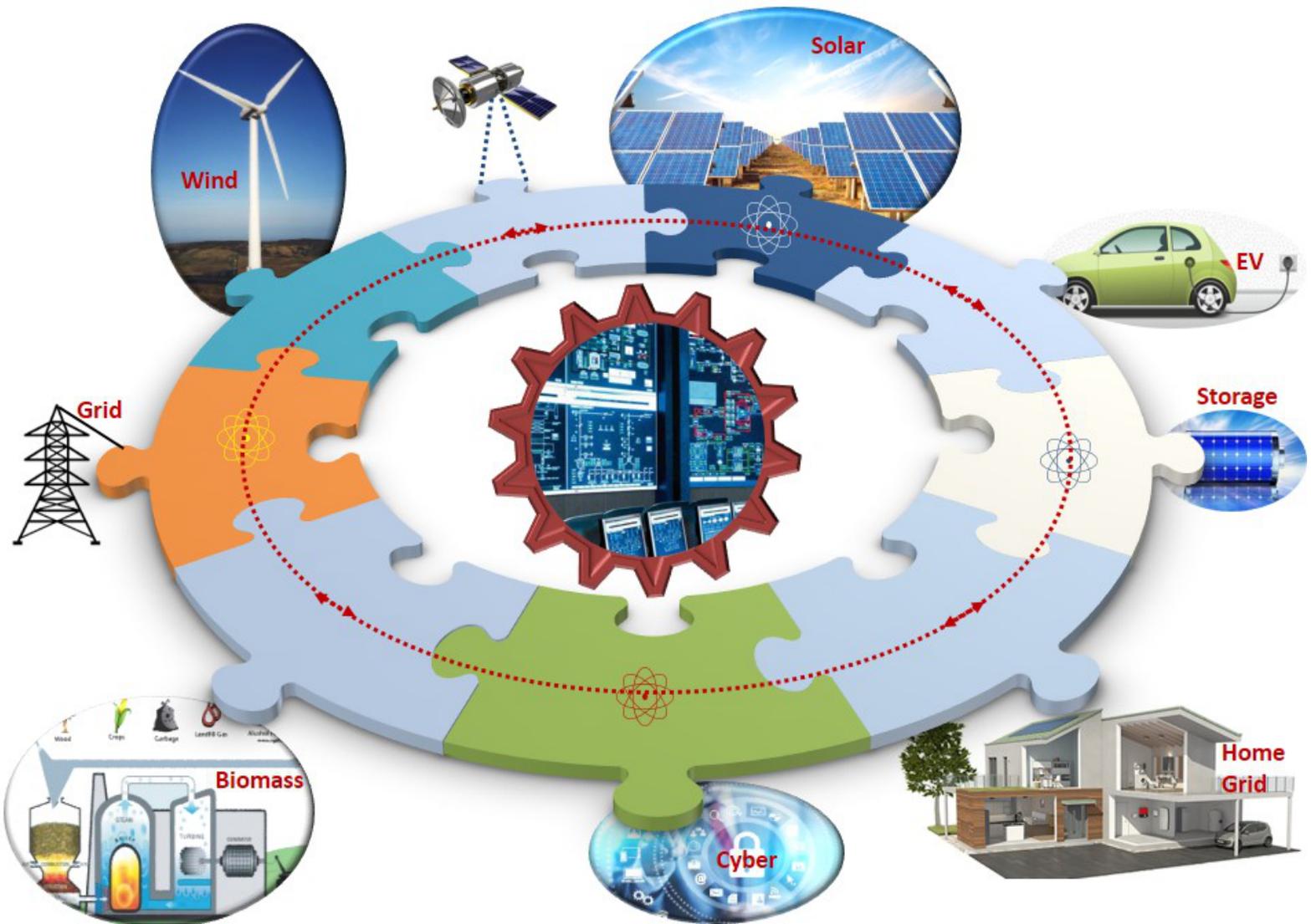




R&D Newsletter

Indian Institute of Technology Kanpur



IIT Kanpur to Lead a Joint Indo-US program
on Advance Smart Grid Technology

Entrepreneurship Enclave-2017

Startup India is a flagship initiative of the Government of India, intended to build a strong eco-system for nurturing innovation and Startups in the country that will drive sustainable economic growth and generate large scale employment opportunities. The Government through this initiative aims to empower Startups to grow through innovation and design.

