SURGE 2015
Annual Report

Office of Resources & Alumni

Indian Institute of Technology Kanpur

Kanpur 208016

Message from Dean, Resources & Alumni

Dear SURGE Friends,

Congratulations to all the 2015 SURGE fellows and their mentors on another successful summer!

The success of the program has been possible due to hard work of SURGE fellows , enthusiastic and dedicated faculty mentors, excellent support provided by staff members, and financial support by our illustrious alumni .

A record number of approximate 2200 applications were received from different colleges and 95 excellent students were welcomed from different institutions to the IITK campus for SURGE.

I would like to congratulate all the members of SURGE family who made this summer so successful. Thanks to the SURGE Core Committee, for their invaluable leadership. Thanks to the all mentors who took time out of their busy summers to direct the boundless energy of SURGEians down the most illuminating path.

Finally, thanks to all of the friends and alumni whose donations help make SURGE financially possible. I applaud all of your tremendous generosity and look forward to your continued support.

Helping support the next generation of innovators is truly an investment in the future!
Thank you!

B. V. Phani
Dean of Resources and Alumni

SURGE program-An overview

IIT Kanpur launched a 8-week Summer Undergraduate Research Grant Excellence (SURGE) program in the summer of 2006. The program aimed to promote a culture of research amongst undergraduate students of IIT Kanpur and some other selected academic institute in India. The students get selected on the basis of their academic record , their research proposal & their technical achievements.

Under the SURGE program, students undertake short duration, but focused on research project and push their intellectual abilities beyond those driven by the classroom.

The SURGE participants are required to give a mid-term presentation after four weeks, to a review committee consisting of a group of academic staff members. The review committee gives feedback and suggests possible improvements in the work. At the end of the program make a poster presentation of the work carried out from IITK . The poster presentation was evaluated by faculty members.

SURGE overseas program welcomes overseas institutes as well. At present, IITK has a exchange program with Melbourne School of engineering, Australia.

Selected students receive a stipend plus prize is also given to those SURGE students who produce exceptional quality research during the 8 weeks.

Contents

Funding SURGE

The participating students receive a stipend of Rs 12,500 for the eight week summer program from the funds raised from external sources. The Dean of Resources and Alumni Office raises funds to support SURGE students from a variety of sources including gifts from individuals, foundations, and corporations. SURGE depends upon the generosity of its many friends for annual gifts or for contributions to the SURGE endowment to build a robust financial base. We thank the donors who have supported SURGE 2015 and beyond! Endowments help to ensure the future of the SURGE program and provide students with unparalleled research opportunities.

Special Thanks to:
Batch 1977 and 1980
Shri N R Narayana Murthy

Opportunities still available for new endowments

Individuals or batches may support in several ways to establish endowments—they may be paid in full at creation, given in installments over a period. The contributors can be proud of the investment they have made in the future of bright and talented students, and the donors gain the personal satisfaction from playing an important part in the formation of young people, many of whom will make significant contributions to the nation and the world.

Participants of SURGE 2015 from IITK

S. N.	Name of the Participant	Project Title	Mentor
1	Hardik Parwana Aerospace Engineering	Impact angle constrained guidance of surface to surface missiles	Dr. Mangal Kothari Aerospace Engineering
2	Jay Patrikar Aerospace Engineering	Neural Networks: Applications in Aeronautics	Dr. A K Ghosh Aerospace Engineering
3	Samvit Kumar Aerospace Engineering	On Vortex Induced Vibrations of Cylinders	Dr. Sanjay Mittal Aerospace Engineering
4	Vikram Shree Aerospace Engineering	Probabilistic Path Planning of a UAV under Uncertainty	Dr. Mangal Kothari Aerospace Engineering
5	Arpit Gokhroo Chemical Engineering	Moving contact lines	Dr. Naveen Tiwari Chemical Engineering
6	Dilsher Singh Malhi Chemical Engineering	Computation Of Hydrodynamic Instabilities In Flow Past Microfluidic Channels	Dr V Shankar Chemical Engineering
7	Harsh Agarwal Chemical Engineering	Efficient Solar Light Harvesting using Dye Sensitized Photoanode	Dr. Sri Sivakumar Chemical Engineering
8	Neha Chauhan Chemical Engineering	Effect of change in edge charge of particle on rheological behavior of Laponite clay suspension	Dr. Y M Joshi Chemical Engineering
9	Subhadeep Paul Chemistry	Effort on synthesis of water soluble N H C ligands	Dr. Sabuj K Kundu Chemistry
10	Aditya Agarwal Computer Science & Engineering	Graph mining using chi-squared test	Dr. Arnab Bhattacharya Computer Science & Engineering

