



R&D Newsletter

Indian Institute of Technology Kanpur



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SOME NEW PROJECTS

Testing and Trajectory Analysis of DFDR (Deployable Flight Data Recorder Unit)

PI: Prof. T.K. Sengupta, Dept. of Aerospace Engineering

Sponsor: Hindustan Aeronautics Limited



A deployable flight data recorder unit is essentially an additional black-box designed to be ejected by an aircraft, in case of ultimate exigency. Designed DFDR unit at IIT Kanpur uses bluff body fluid dynamics for the unit to achieve a low terminal velocity to absorb the shock upon impact on solid ground or water. Its air-tight design

allows floatation on water indefinitely. The composite Kevlar structure gives it sufficient strength to keep the data and electronics functional, after impact on ground. Upon release the unit will send signal to a satellite, which will be tracked from ground station to retrieve the unit. This unique design is pursued for HAL Korwa and to be tested on Dornier DO-

228 aircraft manufactured by HAL Kanpur. In the current part of the project, a qualifying pre-test is proposed whereby the prototype will be released from an aircraft of the Flight Lab, IIT Kanpur to obtain its trajectory; test its structural integrity and ability to send signal after impact on the solid ground.

Gas Turbine Engine Combustion Characterisation by Using Fixed Laser Energy Source

PI: Prof. D. P. Mishra, Dept. of Aerospace Engineering

Sponsor: Gas Turbine Research Establishment



Ignition of fuel-air mixture in a gas turbine engine is quite important and critical for better performance of engine; particularly, in high altitude aerospace applications. Generally, spark plug/glow plugs are being used which have several shortcomings. It has been reported in recent times that laser ignition produces more stable combustion with less fuel

into the chamber, which can enhance its efficiency. Besides this, multiple ignition points can be created easily by laser ignition system which can have better chances of ignition even lean fuel mixture. The main aim of the project is to carry out laser ignition inside an enclosed combustor using Jet A1 fuel which would be the first such attempt in India. The lab has

already carried out laser ignition in open jet diffusion flame. A pulsed Nd-YAG and an in house developed optical system will be used to control the ignition location and ignition energy. It is envisaged to optimize the laser intensity requirement and ignition location with respect to the spray flow field.

SOME NEW PROJECTS

Establishment of New Generation Technologies for Cell Separation and High Throughput Screening using Macroporous Polymeric Matrices

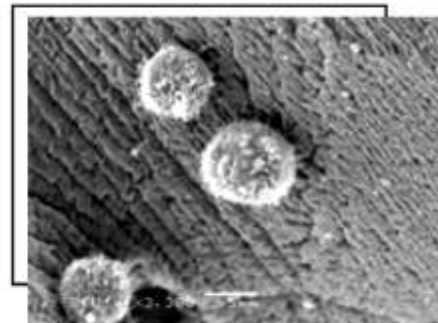
PI: Prof. Ashok Kumar, Dept. of Biological Sc. & Bioengineering

Sponsor: Department of Biotechnology



This is a TATA INNOVATION award project from DBT. The project is awarded in recognition of the outstanding work in translational research. The objectives of the project are to develop new technology for the separation of stem cells and other cell types of medical

importance. The technology will be unique to establish cell separation process on a preparative scale and with generic approach. The other objective of the project is to establish high-throughput screening for environmental pollutants and drug analysis.



specific binding of human acute myeloid leukemia cells on cryogel matrix.

Synthesis of Carba-Aminosugars and aza- and Ininosugars as Glycosidase Inhibitors Starting from Readily Available Sugar Derivatives and L-ascorbic Acid

PI: Prof. Y.D. Vankar, Dept. of Chemistry

Sponsor: Council of Science & Industrial Research (CSIR)



The main objective of this project is to develop new synthetic approaches towards some known and some unknown designed glycosidase (enzyme) inhibitors which are mostly heterocyclic, and some are carbocyclic molecules with well defined stereochemistry of various substituents. The

synthetic strategies proposed take the advantage of cheaply available starting materials such as simple sugar molecules (glucose, xylose, mannitol, arabinose, ribose etc.) and also L-ascorbic acid (vitamin C). The newly designed molecules will be screened for enzyme inhibition after their synthesis. If any of these molecules

shows excellent and specific inhibition of an enzyme, then it can be proceeded further for more elaborate studies and further applications. The work involves synthesis and enzyme inhibition studies, facilities for which are already well established in the research laboratory at IITK.

