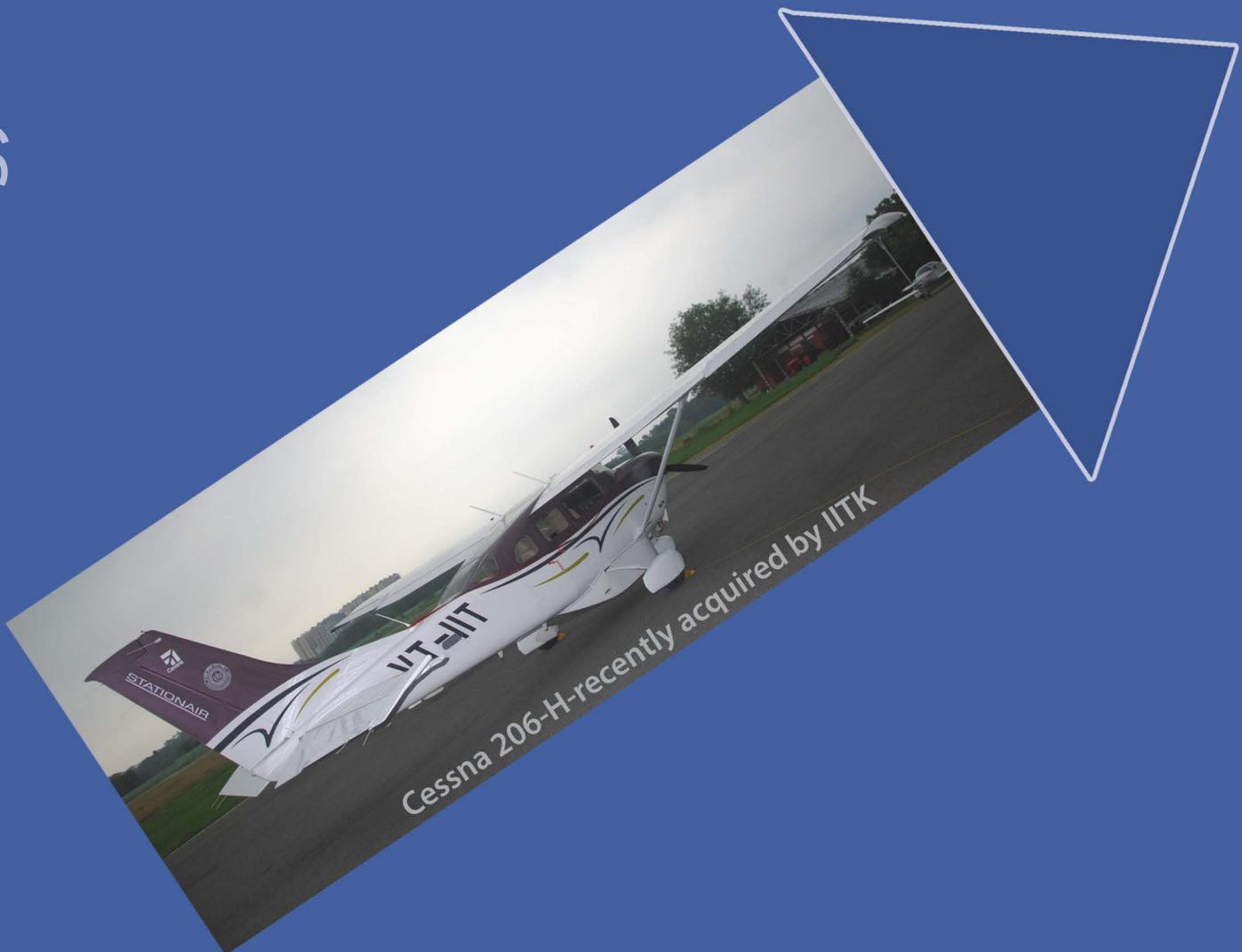




R&D Newsletter

Indian Institute of Technology Kanpur



Cessna 206-H-recently acquired by IITK

soft copy of the newsletter is available at
www.iitk.ac.in/dord/newsletter.htm

RECENTLY REGISTERED PROJECTS

Deciphering The Bmp Signaling Network in Developing Bone: An Interdisciplinary Approach Combining Bioinformatic Data Mining Tools Along with Molecular Genetic and Developmental Biology Strategies



PI: Dr. Amitabha Bandyopadhyay, Dept. of Biological Sc. & Bioengineering
CO-PI: Prof. Harish Karnick, Dept. of Computer Sc. & Engineering
Dr. Arnab Bhattacharya, Dept. of Computer Sc. & Engineering
Dr. Madhav Ranganathan, Dept. of Chemistry

Sponsor: Department of Biotechnology

Bone Morphogenetic Proteins (BMPs) secrete signaling molecules that dictate bone formation. There is evidence suggesting that loss of BMPs may lead to osteoporosis. Thus BMP signaling is a

possible therapeutic target for osteoporosis. The project aims to characterize the molecular network acting downstream of BMP signaling to promote bone formation. This is proposed to be achieved by an interdisciplinary

approach combining bioinformatic data mining, transcriptomic analyses and functional assays using novel in-house developed cell lines and network construction or simulation on the solid ground.