11	Himanshu Shukla Computer Science & Engineering	Study of Analogues of Miller-Yu theorem(2006) in the resource-bound version of plain and prefix Kolmogorov Complexity.	Dr. Satyadev Nandakumar Computer Science & Engineering
12	Vikas Jain Computer Science & Engineering	Learning to Generate Images Using Convolutional Neural Networks.	Dr. Amitabha Mukherjee Computer Science & Engineering
13	Ashutosh Kumar Electrical Engineering	Node Localization over Small World-Wireless Sensor Network	Dr. Rajesh M. Hegde Electrical Engineering
14	Ashutosh Kumar Electrical Engineering	Multiband miniaturized monopole antenna	Dr.Kumar Vaibhav Srivastava Electrical Engineering
15	Dhekane Eeshan Gunesh Electrical Engineering	Future Image Frame Generation	Dr. Nishchal K. Verma Electrical Engineering
16	Saksham Agarwal Electrical Engineering	A Practical Approach for Collision Prediction and Surveillance of Vehicles using a fusion of Parabolic Catadioptric Mirror and a Pan-Tilt-Zoom Camera	Dr. K. S. Venkatesh Electrical Engineering
17	Varun Gupta Electrical Engineering	State Estimation and Wireless Communication Technology for Smart Grid	Dr. Aditya K Jagannatham Electrical Engineering
18	Nimisha Gupta Humanities and Social Sciences	The Impact of Political Parties and their activities on Income inequality: A Quantitative Approach	Dr. Sohini Sahu Humanities and Social Sciences
19	Richa Agrawal Material Science & Engineering	Development of an automated technique for the estimation of true dihedral angles in a polycrystalline microstructure	Dr Sandeep Sangal Material Science & Engineering
20	Harsh Suresh Khoont Mechanical Engineering	Computational modelling of Laser based Additive Manufacturing (especially Selective Laser Melting,SLS)	Dr. Arvind Kumar Mechanical Engineering

21	PratyushMishra Mechanical Engineering	Design of a single cylinder engine for railway locomotive	Dr. Avinash Kumar Agarwal Mechanical Engineering
22	Rishav Jain Mechanical Engineering	Local Heat Transfer Coefficient during Film Condensation of Steam-hydrogen Mixtures in different Flow Configurations for Containment Application	Dr. Sameer Khandekar Mechanical Engineering
23	Ravi Tulsian Mechanical Engineering	Studies in Sound Localization	Dr. Nachiketa Tiwari Mechanical Engineering
24	Abu Saleh Musa Patoary Physics	Theoretical Analysis of 'Four Wave Mixing'	Dr. Saikat Ghosh Physics
25	Uddipan Banik Physics	Self-gravitating systems- structure and properties.	Dr. Kaushik Bhattacharya Physics

Note: The sequence followed in the table is in the alphabetical order of department and name of the participants.

Participants of SURGE 2015 at IITK from Other Universities

S. N.	Name of the Participant	Project Title	Mentor
1	Abhishek H.V Aerospace Engineering	Time response characterization of servo actuators and calibration of GY611 Gyro in AVSC Mode	Dr. C.Venkatesan Aerospace Engineering
2	Ankit Sati Aerospace Engineering	Design and analysis of a mechanism performing heaving and pitching motion in a flapping wing	Dr. D. Das Aerospace Engineering
3	Paurav Abhay Sardeshmuk Aerospace Engineering	Frequency Response Characterization of Servo Actuators and Calibration of GY611 Gyro in Normal Mode	Dr. C.Venkatesan Aerospace Engineering
4	Pawan Kumar Jha Aerospace Engineering	Development of Inverse Flight Dynamics Simulation for Helicopter Maneuvers	Dr. Abhishek Aerospace Engineering
5	Pradip Sanjay Bobade Aerospace Engineering	Analysis and design of a vertical axis wind turbine blade	Dr. Abhishek Aerospace Engineering
6	Praveen K Aerospace Engineering	CFD Study of adiabatic film cooling effectiveness for a jet in crossflow	Dr.Ashoke De Aerospace Engineering
7	Sai Sandeep Dammati Aerospace Engineering	Development of temperature sensitive paint to measure the location of laminar to turbulent transition region in an airfoil	Dr. Sathesh Mariappan Aerospace Engineering
8	Sindhuja Priyadarshini Aerospace Engineering	One Dimensional Modeling of Turbojet Engine	Dr. Ashok De Aerospace Engineering
9	Sparsh Sharma Aerospace Engineering	Leading Edge contamination in transonic regime medium haul aircraft.	Dr.T.K.Sengupta Aerospace Engineering
10	Vishnu Mohan Aerospace Engineering	Flow Past Circular Cylinder with Splitter Plates Attached Downstream	Dr. S. Mittal Aerospace Engineering