Following up with the Startup India Action Plan, as part of the invent program IIT, Kanpur in collaboration with SHUATS, Allahabad, has jointly organized Entrepreneurship Enclave-2017 for the students of Graduate and Post graduate level at the University Auditorium, SHUATS, Allahabad on March 1, 2017.

Around 250 participants gathered at the event. Students mainly from different colleges including SHUATS attended the conclave. The conclave started with “Introduction to Entrepreneurship Eco-system” at IITK by Dr. Abhijit Sathe, CEO INVENT Program, giving an overview of entrepreneurship facilities & funding opportunities available at IIT, Kanpur. Afterwards Mr.



Ravi Pandey, Establishment Officer, IIT Kanpur gave a detailed insight on “Intellectual Property in Entrepreneurship”. Students showed keen interest for starting their own venture with the help of Incubation facilities at IIT Kanpur. Mr. K Sriharsha from Kristnam Technology (Incubate), Mr. Eshan Sadasivan from Prosoc Pvt Ltd. (Incubate) and Mr. Rajeev Ranjan (Agpulse Pvt Ltd.) have directly interacted with the students, sharing their personal experiences during the journey to start their own Startup company.



This seminar was very helpful for the students and faculty members in understanding the overall procedure for starting a startup company.

SIIC has become the SIXTH BIG partner of DBT

SIDBI Innovation & Incubation Centre (SIIC) at IIT Kanpur has been selected as the 6th BIG Partner of DBT for BIRAC’s flagship programme BIG (Biotechnology Ignition Grant). While SIIC, IITK is already a member of BIRAC family through the Bio-NEST programme, the new partnership will help to enhance BIG’s footprint in regions such as Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan.

SIIC is reaching out to entrepreneurs in Chhatisgarh

SIIC initiated the INVENT (Innovative Ventures and Technologies for Development) Social Entrepreneurship program last year, supported by Department for International Development (DFID), Government of the United Kingdom and Technology Development Board (TDB), DST. The mandate was to promote entrepreneurship and provide seed funding, especially to social entrepreneurs, in the two states of UP and Chhatisgarh.

The investment committee of SIIC has approved investments of nearly Rs. 2.0 crores to seven start-ups in these two states. MoU has been signed with a local TDB approved business incubator at Bhilai, Chhatisgarh, who will help in building the pipeline and provide local area support.

For more details visit:

<http://www.iitk.ac.in/invent/portfolio.html>

IIT Kanpur to Lead a Joint Indo-US program to Advance Smart Grid Technology

Indian Institute of Technology (IIT) Kanpur will lead a Pan-India consortia of Technical Institutes, Utilities and Industries in a five-year joint Indo-US research project. The consortia from US, being led by Washington State University (WSU), Pullman, WA, had jointly submitted this proposal titled UI-ASSIST (US-India collaborative for smart distribution System with Storage).

Government of India and the United States of America agreed to expand the Indo-US Joint Clean Energy Research and Development Center (JCERDC) by funding new program furthering research and development on 'Smart Grids and Energy Storage', critical to improving the reliability, flexibility and efficiency of the electricity delivery system. This program will be administered in India by the bilateral Indo-US Science and Technology Forum (IUSSTF) and in the US by the Department of Energy (DOE). The DOE in US and Ministry of Science and Technology, Government of India announced the selection of the winning Bilateral Consortia project on June 22 and 23 2017, respectively.