Metal Catalyzed Decarbonylative Coupling Reactions and their Applications to Organic Synthesis



PI: Prof. M. L. N. Rao, Dept. of Chemistry

Sponsor: Science and Engineering Research Board

In recent years, metal-catalyzed coupling reactions demonstrated tremendous potential in organic synthetic applications both in laboratory and industrial scale preparations. This coupling strategy evolved as an indispensable synthetic tool and thus easily adopted even in multi-step (target oriented) synthetic approaches in addition to applications in Active Pharma Ingredients (APIs). However,

there lies an ample scope for the development of newer approaches employing different reaction partners in place of the well utilized organometallic reagents. This is expected to provide a new platform of hitherto unexplored opportunities in organic synthesis with broader scope and reactivity. The specific goals of the project are:

(I) Utilization of carbonyl functionality such as aldehydes

as coupling partners in coupling reactions under metal catalyzed conditions.

(ii) Development of new reactions and protocols to broaden the scope of these reactions.

(iii) Further exploration of inter- and intra-molecular variations with applications in the synthesis of molecular entities of medicinal and material importance.

RECENTLY REGISTERED PROJECTS

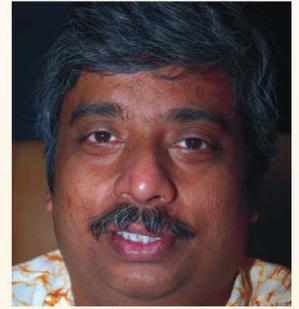
Road Construction Using Recycled Aggregates

PI: Prof. Animesh Das, Dept. of Civil Engineering
Co-PI: Prof. Partha Chakrabarty, Dept. of Civil Engineering

Sponsor: Public Works Department, Govt. of Uttarpradesh

Natural resources used for road construction are depleting. Consequently, the haulage cost for acquiring good quality stone aggregates is increasing. The environmental costs of quarrying are also substantial. The project involves design of a road structure using the aggregates of the existing road as recycled

material. Recycled materials will be used either in unbound form or in lightly cemented form. Suggestions will be made on the suitable proportion of recycled material (and other ingredients) for the individual layers of the road structure. Finally, few design solutions (out of numerous possible alternative designs) will be recommended.



A study on Seismic Soil-Foundation-Structure Interaction using Laminar Container

PI: Dr. Prishati Raychowdhury, Dept. of Civil Engineering

Sponsor: Department of Science & Technology

The main objective of this research is to design and construct a medium-size laminar container with limited shear capacity for experimentally investigating the nonlinear behavior of rocking shallow foundation and its effect on the inelastic response of the structural members during an earthquake event. The laminar container will be placed and tested on the shaking table

already available at the Indian Institute of Technology Kanpur. This research expects to shed lights on complicated phenomenon such as nonlinear force-deformation behavior of the foundation, kinematic interaction between soil and foundation, frequency-dependant impedance function components of the soil-foundation system, geometric nonlinearity such as formation of

gap and permanent deformation at the footing-soil interface during an extreme earthquake event. In a nutshell, the study is envisioned to enhance the understanding on soil-foundation-structural interaction behavior under seismic events. The outcome of the study will be useful for utilizing the potential of inelastic foundations towards more economic seismic design of structures.



RECENTLY REGISTERED PROJECTS

Intelligent Tutor Project

PI: Dr. Amey karkare, Dept. of Computer Sc. & Engineering
Collaborators - Dr. Subhajit Roy, Dept. of Computer Sc. & Engineering
Dr. Sumit Gulwani
(Adjunct faculty, CSE & Microsoft Research, Redmond)



Sponsor: Microsoft Research Lab India Pvt Ltd

The project is aiming to develop Intelligent Tutoring Systems to assist in teaching large classrooms. This includes software for problem solving, hint generation, new problem generation, and automated grading. These tutoring systems

will be developed for various topics such as Chemistry (Periodic Table), Math (Limits, Trigonometry), and Logic (Natural Deduction) to name a few. Automated tutoring systems are not only indispensable in Massive Open Online Classrooms (MOOCs), but are

also useful for traditional classroom settings. The team includes Dr. Amey Karkare and Dr. Subhajit Roy (both Faculty, CSE), Dr. Sumit Gulwani (Adjunct Faculty, CSE and Microsoft Research, Redmond) and students from CSE department.