11	Bojju Sravan Kumar Biological Sciences and Bioengineering	Effect of different metal ions, pH, and temperatures on endonuclease activity of Rv1378c from Mycobacterium tuberculosis	Dr.Saravanan Matheshwaran Biological Sciences and Bioengineering
12	Jahnavi Bhaskaran Biological Sciences and Bioengineering	Distribution of tumorigenic potential of various organ-types of Drosophila melanogaster based on a two-hit approach	Dr.Pradip Sinha Biological Sciences and Bioengineering
13	Radhika Narain Chemical Engineering	Bio-conversion of di-benzo-thiophene to 2-hydroxy biphenyl by Pseusomonas putida: a step towards desulfurization of diesel oil	Dr. P. K. Bhattacharya Chemical Engineering
14	Shivani Narang Chemistry	Effect of Insulin on Insulin Aggregation	Dr. Sandeep Verma Chemistry
15	Srishti Srivastava Chemistry	Synthesis of substituted nucleobases and their transition metal complexes	Dr. Sandeep Verma Chemistry
16	Abhishek Arora Civil Engineering	Damage-Based Design of Low-Rise RC Walls for Multiple Seismic Events	Dr. Vinay K. Gupta Civil Engineering
17	Chanana Reddicherla Civil Engineering	Data Analysis For Air Quality of NCR Region	Dr. Anubha Goel Civil Engineering
18	Shubi Agarwal Civil Engineering	Damage localisation in structures using mode shapes and its derivatives	Dr. Samit Ray Chaudhuri Civil Engineering
19	Kshitij Jain Computer Science & Engineering	Appification of Heritage websites	Dr.T.V. Prabhakar Computer Science & Engineering
20	Chandramouli Pavani Sri Gayathri Electrical Engineering	Modal Profile Calculations for Multilayer Optical Semiconductor Waveguides	Dr. Utpal Das Electrical Engineering

21	Raaghvam Nigam Electrical Engineering	Bandwidth enhancement in microstrip patch antennas using Metamaterials.	Dr.Kumar Vaibhav Srivastava Electrical Engineering
22	Renu Kumari Electrical Engineering	Design and simulation of very wide input voltage range,variable frequency flyback converter	Dr. Sandeep Anand Electrical Engineering
23	Suman Kumar Electrical Engineering	Design of tappered bandgap using variable sized quantum wells	Dr. Utpal Das Electrical Engineering
24	Isha Gupta Humanities and Social Sciences	U.S. public opinion on Global Warming: An ordinal probit analysis.	Dr. Arshad Rahman Humanities and Social Sciences
25	Akanksha Malhotra Industrial & Management Engineering	Arth - A machine learning aid for people having learning issues or mild mental disability.	Dr. Deepu Philip Industrial & Management Engineering
26	Ankita Industrial & Management Engineering	Star Labelling of Air conditioners - Technical and Pricing Aspects	Dr. Anoop Singh Industrial & Management Engineering
27	Mahashweta Ray Material Science & Engineering	Raman spectroscopy of aligned single wall carbon nanotubes	Dr. Anshu Gaur Material Science & Engineering
28	Megha Acharya Material Science & Engineering	Synthesis and Characterization of Sr2TiCoO6 based double perovskites for high temperature thermoelectric applications	Dr. Tanmoy Maiti Material Science & Engineering
29	Natasha Prasad Material Science & Engineering	Simulation of carburization in polycrystal	Dr. Rajdip Mukherhjee Material Science & Engineering
30	Pranav Kulkarni Material Science & Engineering	Interdiffusion in Fe-Ni-Cu System	Dr. Kaustubh Kulkarni Material Science & Engineering

31	Raghuram Kandarpa Material Science & Engineering	Synergistic Effect of Crosslinking and Reinforcement on Bio-plastic	Dr. Vivek Verma Material Science & Engineering
32	Rahul Shaw Material Science & Engineering	Some design aspects of flexible solar panels and preparation of flexible substrates for the same	Dr. Deepak Gupta Material Science & Engineering
33	Sheetal Mohapatra Material Science & Engineering	Studying the response of diffusion planes on electro-chemical response of a Cu-Ni diffusion couple and relating it with diffusivity.	Dr. Kallol Mondal Material Science & Engineering
34	Shivam Sharma Material Science & Engineering	Fabrication and Characterisation Of Peltier Device	Dr. Monica Katiyar Material Science & Engineering
35	Suvajeet Das Material Science & Engineering	Calculation of light out-coupling efficiency in OLED by analysis of light propagation in complex media	Dr. Deepak Gupta Material Science & Engineering
36	Vedant Pravin Sumaria Material Science & Engineering	Fabrication of Solution- Processed Reduced Graphene Oxide Films as Transparent Conductors.	Dr.Monica Katiyar Material Science & Engineering
37	Anirudh Muralidharan Mechanical Engineering	Numerical Analysis of Turning operation in DEFORM 3D software and Experimental Analysis of Wire Electric Discharge Machining on AZ31 Magnesium alloy.	Dr. J. Ramkumar Mechanical Engineering
38	Anuranjan Mishra Mechanical Engineering	Fluid flow and heat transfer analysis of receiver tube of parabolic solar collector.	Dr. Santanu De Mechanical Engineering
39	Shinjan Ghosh Mechanical Engineering	Flow behind a backward facing step in slip-flow regime	Dr.Arun K. Saha Mechanical Engineering

Note: The sequence followed in the table is in the alphabetical order of department and name of the participants.