The Government of India, through the Department of Science and Technology (DST), and the US Department of Energy (DOE) each will provide approximately US \$7.5 million (Approx. Rs. 50 Crore), which will be equally supplemented by US \$7.5 million from each of the consortia from India and US, bringing the total to US \$30 million for this joint R&D effort.

This project will bring together multi-disciplinary team to address essential issues related to the adoption and deployment of smart grid concepts along with Distributed Energy Resources (DERs) including storage in the distribution network for its efficient and reliable operation. Analysis and technology tools for smart operations of interconnected microgrids including DER and storage will also be developed. In addition to developing technical solutions, the UI-ASSIST team will also investigate the societal acceptance, impact and value of the integrative solutions of smart meters, renewable energy, storage and microgrid solutions, along with the policy implications.

A key component of the joint program is the demonstration of the technology at several lab level pilots and the field demonstration covering the rural, semi-urban and urban settings involving residential, commercial and industrial consumers. It also aims at the capacity building and workforce training, which will be essential for both the countries in developing the next generation power engineers to work with these smart distribution systems.

The winning consortium:

Indian Lead: Prof. Suresh C Srivastava, Indian Institute of Technology Kanpur

Indian Co-Lead: Prof. Santanu Mishra, Indian Institute of Technology Kanpur

US Lead: Prof. Noel Schulz, Washington State University, Pullman

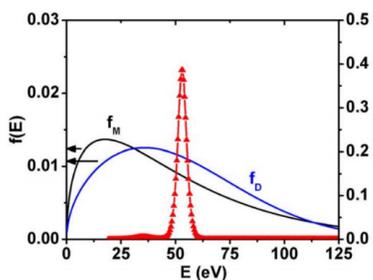
US Co- Lead: Dr. Anurag Srivastava, Washington State University, Pullman

Featured Research

Variable gaseous plasma focused ion beams and creation of high aspect ratio microstructures

Sudeep Bhattacharjee, Dept. of Physics

Ion beam tools have become inevitable in today's science and technology research and industrial applications. The application spans over several areas and traditionally have addressed milling, patterning, high resolution imaging and implantation, including fundamental physics research. In order to serve emerging research applications, there are efforts to develop ion beam tools that use gaseous plasmas, which can be non-toxic and therefore suitable for biomaterials and provide an option for rapid processing due to higher currents without metallic contamination. To mention a few, ion beam processing of polymer biomaterials (e.g polyurethane and silicon rubber) are becoming increasingly important for applications in artificial heart valves. The surface properties of metallic bio-materials such as titanium/titanium alloys and cobalt-chromium alloys (Co-Cr) used in orthopedic prostheses, can be improved by employing nitrogen ion beams which reduces wear and tear. For microfluidic applications sometimes network of channels are required in the micro-meter regime. As a possibility to address the above requirements, a microwave plasma based multi-element ion beam system has been developed, that can deliver ion beams of different gaseous elements (e.g. Ar, Kr, Ne, H₂) with the present capability of focusing the beam down to single digit in micrometers.



The ion beams have an axial ion energy spread ~ 5 eV (shown in Figure 1) which is comparable to conventional commercially available Ga focused ion beams systems.

Figure 1: Comparison of the ion energy distribution at the beam extraction region with standard Maxwellian (f_M) and Druyvesteyn (f_D) distributions having same mean energy

References

1. J. V. Mathew, I. Dey and S. Bhattacharjee, Microwave Guiding and Intense Plasma Generation at Subcutoff Dimensions for Focused Ion Beams, Applied Physics Letters 91, 041503 (2007).
2. J. V. Mathew and S. Bhattacharjee, Compact Electrostatic Beam Optics for Multi Element Focused Ion Beams: Simulation and Experiments, Review of Scientific Instruments, 82, 013501 (2011).
3. Sanjeev K. Maurya, Samit Paul, Jay Kumar Shah, Sanghamitro Chatterjee, and Sudeep Bhattacharjee, Momentum transfer using variable gaseous plasma ion beams and creation of high aspect ratio microstructures, Journal of Applied Physics, 121, 123302 (2017).

