematical advancements in the optimal control of infinite dimensional nonlinear system theory and partial differential equations, the mathematical analysis and computation of controlling the viscous incompressible flows governed by the Navier-Stokes equations or related equations have been developed extensively over the past several decades. The major goals in the theoretical as well as numerical studies of optimal control of fluid flow models are

- the analysis of fluid dynamic models to answer questions on the existence, uniqueness and regularity of solutions (weak as well as strong) and to derive necessary conditions of optimality, and the characterization of the optimal control.
- the construction and mathematical analysis of discretization methods for determining approximate solutions of the optimal control problem and the rigorous derivation of error estimates and
- some iteration schemes for solving the system of partial differential equations, the development of computer code, which implements discretization algorithms and also to solve problems of practical interest.

The main objective of this project is to carry out the theoretical studies and numerical analysis of the optimal control problems governed by the doubly diffusive flows with temperature-dependent viscosity and possible cross-diffusion terms, which satisfy the restriction of maintaining the coercivity of the diffusion operator.



THE ELECTRIC FIELD CONTROL OF MAGNETIZATION PROPERTIES IN QUANTUM MATTER HETEROSTRUCTURES

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Quantum matter heterostructures exhibit variety of novel phenomenon at the interfaces. Such phenomenon could be utilized in development of functional devices based on the quantum materials. Electric field tuning of magnetic and electronic states at the interfaces of multiferroic heterostructures will be studied in this project. Specifically focus will be given to the electric field tuned exchange bias coupling at the interfaces of the ferromagnetic and antiferromagnetic multiferroic materials.. Theoretical understanding of the role of magnetoelectric coupling at the interface of a multiferroic material would greatly help to design new materials for this purpose.

Sponsor: Science and Engineering Research Board , New Delhi

The study of the homotopy analysis method for unsteady hyperbolic conservation laws is a completely new concept. This type of work will be helpful for understanding the behavior of the solutions of Burgers, Euler, shallow water equations in various applications including wave processes, nonlinear gas dynamics equations arising in shock fronts, ideal polytropic dusty gas, magnetogasdynamics acoustic transmission, etc.

Sponsor: Science and Engineering Research Board , New Delhi



A SEMI-ANALYTICAL METHOD FOR HYPERBOLIC CONSERVATION LAW: APPLICATION TO RIEMANN PROBLEM

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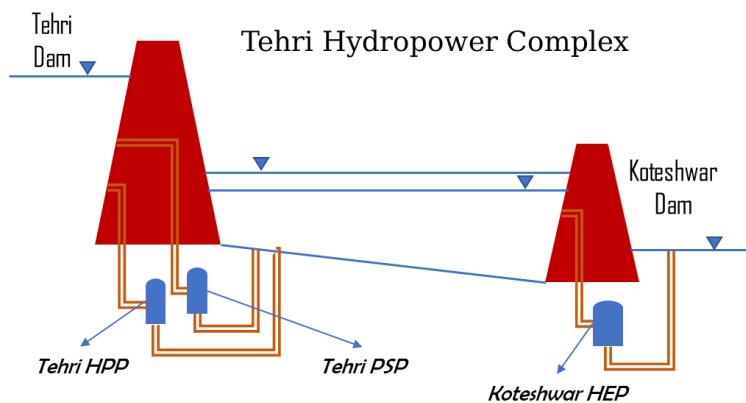
DEVELOPMENT OF SOFTWARE FOR AUTHENTICATION OF AUDIO-VIDEO FOOTAGE

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Digital multimedia documents (i.e., audio, image, and video) increasingly play a significant part in crime investigations and criminal proceedings. Since multimedia documents can easily be manipulated using freely available editing tools, their admissibility as evidence in a court of law is often challenged. Doctored audio/image/video is also widely used to create fake news items, malign individuals, and spread propaganda on social media platforms. The project aims to develop novel source verification and manipulation detection techniques for the forensic analysis of digital audio-video footage.

Sponsor: Directorate of Forensic Science Services, Ministry of Home Affairs



The industrial collaboration between the THDC India limited and Department of Water Resources Development & Management, IIT Roorkee aimed at developing a "Decision Support system for the Integrated Operation of Tehri Hydropower plant (HPP), Koteswar Hydroelectric plant (HEP) and Tehri Pumped Storage plant (PSP) complex". The main objective of the project was to formulate a Real time Simulation – Optimization framework for maximization of the operational benefit with maximum energy generation subjected to physical and operation constraints. A Graphical user interface will be developed to examine the energy generation on daily, annual and desired time period.