Participants of SURGE 2015 from IITK to Overseas Universities

S.N.	Name of the Participant	Name of the Institute	Project Title	Mentor
1	Shashank Kamdar Chemical Engineering	Melbourne School of Engineering,University of Melbourne	Bio-Inspired Artificial Catalytic triads	Dr. Luke Connal Chemical and Bio-molecular engineering
2	Akash Bajaj Material Science & Engineering	Melbourne School of Engineering,University of Melbourne	A Study of Thermal Decomposition of Trimethylbenzenes	Dr. Gabriel da Silva Chemical & Biomolecular Engineering

Note: The sequence followed in the table is in the alphabetical order of department and name of the participants.


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Abstracts: SURGE 2015 Research projects done at IIT Kanpur

Title: Damage-Based Design of Low-Rise RC Walls for Multiple Seismic Events

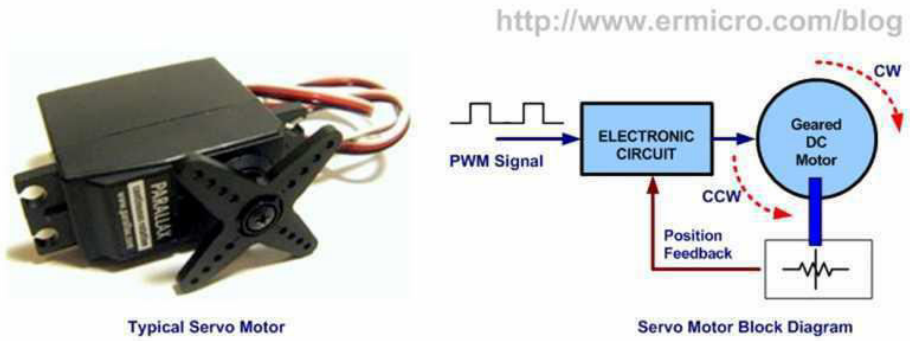
Abhishek Arora (IIT Guwahati)
Mentor: Dr. Vinay Kumar Gupta

Conventionally earthquake resistant structures are designed to ensure *'no collapse'* during the most severe event in the design lifetime of structure. However, this methodology doesn't consider the effects of damage accumulation during several not-so-severe events expected to occur during the design lifetime of structure. Hence, this study envisages to improve the conventional design philosophy by considering design force ratio (DFR) spectrum for taking an informed decision on the extent to which the yield strength levels should be raised to ensure *'no collapse'* during all the expected events during the lifetime of structure. In this study, empirical stiffness and strength degradation models of low-rise RC walls are used to estimate deterioration in structural properties. It is shown through numerical study for a hypothetical seismic environment that yield strength levels for RC walls with openings should be kept higher than for solid walls to prevent failure during their design lifetime. It also shown that RC walls designed for lesser ductility have better chance of surviving through the design lifetime. It is also shown that DFR spectrum is highly dependent on the sequence of expected seismic events during the entire lifetime of RC walls.

Title: Time response characteristics of servo and calibration of GY611 Gyro controller in AVCS mode for hover of autonomous mini helicopter

Abhishek H. V (R.V College of Engineering, Bangalore)
Mentor: Dr. C Venkatesan

The most important aspects of an autonomous vehicle is its controls, sensors and the actuators on board the machine, which acts upon the directions of the control algorithms. The effectiveness of the vehicle greatly depends upon the robustness of the control algorithm and the fidelity with which the actuators respond to it. Thus a suitable actuation control mechanism was to be chosen to control the RPM, Collective, Pitch, Roll and Yaw control of a mini helicopter weighing 8kg. The time response characteristics such as settling time, delay, rise time and peak overshoot was found out experimentally using PXI system and LabVIEW program for s3001, s3003, s3004, s3151 and s9256. A comparative study was done to choose the most appropriate actuator. The heading of helicopter was controlled using a GY611 single axis gyro controller. The working of controller in AVCS (Angular Vector Control System) was understood by conducting experiments and was found to behave as "Stop drifting and return to original position" which helps in the hover of helicopter. The different gain values of controller such as G1N, G2A, D1IA, D1DA, LMT, NCGA were studied to find their significance and an optimum set of values was calculated experimentally within the working range for use in the autonomous mini helicopter for stable flight.



The Servo Motor

Title:Theoretical Analysis of Four Wave Mixing

Abu Saleh Musa Patoary (IITK)
Mentor : Prof. Saikat Ghosh

Four-wave-mixing is a process in atoms, where two classical optical fields generate two quantum-correlated photons, through their interaction with atoms. For the SURGE summer project, we study both theoretical and experimental aspects supporting this process. Theoretically, I am working on understanding and developing effective equations governing such processes. Simultaneously, I have worked on feedback-controlled circuits for controlling various parameters (laser current and temperature control) for a practical realization of this experiment.

In a four level atom we are interested in the process shown above. Transition 1→ 4 is a Raman transition by a laser field that we call probe field..Another 2 laser is used for the transition 2→ 3 and called coupling field. Corresponding Rabi frequencies are denoted by p and c respectively. Remaining two transitions 4→ 2, 3→ 1 generates a pair of correlated photons. Our problem is to find the equation of propagation of these two photon fields.