Recently this system has been used to create high aspect ratio (Line width/depth) microstructures in the range 100 - 1000, as shown in Figure 2. Variable milling rates in the range 1 - 500 $\mu\text{m}^3/\text{s}$ on metallic copper substrates can be easily achieved. The abbreviated name of our institute "IITK", engraved on copper thin films including other microstructures created by the ion beams is shown in Figure 3. It is expected that the device will be able to address emerging areas in microfluidics and rapid processing of biomaterials.

The device has been built at IIT Kanpur with support from DST and has recently received a US patent

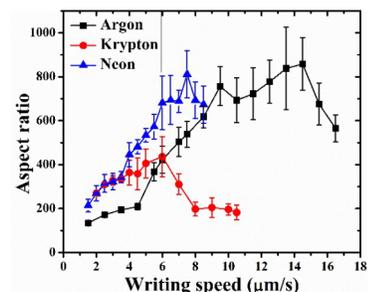


Figure 2: Variation of aspect ratio with writing speed for Ar, Kr and Ne ion beams

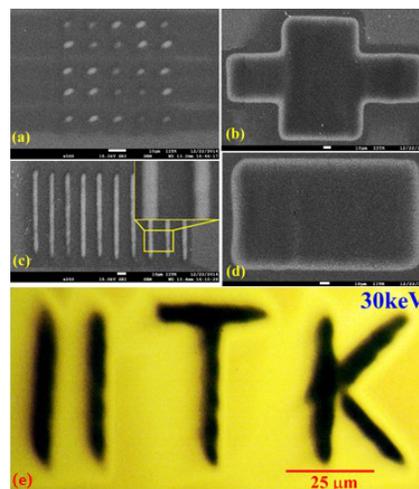


Figure 3: Images of Ar ion beam writing on 50 nm Cu thin film. Scanning electron microscope (SEM) images of (a) 5×5 arrays of micro-spots created by 0.4 s irradiation, (b) cross symbol, (c) gratings of 50/mm rulings, (d) rectangle of $180 \mu\text{m} \times 120 \mu\text{m}$, written with 18 keV ion beams (white scale bar on figure a-d represents 10 μm). (e) optical microscopy image of our institute's name "IITK" written with 30 keV ion beams.

Featured Research: Materials & Mechanics

Poisson Effect Driven Anomalous Lattice Expansion in Metal Nanoshells

Research team: Ganesh Iyer ¹, Suboohi Shervani ¹, Gargi Mishra ², Deb De ², Arun Kumar ¹, Sri Sivakumar ², Kantesh Balani ¹, Raj Pala ² and Anandh Subramaniam ¹

¹Dept. of Materials Science and Engineering,

²Dept. of Chemical Engineering

Surface tension compresses a water droplet and equivalently the effect of surface stress is to decrease the lattice parameter in metal particles. The effect of surface stress and elastic properties like Poisson's ratio can be accentuated in lower dimensional systems like metal nanoparticles. The IIT Kanpur team, using a two scale computational method and transmission electron micros-

copy, not only show a lattice expansion due to purely surface stress effects in a metallic system, but also discover anomalous lattice expansion in the case of very thin walled in metal nanoshells. This effect where "compression is causing expansion" has been hitherto unanticipated. The Kanpur team not only establish that this is a Poisson effect driven phenomenon but generalize it for all metal nanoshells.