SOME NEW PROJECTS

Role of SPINK1 in Cancer Progression: Regulatory Mechanisms and Therapeutic Target Potential

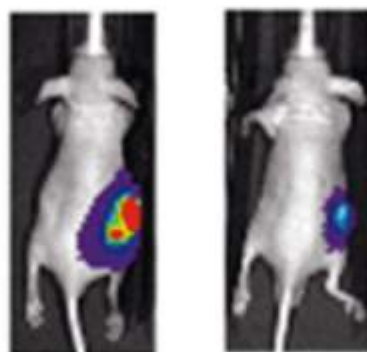
PI: Dr. Bushra Ateeq, Dept. of Biological Sc. & Bioengineering

Sponsor: Wellcome Trust



The prevalence of SPINK1 outlier expression or *ETS* genetic rearrangement status among prostate cancer (PCa) patients is largely unknown in India. This project proposes to characterize the full spectrum of the PCa specific driver aberrations in a large cohort of Indian prostate cancer specimens, with specific focus on estimating the prevalence of SPINK1 overexpression. Therefore, this study, a first of its kind, will provide a thorough understanding of causal genomic events of PCa

in the Indian population. Furthermore, this will also unravel the underlying mechanism for the increased SPINK1 expression in a subset of aggressive Pca and its role in cancer metastases. This comprehensive study will



22 RV1 Control 22 RV1 SPINK 1 Knockdown

also explore the potential of SPINK1 to serve as a therapeutic target in SPINK1+ PCa patients.

Clinical Collaborators:

1. GSVM Medical College, Kanpur.
2. King George's Medical University, Lucknow.
3. All India Institute of Medical Sciences, New Delhi.

Research Facilities:

Pre-clinical mouse models for cancer.

33KV Substation Design and Estimation Cost

PI: Prof. SN Singh, Dept. of Electrical Engineering

Co PI: Er. Rajeev Garg

Sponsor: Doctor Harisingh Gour Vishwavidyalay



The aim of this project is to provide consultancy service to Doctor Harisingh Gour Vishwavidyalaya, Sagar (MP) for substation design, feeder up to 11 kV and estimation of cost. There are two phases in this project. In

Phase-I, a study of existing network and availability of space for the substation and lines (up to 11 kV) of the campus is to be carried out. Single line diagram would be submitted. In Phase-II,

estimation of cost of the network along with others will be prepared.

SOME NEW PROJECTS

Non-gassing Electrode Materials for Electro-osmotic Pumping Based Subcutaneous Drug Delivery System

PI: Prof. P.K. Bhattacharya, Dept. of Chemical Engineering

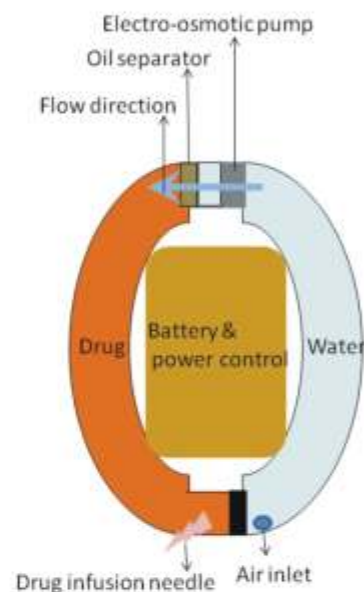
Co PI: Dr. R. K. Nagarale, Ramanujam Fellow, DST

Sponsor: Science and Engineering Research Board



Miniature pumps are the core of programmable drug delivery systems. Of the known miniature pumps, electro-osmotic pumps are arguably the simplest of all pumps, having no moving parts. They consist of merely an ionic membrane sandwiched between two electrodes. The conventional electrode material, platinum being

obviously expensive, has the shortcoming of catalyzing the generation of oxygen at the anode and of hydrogen at the cathode. As a result, the resulting flow is neither constant nor predictable. It is specifically proposed to synthesize potentially very inexpensive quinone derivatives /polymers and tailor these for use in non-gassing electroosmotic pumps for transcutaneous drug delivery.