Title: Graph Mining Using Chi-Squared Statistic

Aditya Agarwal (IITK)

Mentor: Dr. Arnab Bhattacharya

Graph mining is answering queries based on the data present in the form of a graph. We try to find matches for the query(also a small graph) in the the usually large data graph. But finding top-K sub-graph matches is an NP-complete problem. So, we try to find the top-K approximate sub-graph matches for the query graph in the data graph. Much work has been done on this problem using various ideas such as edit distance and cost calculation. We approach this problem using chi-squared statistic.

In our approach to this problem we represent graphs as set of triplets. A triplet is a group of three nodes connected by two edges. The centre of the triplet is the node that is connected to the other two nodes using these edges. Then looking at the similarity between the triplets of the nodes in query graph and data graph we calculate the chi-squared statistic for the nodes.

Title: ARTH - A Machine-Learning Aid for People Having Learning Issues, Or Mild Mental Disability

Akanksha Malhotra (HBTI, Kanpur)
Mentor: Dr. Deepu Philip

The objective of this project is to solve one of the major problems faced by the people having learning issues, or mild mental disability. “ARTH” is a self-learning set of algorithms that is an intelligent way of fulfilling the need of “reading and understanding the text effortlessly” . It adjusts iself, according to the needs of every user. The research project propagates in two steps. In the first step, the algorithm performs pre-processing of the text to generate a stream of words using techniques from natural language processing. "ARTH" comprises of a set of algorithms that finds the value of important parameters for every word. These parameters check the difficulty of words and become an aid to classify the words in the given text. For the purpose of classification, the algorithm uses clustering, an unsupervised machine learning tool. After the analysis of the clusters, the algorithm labels these clusters, according to their difficulty level. In the second step, the algorithm interacts with the user. It aims to test the user's comprehensibility of the text and his/her vocabulary level by taking an automatically generated quiz. Since, every word can have multiple meanings, the algorithm tries to find the exact meaning of the word using the concept, "Word Sense Disambiguation" while preparing the quiz. The algorithm identifies the clusters which are difficult for the user, based on the result of the analysis. It is an interactive process. It tests the knowledge of a user, every time he or she reads the text. The results of previous quizzes are also taken into account, with the help of a machine learning tool. The technology "ARTH" focuses on the revival of the joy of reading among those people, who have a poor vocabulary or any kind of word processing issues.

Title: Simulation of Turning operation in DEFORM 3D software and Experimental analysis of Wire Electric Discharge Machining on AZ31 Magnesium alloy

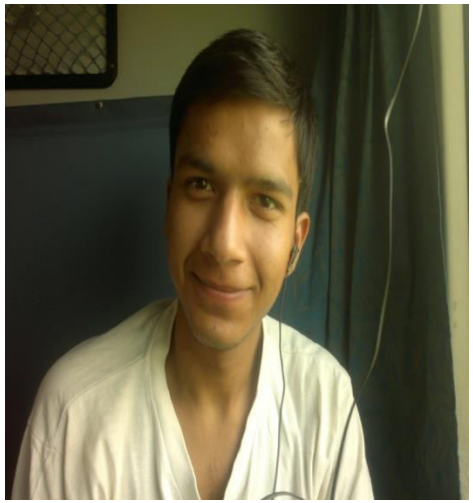
Anirudh Muralidharan (SASTRA University, Thanjavur)
Mentor: Dr. J. Ramkumar

Objective of this work is to simulate turning operation on six different materials namely, Al6061, Ti6Al4V, AISI1045, 30CrNiMo8, AZ91, PMMA (Polymer) for five different depth of cuts and five different feed rates using DEFORM 3D software. The study of trend for various cases viz. effective strain, effective stress, load in the cutting direction, work piece and tool tip temperatures has been carried out. VNMA 432 insert with Tungsten Carbide as base material is used as the cutting tool. Among the given materials, 30CrNiMo8 is the hardest to machine having highest effective stress and AZ91 is the easiest to machine having the least effective stress. Cutting forces increase, as the depth of cut and feed rate increases. During machining, Ti6Al4V exhibits highest surface temperature because of its poor thermal conductivity.

Also to produce slots of width 50 micron using Wire Electric Discharge Machining on AZ31 Magnesium alloy, initial trials have been taken to produce slots of width ranging from 259 to 284 micron using a 220 micron Molybdenum wire. The parameters used during these experiments were Pulse-On time of 10 µs and Pulse-Off time of 10 µs and 5 µs with two different values of peak current viz. 2 A and 3 A. Reasons for overcut and variation in machining speed have been analysed with the optical micrographs of the slots machined. With 30 micron Tungsten wire, a single slot has been machined up to a depth of 1.2 mm and minimum width of 62 micron has been achieved using a gap voltage of 80 V and a capacitance of 10 pF. For both the experiments, work piece was given the positive polarity.