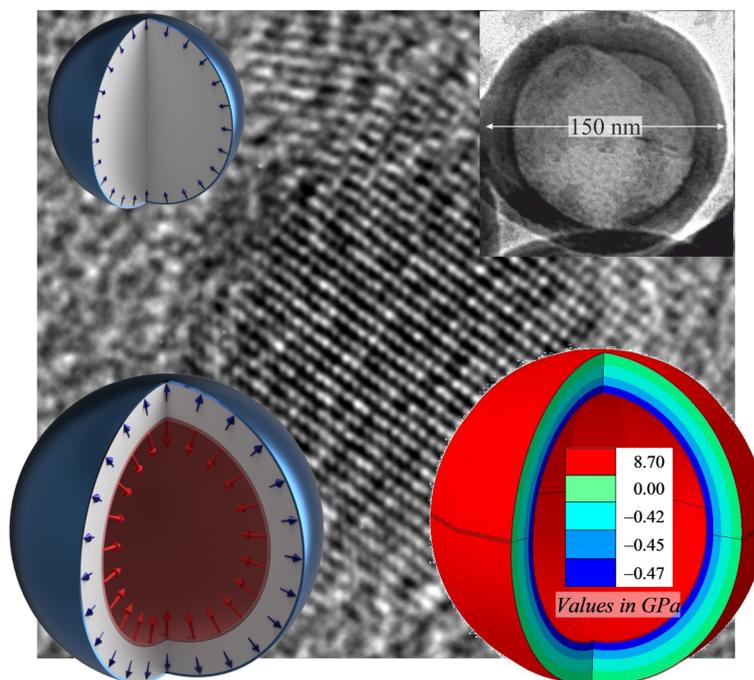


Figure. As we traverse from a metal nanoparticle to thin nano-shells, the lattice expansion effects grain prominence.

Reference

"Poisson effect driven anomalous lattice expansion in metal nanoshells"

Ganesh Iyer, Suboohi Shervani, Gargi Mishra, Deb De, Arun Kumar, Sri Sivakumar, Kantesh Balani, Raj Pala and Anandh Subramaniam, Applied Physics Letters 110, p.131603, 2017.

Recent Projects

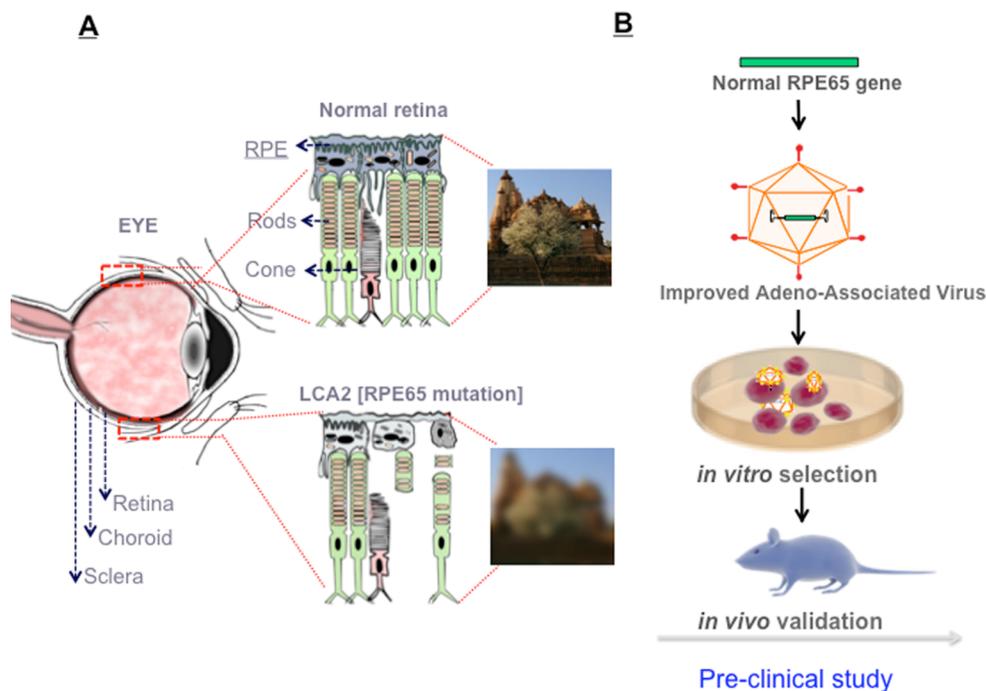
Development of a Highly Efficient and Immunologically Inert ADENO-Associated Virus based Vector System for Retinal Gene Therapy