Development of Flexible Pressure Sensors

PI: Dr. Animangsu Ghatak, Dept. of Chemical Engineering

Sponsor: Science and Engineering Research Board



Low cost, large area, ultra-sensitive, flexible sensors are important for variety of engineering applications: electronic skin, intelligent textiles, smart switches and devices for autonomous manipulation of objects, energy harvesting,

stress measurement, vibration control and so on. Such sensors will be fabricated using soft rubbery films with their surface and bulk patterned with nano-microscopic features like hairs, pillars, islands and pyramids. The effective material properties of these

films will be strong function of the dimension of these features. Therefore, any change in loading on the film surface will alter their modulus, dielectric constant, capacitance and others which will be measured.

SOME NEW PROJECTS

Developing Standards for Airborne LIDAR Data Acquisition

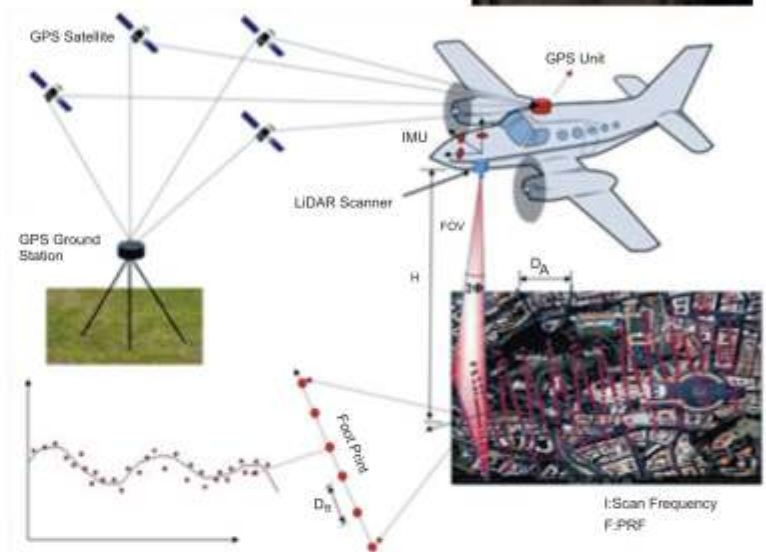
PI: Dr. Bharat Lohani, Dept. of Civil Engineering

Sponsor: Department of Science and Technology



Airborne LiDAR is an industry standard technique to collect dense and accurate three dimensional data of terrain and the features on it. Being still a new technology, currently there are no standards available in India for acquisition and processing of LiDAR data. However, the coming decade is going to witness multifold increase in the use of LiDAR datasets in view of India's

infrastructural growth, need of disaster management and other applications. This project aims to establish basic framework for standards for LiDAR data acquisition and processing. The deliverables of the project would be a set of technical specifications with potential to be



adopted as national standards.

Study into Cracking of Deck Slab and Girders of Flyovers at Dholpur on NH3 & Development of Strengthening Schemes

PI: Prof. Durgesh C. Rai, Dept. of Civil Engineering

Sponsor: PNC Infratech Limited



The two flyover structures of Dholpur-Morena section of NH-3 located at Dholpur developed inclined shear cracking in their prestressed girders at both ends in addition to deck slab cracking. These structures, except at the obligatory spans over the railway tracks or highway, are composed of three-span modules of simple span precast prestressed I-girders made continuous. After detailed study of the structure

and analysis using CSiBridge program, several design and construction discrepancies have been identified, namely, too slender girders, inadequate bursting and shear reinforcement in girders, increased negative continuity moments due to change in construction sequence (continuity diaphragms were cast before the deck slab) and inadequate quantity and anchorage length of negative continuity

reinforcement in the deck slab. Two levels of strengthening is being investigated which involves thickening of girder webs with additional shear reinforcement and new deck slab overlay with required negative continuity reinforcement along with use of externally bonded steel plates and carbon fiber wraps and laminates to further increase flexure and shear strength of pre-tensioned girders.