Title: Design and analysis of a mechanism performing heaving and pitching motion in a flapping wing

Ankit Sati (NIT Silchar)
Mentor: Dr. Debopam Das



The objective of work is to design and analyze a mechanism which while performing linear reciprocating motion of the airfoil simultaneously varies its pitching position about the leading edge. This can be used to achieve a process where variation of the pitching angle corresponding to its heaving component is more dynamic and simultaneously is to be able to work on rigid wing section where flexural rigidity cannot play a major role in pitching component of the airfoil. The work consist of using the scotch yoke mechanism to provide the heaving component to the section while using modified four bar linkage to help varying the angle of attack with that. But this creates fixed non varying angular positions of the section with a corresponding linear component for the particular mechanism (i.e. fixed kinematics) which is solved using the servo controlled mechanism. In this model the analog voltage reading of the potentiometer attached to heaving section of mechanism is sent to arduino due ™. These reading are thereby easily read by the arduino which controls servo through PWM.

Title: Star Labelling of Air Conditioners - Technical and Pricing Aspects

Ankita (National institute of Technology, Jamshedpur)
Mentor: Dr. Anoop Singh

Energy is the fundamental requirement for the economic development of a country as development of any country critically depends on the availability and accessibility of energy. Today, India has become one of the fastest growing economies of the world and consequently its energy consumption is also increasing at an alarming rate. Market demand for air conditioners in India is constantly increasing with the increment in level of average income of people and so is their choice of living a luxurious life. Air-conditioning load forms a significant proportion of the total electricity demand in the household sector as ACs consume very large amount of energy. An average size AC of 1.5 tonnage of refrigeration consumes electricity around 1500-1800 W which is enough to operate about 25 ceiling fans.

Title: Fluid flow and heat transfer analysis of the heat collector element of Parabolic Solar Collector

Anuranjan Mishra (MNNIT Allahabad)
Mentor: Dr. Santanu De

Intensity of solar radiation while coming to the earth reduces by large amount because of the sun- earth geometrical position. To harness solar energy, the radiation coming to the surface of earth, it is concentrated over a pipe in Parabolic Solar Collector (PTC). The solar radiation energy is converted to thermal energy by heating up the thermic fluid flowing through the heat collector element (pipe) of PTC.
Selection of thermic fluid greatly influences the efficiency of solar power plant.

A numerical analysis of the performance of a solar Parabolic Trough Collector (PTC) has been done which is focusing solar radiation on its receiver which is carrying *Therminol* as heat transfer fluid. The receiver has been subjected to seasonal and diurnal variations of solar radiation along with the concentrated heat flux reflected from the parabolic trough mirror.

Secondly, similar study was done by taking water as heat transfer fluid as it undergoes phase change while flowing through the pipe.

Spreading of thin lm of a shear-thinning Ellis uid

Arpit Gokhroo (IITK)
Mentor: Dr. Naveen Tiwari

Wide-ranging applications of spreading thin liquid films have attracted attention of researchers on the phenomenon leading to instability and possibly finger like structure formation at the contact line of such films. Huppert was the rest to appreciate that a liquid _lm driven by a constant force may show fingers due to breakdown of the interface. It is well known that the mechanism of the instability involves an interplay between the driving body force and the curvature effects. It was shown by Troian et. al. that the instabilities lead to the formation of fingers in the direction perpendicular to the main flow and the instabilities are largest in the capillary region near the contact line where the force due to surface tension is comparable to the viscous and gravitational forces. The instability has been observed and studied earlier by various authors.

To relieve the stress singularity at the three phase contact line, two models that are widely used. One model assumes the presence of a precursor _lm in front of the contact line making it an apparent contact line while the second model allows slip at the liquid-solid interface in which the contact slope can be specified explicitly. Using the precursor film model, Bertozzi and Brenner showed that the normal component of gravity has significant effect on the shape and stability of the advancing front. They observed that after certain angle of inclination the bump near the contact region disappears and lead to stable front. They also observed that regardless of whether the front is linearly stable, there is significant transient growth over the time of the experiment, and that the transient amplification of small perturbations near the contact line occurs both above and below the critical inclination angle for linear stability. They related the precursor _lm thickness to the characteristic scale of the microscopic physics in a particular experiment, for spreading on a rough surface this length scale is the scale of the surface roughness, and on smooth surfaces, this length would be set by van der Waal's interactions.

Title: Multiband miniaturized monopole antenna
Ashutosh Kumar (Roll No. 13162, IITK)
Mentor: Dr. Kumar Vaibhav Srivastava

Printed antennas are becoming very popular in wireless communication due to low profile, low cost and simple fabrication. Modern day communication devices need to support multiple services like Bluetooth, WLAN and GPS etc. For supporting such services miniaturized antennas with multiband operations are required.
In this project we have tried to address the issue of miniaturization and multiband operation with the use of fractal antenna. Fractal antenna is an antenna that uses fractals (self-similar designs) to provide us multiband operation in a very compact design. An important advantage of fractal antenna is that it is capable of operating with good radiation performances at multiple frequencies simultaneously. We have used minkowski fractal shaped slots to provide multiband operation and have tried to optimize various parameters to enhance the performance of antenna. We have tried to cover lower and upper WLAN frequency bands (2.4-2.7 GHz and 5.2-5.8 GHz).