Improving Coverage of Test-Suites via Automatic Test-Case Generation

PI: Dr. Subhajit Roy, Dept. of Computer Sc & Engineering
Co-PI: Dr. Amey Karkare, Dept. of Computer Sc & Engineering
Collaborator: Dr. A.K. Bhattacharya SO(H) & Head, Software Reliability Section, Rector Control Division, BARC and Adjunct Professor (Electrical Sciences), Homi Bhabha National Institute, (BARC)



Sponsor: BRNS

Program testing is a fundamental chore in the development of any software system. An expert testing team, using relevant domain knowledge of the system being built, would design a set of test-cases aimed at ascertaining certain degree of confidence in the product. However, such test-

cases often fail to uncover small corner-case bugs. The project aims to build a tool that would leverage the testing team's effort to improve test coverage. By leveraging on the knowledge of these domain experts, and supplementing it with the rigour of systematic exploration based on formal methods, this tool is

more likely to gain improved coverage than either a manually developed test-suite or a completely automated test-case generation system. It is expected that this will also open these tools to wider acceptance as the trusted domain experts are not replaced, only complemented, by this tool.

RECENTLY REGISTERED PROJECTS

Experimental Characterization and Numerical Modeling of Charge Transport in Synthetic Polymers Used for Electrical Insulation under Low and High Applied Voltages

PI: Dr. Nandini Gupta, Dept. of Electrical Engineering
Collaborators - Prof. KALLEL Ali, Faculty of Sciences of Sfax
Sponsor: Dept. of Science & Technology



Injection and accumulation of space charge into the volume of high voltage polymeric dielectrics plays a significant role in driving aging mechanisms. Space charge measurement is a relatively new and developing technique, and holds promise as a means to determining the lifetime of the insulation in service. The current project aims at characterization of space charge accumulation and dynamics in polymeric dielectric materials commonly

used in high voltage insulation. To this end, Pulsed Electro-acoustic (PEA) measurement techniques, Electroluminescence measurements, and conduction current measurements will be used in conjunction. Additionally, theoretical studies will be undertaken to devise a methodology

for prediction of ageing and breakdown in insulating materials, in terms of space charge dynamics.



Experimental facility: Pulsed Electro-Acoustic Technique for space charge measurement in polymers.

Linearity Improvement of High Current Hall Effect Current Sensors

PI: Dr. Partha Sensarma, Dept. of Electrical Engineering
Sponsor: M/S Electrohms Pvt. Ltd. (ELECTR)



Electrohms, a Bangalore-based company is the only Indian manufacturer of Hall-effect based closed-loop sensors, the market of which is dominated by Swiss and other European players. Recently they had noted a problem in their 500 A sensors at mid-range frequencies, which after discussion turned out to be a problem of linearity improvement, over the declared

bandwidth. The manufacturer had provided all circuit details and the project suggested some preliminary modifications. A few sensor samples were tested using the company's specialized equipment and measurement instruments available here. Initially, the frequency range involving maximum deviation was bracketed and its performance was analyzed in

this bracket. Additional improvements in circuit design were proposed, incorporated and tested to ensure that subsequent performance matched international benchmarks. Detailed analysis of the component tolerances were conducted to ensure less than 0.1% error in linearity over the declared current range, with marginal cost increment.

RECENTLY REGISTERED PROJECTS

Design and Development of a Pipe-line Health Monitoring Robot based on Smart Sensor Embedded Rotating Probes and an Efficient Data Communication

PI: Prof. Bishakh Bhattacharya, Dept. of Mechanical Engineering
Co-PI: Dr. Nachiketa Tiwari, Dept. of Mechanical Engineering
Sponsor: Gas Authority of India Limited (GAIL)



Due to corrosive environment, pipes used for transportation often



Typical Failure of a Gas Pipe Line

get damaged and may cause serious accidents like

leakage, fire and blasts. It also reduces the life of transportation systems substantially. The project aims at developing a pipe health monitoring system based on smart sensor based

rotating probes which can be transported inside pipes of variable diameters with the help of a conduit crawler robot. Crawler robots are being developed for pipe –health monitoring, but most of them rely on wired signal transmission which causes problems with the movement of the robot inside the pipe. The objective of this work is to establish

the usability of a new PVDF based cantilever smart probe as a sensor to sense finite sized discontinuities over a surface using the pipe crawler robot. It is envisaged that this novel sensing system could be used effectively for pipe health monitoring.