SOME NEW PROJECTS

Use of Mode Localization for Quieter Panels of Superstructure in A Stealth Ship

PI: Dr. Shakti Gupta, Dept. of Mechanical Engineering

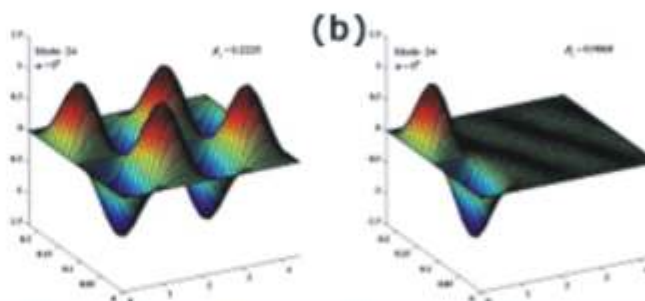
Sponsor: Naval Research Board



Flat plates/laminates are widely used in construction of various parts of superstructure of a stealth ship to scatter electromagnetic waves (Fig a). These flat structures have very low stiffness leading to enhanced vibration, fatigue failure and noisy habitat in the

battle ship. To reduce vibration of such plates the project proposes to study and utilize the phenomenon of mode localization. Mode localization is a phenomenon in which a mode of vibration in a flat plate gets localized in a certain region of it depending on the constraint imposed within its

interior (Fig. b). The occurrence of this phenomenon has been proved computationally in the recent past. In this project the goal is to observe and validate the phenomenon and develop a methodology to implement it practically.



(a) HMS *Helsingborg*, Swedish Navy (http://en.wikipedia.org/wiki/Stealth_ship).

(b) finite element simulation of a mode of vibration of a composite lamina without (left) and with (right) interior constraint. With interior constraint mode localizes in a small region of the lamina.

Oxidation of Graphite and Protective Coatings: Multi Length Scale Abridgment

PI: Dr. Kantesh Balani, Dept. of Materials Science & Engineering

Co PI: Dr. Sarang Ingole, Dept. of Materials Science & Engineering

Sponsor: Science and Engineering Research Board



The project aims to evaluate the oxidation behaviour of graphite (ASTM 7542 grades) at high temperatures (upto 1200 °C) and attempt the protection methods (via plasma spraying of SiC/ZrB₂/Al₂O₃ nanocomposite coating). It is

highly critical to accumulate the reliable data considering the weight loss of graphite under various temperature regimes as their kinetics varies with changing temperature and composition. Outcome of this study will bridge the dominant strengthening mechanisms at

different length-scales of the nanocomposite SiC-ZrB₂-Al₂O₃ coatings in order to assess the damage accumulation, and protection of graphite.

- Havells India Ltd. visited IIT Kanpur on June 11th, 2013 to discuss the possibility of joint R&D projects between Havells India and IIT Kanpur.
- Whirlpool team visited IIT Kanpur on June 4th, 2013 for a possible tie-up. Their main focus was on Nano-technology and Frugal Innovation.
- Bharat Heavy Electricals Ltd (BHEL) team visited IIT Kanpur from 16th to 18th May 2013 for exploring collaborative research opportunities.

Efforts were made to publicize the institute's External Registration Program (ERP) for Ph.D. Letters inviting applications for the ERP were sent by the Director to various National Labs: CSIR, DAE, DoS, DRDO, C-DoT and C-DAC.

MoU Signed between JK Center for Technician Training & IIT Kanpur



On June 5th, 2013 JK Center for Technician Training (JKCTT), Kanpur and IIT Kanpur signed a Memorandum of Understanding to promote and cooperate on up-gradation of technical skills of local technicians. Director of the institute Prof. Indranil Manna, the Dean of Research and Development, Prof. Ajit Chaturvedi, the Head of the Central Workshop, Dr. Sameer Khandekar, Mr. Manoj Pant and Mr. Lalit Khanna from JKCTT and eminent personalities from local Kanpur industry and Merchants Chamber were present at the MoU signing ceremony. The first three-day training program under this MoU was held during July 26-28, 2013, at the Central Workshop.



Feedback/Suggestions

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