PI: Prof. Jayandharan G. Rao, Dept. of Biological Sciences & Bioengineering

Sponsor: Wellcome Trust, DBT



Leber congenital amaurosis (LCA) type 2 is a form of hereditary blindness caused by mutations in the retinal pigmental epithelium (RPE)65 gene. The disease is characterized by degeneration of the retinal cells and a profound impairment in vision. Gene therapy i.e, replacement of the defective RPE65 gene with a normal copy, using a delivery vehicle such as AAV has not been long-lasting in humans due to either sub-optimal delivery of the vector, a very low level expression of the RPE65 or the immune response against the vectors after gene therapy in humans. In this project, supported by the Wellcome-Trust/DBT India alliance (Senior fellowship), it is proposed to develop newer vectors that can bypass some of these transduction and immune barriers and further test them in suitable in vitro and in vivo models of LCA2.



Deciphering the Structural Role of Glycogen in Neuronal Autophagy and Neurodegeneration

PI: Prof. S Ganesh, Dept. of Biological Sciences & Bioengineering

Sponsor: University Grants Commissions: Indo-Israel joint project



The objective of the project is to understand the roles of glycogen in neuronal survival. Neurons do not store glycogen, although they do have the mechanism to synthesize it. Since glycogen inclusions are seen in the degenerating neurons in the diseased condition, this project looks at the role of glycogen in proteolytic processes and their impact on neuronal survival.

Recent Projects

National Interdisciplinary Center For Cyber Security and Cyber Defense Of Critical Infrastructures

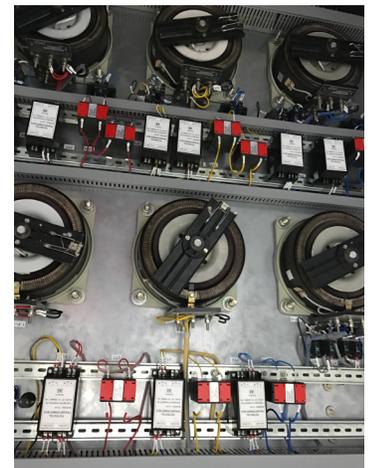
PI: Prof. Manindra Agrawal, Dept. of Computer Science & Engineering

Co-PI: Prof. Sandeep K Shukla, Dept. of Computer Science & Engineering

Sponsor: Science & Engineering Research Board



Cyber Security is one the greatest challenges we face today as we are increasingly dependent on computing, networking, and data driven decision and control. Our critical infrastructures such as power grid, water and sewage system, railway signaling and transportation, manufacturing and process control etc are increasingly vulnerable to cyber attacks. In the recent years, cyber attack induced power grid failure in Ukraine and Israel and halted the banking system in Turkey. The DNS poisoning based attack on the domain name system in India caused loss of 3.2 million debit card data through ATM malware. Attacks on German steel plants, the New York dam and many other cases point to the possibility that wars in the future will be fought in the cyber space. The interdisciplinary center for cyber security and cyber defense of critical infrastructure at IIT Kanpur received a funding of 14.43 crore from SERB/DST recently to build India's first industry scale cyber security test bed for cyber physical infrastructure, and to carry out research on protection, detection, and cyber attack resilient design of critical infrastructures.