Sponsor: THDC India Limited



DECISION SUPPORT SYSTEM FOR INTEGRATED OPERATION OF TEHRI HYDROPOWER COMPLEX

Prof. Kasiviswanathan KS
Water Resources Development & Management

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<http://lab.hydropmetlab.in/about.html>

SOME MAJOR COLLABORATIONS IN 2022

- Rail India Technical and Economic Service Ltd.
- IIT Roorkee Foundation Inc, USA & Donors of Alumni batch
- Aryabhata Research Institute of Observational Sciences (ARIES)
- Wipro Limited
- Bureau of Indian Standards
- Power System Operation Corporation Ltd
- Tata Consultancy Services Limited
- BKC Aggregators Pvt Ltd
- Directorate of Forensic Sciences, New Delhi
- Oil and Natural Gas Corporation Limited
- Deloitte
- Ministry of MSME, GOI
- Ministry of Railways, GOI
- Bureau of Energy Efficiency
- Defence Research & Development Organisation (DRDO)
- Ministry of Defence, Government of India
- John Deere India Private Limited
- Himalayan Environmental Studies & Conservation Organization (HESCO)
- National Highways & Infrastructure Development Corporation Ltd.
- International Institute of Technology Bangalore Comet Foundation
- ICAR-Central Citrus Research Institute, Nagpur
- Directorate of Census Operations, MoHA, New Delhi
- Schaeffler India Ltd.
- Research for resurgence foundation Nagpur
- OSAW Industrial Products Pvt. Ltd.
- Research Design and Standards Organization (RDSO) Lucknow
- National Rail and Transportation Institute, Gujrat
- Information Technology Development Agency and Special Task Force (Uttarakhand Police)
- Ozone cell, Ministry of Environment, Forest and Climate Change, GoI
- HDFC Bank Limited
- Nuclear Fuel Complex, Department of Atomic Energy

OTHER RECENTLY REGISTERED PROJECT (OUTLAY OF 20 LACS AND ABOVE)

Principal Investigator	Department	Title of Project	Sponsor Agency
Prof. Prabhjot Singh Chani	Department of Architecture & Planning	Study of Learning Spaces using mobile-EEG neurofeedback to understand the impact of different built-environment stimuli on cognition	SERB, New Delhi
Prof. Rajan Arora	Department of Applied Mathematics & Scientific Computing	A semi-analytical Method for hyperbolic conservation Law: application to Riemann problem	SERB, New Delhi
Prof. Ranjana Pathania	Department of Biosciences & Bioengineering	To study the prevalence phylogeny and virulence of linezolid resistant enterococcus faecium in hospital acquired infections and environment	ICMR, New Delhi
Prof. Sanjoy Ghosh	Department of Biosciences & Bioengineering	Bioprocess development for the production of poultry feed from agro residues by solid state co-fermentation	Ministry of Fisheries, Animal Husbandry and Dairying
Prof. Partha Roy	Department of Biosciences & Bioengineering	For comprehensive and scientific validation of nutritional biological and stability properties of high altitude Indian honey samples from north-eastern and western Himalayan region	National Bee Board, Ministry of Agriculture & Farmers
Prof. Debabrata Sircar	Department of Biosciences & Bioengineering	A Comparative metabolomics approach for the analyses of Scab-disease resistance in apple and development of a metabolite-based non-invasive sensor for early scab-disease diagnosis	Indian Council of Agricultural Research (ICAR) National Agricultural Science Fund (NASF), New Delhi
Prof. Jitin Singla	Department of Biosciences & Bioengineering	Modelling mitochondrial network in pancreatic B-cells for better therapeutic design	Chellaram Diabetes Research Centre, Pune
Prof. Saurabh Vijay	Department of Civil Engineering	Interlinked seasonal evolution of supraglacial lakes and ice velocity changes of glaciers in greenland	ISRO, Bengaluru
Prof. Sandeep Kumar	Department of Computer Science & Engineering	Methods to test and rate AI services for trust with an Indian Perspective	SERB, New Delhi
Prof. Partha Pratim Roy	Department of Computer Science & Engineering	Multilingual Recognition & Interpretation	Ministry of Electronics & Information Technology
Prof. Ajanta Goswami	Department of Earth Sciences	Avalanche Hazard zoning and forecasting of snow avalanche using the machine and deep learning approaches	Indian Institute of Remote Sensing (IIRS), Dehradun
Prof. Ganesh Balu Kumbhar	Department of Electrical Engineering	Impedance calculation and load flow analysis in railway traction system	Research Designs & Standards Organization (RDSO), Lucknow
Prof. Akhilesh Mohan	Department of Electronics & Communications Engineering	Low frequency flexible and conformal capacitive surface-based broadband absorbers with minimum thickness and maximum bandwidth targeting surveillance RADAR Signal avoidance	SERB, New Delhi