Title: Node Localization in Small World – Wireless Sensor Network
Ashutosh Kumar (Roll No. 13163, IITK)
Mentor: Dr. Rajesh M. Hegde

The objective of this work is to introduce small world characteristic in Wireless Sensor Network (WSN) and to study the outcomes of small world property in WSN. WSN is spatial graph that is close to regular network which shows high path length and high clustering coefficient. Small World Network is a type of complex graph which shows low path length and high clustering coefficient. By adding few random links in WSN path length is drastically reduced and small world property is observed. Reduction in path length increases network efficiency in terms of time delay and energy requirements data transmission requires less number of hops if path length is low. Localization is very important in WSN and by introducing small world property in WSN many parameters for localization is improved. Localization error in Small World Wireless Sensor Network (SWWSN) is less as compared to spatial WSN.

Title: Effect of different metal ions,pH,andtemperatures on endonuclease activity of Rv1378c from *Mycobacterium tuberculosis*

Bojju Sravan Kumar (Kakatiya University,Warangal)
Mentor: Dr.Saravanan Matheshwaran

Tuberculosis causes more deaths worldwide than any other infectious disease and is caused by the bacterium *Mycobacterium tuberculosis*. The causal agent of this disease invades macrophages and can reproduce inside them. Macrophage, a cell type that has evolved to kill the invading bacteria. A hallmark of *M. tuberculosis* infection is its ability to grow in these types of cells. When macrophages are activated, they produce reactive oxygen and nitrogen intermediates (ROS & NOS) that can damage DNA. Thus, a major critical step during infection by *M. Tuberculosis* is to survive these assaults by the DNA damage response. Our main focus is the SOS response of *M. tuberculosis.* LexA is an essential component of the SOS response. Under normal growth conditions, LexA represses transcription of DNA damage-inducible genes by binding to an upstream DNA sequence termed the SOS box. All the SOS genes share similar sequences in the regulatory regions called the “SOS box” to which LexA repressor binds to repress the transcription in the absence of DNA damage. Upon DNA damage the presence of single stranded DNA activates RecA which in turns simulates autocatalytic cleavage of LexA, lifting repression of the regulated genes. The induced products of the “SOS genes” repair DNA lesions by various mechanisms including recombination, excision repair and error prone repair, and as the consequence, the SOS signal in the cell decreases and the repression of the SOS genes is restored. In that case, Rv1378c is one of the genes under SOS regulation. The function of Rv1378c protein is endonuclease activity in *M. tuberculosis* which has not been characterized yet. Our objective is to characterize the functional role of RV1378c. The main objectives include its activity in presence of various metal ions, different pH and temperatures.

Title: Analysis of Pollutant levels in ambient air for 3 cities in NCR during 2014

ReddicherlaChandana (NIT, Raipur)
Mentor: Dr. Anubha Goel

The objective of this research is to analyse the data of various pollutants mainly PM-10, SO2, NO2 of three cities in National Capital Region (NCR) namely, Meerut, Noida and Ghaziabad from Oct 2013-June 2015.We know that Delhi is the most polluted city in India but not much aware about pollution levels of the smaller cities in NCR expanding. There are reports about scientific studies, which indicate Delhi is receiving pollution from neighbouring towns and industries present in NCR.The data for this project is obtained from UPPCB web portal. Different analysis of data is done using Microsoft Excel and trends of variation in pollutant levels are observed. The pollutants which are greatly exceeding the permissible values and which are primarily responsible for pollution are identified. Further Air Quality Index is calculated and accordingly the regions are classified based on the AQI value. The critical locations where the pollution levels are extremely high are obtained after this analysis. Thus helps us to concentrate on those locations to implement precautionary measures to prevent further deterioration and improve the existing scenario. The results of this research are supported by the reports of newspapers.

Title: Modal Profile Calculations for Multilayer Optical Semiconductor Waveguides

Chandramouli Pavani Sri Gayathri (Indian School of Mines, Dhanbad)
Mentor: Dr. Utpal Das

This present work considers a waveguide photo detector (of p-i-n type) where its active region has been chosen as an undoped layer consisting of multiple $In_{0.53}Ga_{0.47}As$ QWs sandwiched between InP barriers. The material for the cladding layers have been chosen in such a way that the absorption of the incident light occurs mostly in the active MQW layer. It has been observed that $In_{1-p}Ga_pAs_qP_{1-q}$ layers with a proper selection of the As fraction 'q' can provide band gaps that will not absorb CWDM wavelengths. The maximum permissible thickness of this cladding layer without entering into higher modes is calculated. Substrate and cover are considered as p-type and n-type InP respectively. This prescribed structure enhances the speed of photo detector as it results in tapered band gap. The Objective of this work is to calculate Electric and Magnetic Field profiles for the described structure. By considering this structure as multilayer structure, Transfer Matrix Method (TMM) is applied to calculate effective refractive index and modal profile.