The proposed New Robot based on PVDF Sensor

Deep Sea Pressure

PI: : Dr. Nachiketa Tiwari, Dept. of Mechanical Engineering
Sponsor: Hindustan Aeronautics Ltd



Hindustan Aeronautics Limited has a division located in Korwa, UP which is engaged in design and development of flight data recorders. These devices have to survive extreme pressures for prolonged periods of time, in case they fall in deep oceanic waters. The goal of this project is to develop a test facility which can produce such high

pressures in the lab corresponding to several kilometres of water head. Towards this end, the project aims to successfully modify a pre-existing non-functional device, which can meet HAL's test needs i.e., the facility can be used to generate pressures in the range of 600 to 900 bars. The functional facility will also be subsequently used to test

prototype-level flight data recorders in IITK labs. While working on this project, safety of the operating personnel and structural integrity of the pressure intensifier will be of paramount importance. The project also involves development of a relatively robust, easy to use, and fail-safe hydraulic mechanism, which can generate and sustain high pressures for several days.

RECENTLY REGISTERED PROJECTS

Establishment of a Multidisciplinary Innovation Lab

PI: Dr. B.V. Phani, Dept. of Industrial Management & Engineering

CO PI: Dr. Sameer Khandekar, Dept. of Mechanical Engineering

Dr. Deepu Philip, Dept. of Industrial Management & Engineering

Sponsor: Department of Science & Technology

As the product life cycles are getting shorter and companies face intense pressure to be first in the market, this facility is expected to reduce the time to market and increase the profitability of start-ups. These facilities are often beyond the reach of start-ups who often face difficulty in arranging all resources. The lab will be accessible to Incubators all over the country, students and start-up entrepreneurs to test, validate and prototype their ideas into new products and services, specially in the advanced technology domains. The services are kept at nominal rates so that they can be easily afforded by start-ups and SMEs. The objective of the project is to establish a multi disciplinary Innovation Lab at IIT Kanpur so as:

- To promote entrepreneurship by providing a perfect eco-system.
- To provide a training ground to students by providing them right tools for experimentation.
- To offer all facilities & services required for product development for start-ups at affordable prices.
- To expedite the process from Lab to market.

High tech equipments like Abrasive jet cutting machine, 3D reserve engineering system, Rapid injection moulding, Laser direct structuring machine with high grade polymer 3D printer will be available in the lab. These machines will be used in conjunction with the existing machines in the Tinkering and 4i Labs at IIT Kanpur.



Multi-layer PCB Compaction Press

INDUSTRIAL COLLABORATION ADVISORY GROUP (ICAG)

The Industry Connect Talk Series, organized by the Industrial Collaboration Advisory Group (ICAG), has been initiated where speakers from the industry are invited to present their company's research areas of interest to explore possibilities of collaboration with researchers at IIT Kanpur. The inaugural talk, titled "L&T – Company overview and areas of interest for academic collaborations", was delivered by Mr. G.B.P. Manivannan, Principal Technology Officer at Larsen & Toubro Ltd., on 18th September, 2013.

Larsen & Toubro Limited (L&T) is India's largest Engineering & Construction company with interests in infrastructure development, manufacturing and financial services. Some of the key areas where L&T seeks engagement with IIT Kanpur are wireless smart sensor network, smart grid, cloud computing, M2M cloud solution, and some specific focus areas include Embedded Technologies like IP development & energy harvesting, consumption reduction systems, aerospace/ defence technology development has robotic systems like UAV etc.

The visiting team from L&T comprising Dr. G. Anand, Mr. Gyan Pattnaik, Mr. Ashok Kumar, along with Mr. G.B.P. Manivannan, held discussions with some faculty members. An MOU has been signed between IIT Kanpur and L&T.



R&D NEWS

A Japanese delegation visited IIT Kanpur on 17th Sept - 18th Sept, as part of the Visionary Leaders for Manufacturing (VLFM) Program, which is an inter institute program, jointly offered by IIM Calcutta, IIT Kanpur, and IIT Madras. The delegation consisted of Prof. Shoji Shiba, Mr. Massaki Doi, and Mr. Kondo; representing the Japan International Cooperation Agency (JICA).



Feedback/Suggestions

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