OTHER RECENTLY REGISTERED PROJECT

(OUTLAY OF 20 LACS AND ABOVE)

Principal Investigator	Department	Title of Project	Sponsor Agency
Prof. Sanjeev Manhas	Department of Electronics & Communications Engineering	Remittance advice payment issued on 17.03.2022 by Applied Material Inc.	Applied Materials Inc. (USA)
Prof. Dharmendra Singh	Department of Electronics & Communications Engineering	Development of State-of the art novel algorithm for mapping and monitoring the flooded regions and partially submerged vegetation using multi temporal multi-frequency & multi polarization SAR data	Indian Institute of Remote Sensing (IIRS), Dehradun
Prof. Rajib Kumar Panigrahi	Department of Electronics & Communications Engineering	Development of Satellite interferometry based landslide early warning (Sin LEW) system	Indian Institute of Remote Sensing (IIRS), Dehradun
Prof. Ankit Agarwal	Department of Hydrology	Anomalous Moisture Transport for Hydrological extremes in a Changing Climate AMOTHEC	DST, New Delhi (Indo - Portugal)
Prof. Bhaskar Jyoti Deka	Department of Hydrology	Advanced Nanocomposite Polymeric membranes for conversion of wastewater into potable water and revitalization of air in space	ISRO, Bengaluru
Prof. Sumit Sen	Department of Hydrology	Monitoring and modelling of hydro-glaciological processes in glaciated and non-glaciated watershed of north-west himalaya	Indian Institute of Remote Sensing (IIRS), Dehradun
Prof. Arun Kumar	Department of Hydro and Renewable Energy	Training of technicians for system design, installation, operation, maintenance and repair of renewable energy systems at grass root Level-Jal Urja Mitra Programme (Small Hydro)	Ministry of New and Renewable Energy, New Delhi
Prof. Pratham Arora	Department of Hydro and Renewable Energy	Exploring low-Carbon transportation pathways for India	New Venture Fund-FNCE- Indian Institute of Technology
Prof. Arbaz Khan	Department of Mathematics	Optimal Control of doubly diffusive flows: theoretical studies and numerical analysis	SERB, new Delhi
Prof. Dwijendra Narain Pandey	Department of Mathematics	Qualitative analysis of differential equations and inclusions with general nonlocal conditions	SERB, New Delhi
Prof. S. H. Upadhyay	Department of Mechanical & Industrial Engineering	Design and Analysis of Inflatable Military Decoys & testing of experimental model	DRDO, Pune
Prof. Avinash Parashar	Department of Mechanical & Industrial Engineering	Experimental and numerical analysis of light weight nanocomposites for static and dynamic loading	ISRO, Bengaluru

OTHER RECENTLY REGISTERED PROJECT

OUTLAY OF 20 LACS & ABOVE)

Principal Investigator	Department	Title of Project	Sponsor Agency
Prof. Kaushik Pal	Department of Mechanical & Industrial Engineering	Development of Super thermal insulating material (AEROGEL) based flexible blanket system for the interplanetary missions with gaseous convective environments	ISRO, Bengaluru
Prof. Arka Lahiri	Department of Metallurgical & Materials Engineering	Multi-Scale Modeling of Hydrogen Embrittlement	SERB, New Delhi
Prof. B. Venkata Manoj Kumar	Department of Metallurgical & Materials Engineering	Tough & Conductive spark plasma sintered SiC composites for wear resistant and electrical discharge machining applications	SERB, New Delhi
Prof. Anish Karmakar	Department of Metallurgical & Materials Engineering	Role of Cu on the mechanical response of quenched and tempered (Q&T) steel	SERB, New Delhi
Prof. Ujjawal Prakash	Department of Metallurgical & Materials Engineering	To study the high temperature Creep Rupture Behavior of SU 718 alloy	DRDO, Bangalore
Prof. Anjan Sil	Department of Metallurgical & Materials Engineering	Development of solid electrolytes for high voltage and high energy density Li and Na-ion batteries	ISRO, Bengaluru
Prof. Sumanta Sarkhel	Department of Physics	Investigation and characterization of ionospheric two dimensional plasma structures over the geomagnetic low-mid latitude transition region using artificial intelligence and machine learning	SERB, New Delhi
Prof. Soumitra Satapathi	Department of Physics	Development of Transparent Perovskite Devices for building Integrated Photovoltaics (TRADE)	SERB, New Delhi
Prof. Yogesh Kumar Sharma	Department of Physics	Mass Production of High Performance carbon fibers and nanofibric separators by Electro-spinning techniques for rechargeable batteries and super-capacitors	National Technical Textiles Mission, Ministry of Textiles, Udyog Bhawan, New Delhi
Prof. Akhilesh Kumar Mishra	Department of Physics	IR Radiation Propagation study through Mono-centric Ions (MCL) assembly	DRDO, Dehradun
Prof. Vivek Kumar Malik	Department of Physics	The Electric field control of Magnetization properties in Quantum Matter Heterostructures	SERB, New Delhi
Prof. Mayank Goswami	Department of Physics	Soft hydrogel lens as non-invasive ocular implant for image assisted in vivo drug delivery in diabetic retinopathy	Chellaram Diabetes Research Centre
Prof. Basant Yadav	Department of Water Resources Development and Mangement	Water Security assessment at the river basin level using the water footprint concepts	ISRO, Bengaluru