Design and Development of Adaptive Intelligent Pipe Health Monitoring Robots for Fuel Transportation Systems

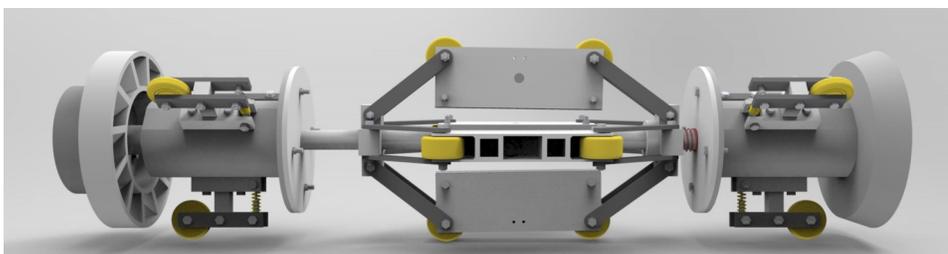
PI: Prof. Bishakh Bhattacharya, Dept. of Mechanical Engineering

Co-PI: Prof. PK Panigrahi, Dept. Mechanical Engineering

Sponsor: MHRD (Department of Science & Technology) and Gas Authority of India Limited (GAIL)



Almost all the energy related utilities like fuel, gas or oil supply lines and power generation sources such as nuclear and thermal power plants and so forth require an extensive network of pipelines for various transportation purposes. These pipelines, however, have limited life cycles due to various types of static and dynamic loads originated from both inside and outside the pipe; as well as, due to natural processes of degradation such as oxidation and corrosion of the pipe-surface, and joint failures due to abrasion. As it is nearly impossible to equip the entire pipeline with distributed array of sensors, a better strategy that has been envisaged is to monitor the condition of the inner surface of the pipe with the help of a surveillance robot. This project proposes the establishment of a Robot Development and Testing facility to explore the possibilities of developing complete pipe health monitoring systems with collaboration between IIT Kanpur and GAIL. The relationship can leverage the research expertise of the former and the experience of application and field challenges that GAIL possesses as a pipeline owner in India. It will also facilitate commercialization of the developed systems for both national and international market. This Project is under the scheme of Uchhatar Avishkar Yojana (UAY) of Govt. of India



Technology Day 2017

National Technology Day is celebrated every year on May 11 to commemorate the history of India's technological innovations and excellence. As part of this activity, the institute organized an event on May 11, 2017 and the theme of this event is "From Tinkering to Technology." Dr. Shailesh Nayak Distinguished Scientist from the Earth System Science Organization, Ministry of Earth Sciences, was the chief guest. The event included talks on technology and its application, talks by young entrepreneurs on their journey, and display/demonstration of technologies developed at IIT Kanpur. Besides the institute community, the event was attended by a large number of school children.



Institute lecture 2017 (Till June 2017)

Density Cumulant Theory

Prof. Henry F. Schaefer, III

Graham Perdue Professor of Chemistry, Director of the Center for Computational Quantum Chemistry, University of Georgia

Dark Matter, Dark Energy, Einstein's Cosmological Constant, and the Accelerating Universe

Prof. Bharat Ratra,

University Distinguished Professor of Physics,
Kansas State University

New Webpages designed to facilitate Industry-Academia Collaboration

Online form for seeking technology/ research solutions

This form is a platform for communication between Industries and IIT Kanpur. Using this form one can post queries related to science and technology and seek relevant solutions.

<http://www.iitk.ac.in/dord/query-form>

Search of expertise by Technology Domain &/or by PhD/ M.Tech. Thesis Title

This page is designed to help one in finding within IIT Kanpur an expert in various domains of science, engineering and management. Here one finds also MTech and PhD thesis titles which have been submitted to IIT Kanpur in the recent past.

<http://www.iitk.ac.in/dord/search-faculty-expertise/>

Short term Industry Oriented Courses

This page is designed to help one look for an industry oriented course that can be offered by faculty members of IIT Kanpur.

<https://www.iitk.ac.in/dord/industry-oriented-courses>
<http://www.iitk.ac.in/dord/component/users/?view=login>

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dord@iitk.ac.in
chitrab@iitk.ac.in

Address for Correspondence

Dean, Research & Development
Indian Institute of Technology Kanpur
Kanpur 208016
dord@iitk.ac.in
Phone: +91-512-259 7578