GRANTED PATENTS FROM JANUARY TO JUNE 2022

Title of the Disclosure	Inventor's Name	Patent Number
Dissimilar metallic coating on steel by activated diffusion	B. V. Manoj Kumar, P.K. Ghosh and Sandan Kumar Sharma	IP 390919
A method for synthesis of nitrogen-doped reduced graphene oxide (N-RGO) for high performance supercapacitor	Anil Kumar and Sahil Thareja	IP 391742
Ni-Fe bimodal catalyst for syngas production from carbon dioxide reforming of methane and process for the preparation thereof	Prasenjit Mondal and Mumtaj Shah	IP 391874
Activating flux coating for symmetric weld bead profile	D.K. Dwivedi and Ravi Shanker Vidyarthi	IP 393302
A hybrid iron sulphide impregnated anion exchanger (HISIX) for selective removal of hexavalent chromium from contaminated water	Sudipta Sarkar and Laiju A. R	IP 393640
Household Modified Septic Tank	A. A Kazmi, Sudipta Sarkar and Meena Kumari Sharma	IP 395747
A dual-chamber gas analysing system and method for selective gas sensing	Kaushik Pal, Keerti Rathi and A. Naveen Kumar	IP 396484
A method for the synthesis of amides from various carboxylic acids and amine derivatives	Debasis Banerjee and Shuvojit Halder	IP 397387
A synthesis process for the development of calcium silicate hydrate (C-S-H) based concrete hardening accelerator	Sonalisa Ray, Saikat Das and Sudipta Sarkar	IP 397480
A method of synthesis of aldehyde and ketones from dicyanovinyl derivatives	K. R. Justin Thomas and Anupam Das	IP 397930
A method of synthesizing pure phase sodium manganese silicate ($\text{Na}_2\text{MnSiO}_4$)	Yogesh Sharma and Harishpal Kumar	IP 398875
A Ni(II)-pincer complex for catalytic amination of alcohols	Debasis Banerjee and Atanu Bera	IP 399507
A novel electrode composite for high power and high energy application in rechargeable lithium-ion battery	Anjan Sil and Hari Raj	IP 400066
Low cost reinforced bipolar membrane fabricated with interface layer	Sujay Chattopadhyay and Bhuvanesh E.	IP 400162
Surface functionalized hierarchical carbon fiber reinforced composites hybrid polypropylene composites and the method of preparation	Gaurav Manik and Rupam Gogoi	IP 400382

TECHNOLOGIES TRANSFERRED FROM JANUARY TO JUNE 2022

Sr. No.	Title of the Innovation/Patent/Technology	Name of the inventor	Technology Transfer Partners
1.	Bactericidal metal nanoparticles and its method of preparation	Prof. N. Siva Mohan Reddy and Utsav Dalal	NSMR Private Limited
2.	A novel bio reactor system for solid state fermentation and process of operation thereof	Prof. Sanjoy Ghosh, Richa Rani and Sidharth Arora	Fermentech Labs Pvt. Ltd
3.	In-situ charging system for implantable pacemaker	Prof. Indranil Lahiri, Siddharth Sharma, Prof. Debrupa Lahiri and Prof. Partha Roy	Healagnostic Pvt. Ltd.
4.	Development of formaldehyde modified thermoplastic starch and its blending with low density polyethylene (LDPE) for biodegradable packaging bags	Prof. P. P. Kundu	Agrsar Innovatives LLP Greater Noida
5.	Biosensor for detecting cancer using exhaled breath	Prof. Indranil Lahiri, Prof. Debrupa Lahiri, Prof. Partha Roy, Siddharth Sharma and Swati Halder	Tata Steel Limited

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Prof Sujoy Chattopadhyay & team, IIT Roorkee, Technology Transfer agreement with Permionics Global Technologies



Prof PP Kundu, IIT Roorkee, Technology Transfer agreement with Agrsar Innovatives LLP Greater Noida



Prof Lahiri and team, IIT Roorkee has signed technology transfer agreement with Tata Steel Ltd.