Title: High Accuracy Optical Flow Based Future Image Predictor Model

Dhekane Eeshan Gunesh (IITK)
Mentor: Dr. Nishchal K. Verma

In this project, High Accuracy Optical Flow (HAOF) based future image frames generation model is proposed. The aim of the project is to develop a framework which is able to predict the future image frames in any given sequence of images with better accuracy. Using High Accuracy Optical Flow (HAOF) algorithm, the flow velocities of intensity of pixels are estimated, which then are then modelled using separate Artificial Neural Networks (ANN). These trained models are then used to predict the flow velocities at in the future image frames. The intensities are mapped to their new positions by using the predicted flow velocities to generate the future images. Their quality is evaluated by using Canny Edge Detection based Image Comparison Metric (CIM) and Mean Structural Similarity Index Measure (MSSIM).The predictor model is simulated and tested for performance by applying it on an image sequence of a fighter jet landing over the navy deck and is found to give results with better clarity and better accuracy than those obtained from the previously done work.

Title: Computation Of Hydrodynamic Instabilities In Flow Past Micro fluidic Channels

Dilsher Singh Malhi (IITK)
Mentor: Dr. V Shankar

While most conventional technological applications use rigid tubes and channels for fluid transport, in Nature we often find soft deformable tubes and channels being used for the transport of blood and other fluids in biological systems. Modern devices designed using micro fluidic technologies also use elastomeric (`soft') platforms for fabrication. In the design of such micro fluidic devices, it is often desired to improve the transport properties because the flow regime in such devices is laminar due to the small dimensions involved. In laminar flow, transport across streamlines can occur only by diffusion, which is often slow. To improve mixing in micro fluidic devices, strategies such as generation of secondary flows using serpentine mixers, and electro kinetic instabilities have been proposed in the literature. In this project, we try to explore the possibility of exploiting the instabilities present in flow through deformable tubes and channels as a means to improve mixing characteristics in micro fluidic devices. We use both analytical and computational tools to uncover new instabilities in flow past soft, deformable solid surfaces, wherein we predict the critical Reynolds number as a function of solid elastic modulus. While it is well known that laminar-turbulent transition in rigid tubes occurs at a Reynolds number near 2000, we find that in flow through soft, deformable tubes, the laminar flow becomes unstable at much lower Reynolds number. These studies are also relevant in the biological context, wherein the flow regime would determine the rates of transport of oxygen and other nutrients in the circulatory system.

Title: Impact and Body Angle Constrained Missile Guidance Law

Hardik Parwana (IITK)
Mentor: Dr. Mangal Kothari

Guided missiles are the most advanced and effective weapons of modern warfare. Guidance engineers are in continuous pursuit of robust and efficient guidance laws for fast evolving engagement scenarios.

The Classical Guidance Laws, based on simple ideas are designed primarily for minimizing the miss distance, and they are usually silent on impact angle constraints. The motivation for achieving a particular terminal impact angle often stems from the requirement of increasing the lethality of impact in case of direct hits and/or to increase the lethality of the warhead that the vehicle carries.

Title: Efficient Solar Light Harvesting using Dye-sensitized Photo-anode

Harsh Agarwal (IITK)
Mentor: Dr. Sri Sivakumar

We have demonstrated a unique approach based on click chemistry to fabricate the dye-sensitized photo anode to facilitate the solar light driven organic pollutant degradation. Further, we have performed the photo electrochemical and photo catalytic dye degradation using our fabricated dye-sensitized photo anode where the dye anchored over semiconductor plays an important role towards degradation of free dye solution. Additionally, we have also studied the role of different parameters under different conditions to study the mechanistic aspect of reactions taking place during degradation of dye. Our results also suggest a pathway to design an efficient dye-sensitized semiconductor heterostructure photo catalyst which can interact with a much larger fraction of solar energy reaching us and exhibiting better performance in waste water treatment.

Title: Computational modelling of Laser Based Additive Manufacturing (especially Selective Laser Melting)

Harsh Suresh Khoont (IITK)
Mentor: Dr. Arvind Kumar

Selective laser melting is developing into a standard manufacturing technology with applications in various sectors. However, the process is still far from being at par with conventional processes such as welding and casting, the primary reason of which is the unreliability of the process. While various numerical modelling and experimental studies are being carried out to better understand and control the process, there is still a lack of research into establishing the reliability of the process.

A selective laser melting (SLM) physical model of coupled radiation, convection (Marangoni+natural), conduction transfer and thermal diffusion is proposed, which provides a local temperature field. A strong difference in thermal conductivity between the powder bed and dense material is taken into account. Both volume force, Marangoni effect and volume shrinkage due to melting of powder (porosity=0.35) to denser liquid, which are the major driving forces for the melt flow, are incorporated in the formulation. The effect of the Gaussian laser energy input on the temperature distribution, melt pool dynamics, surface tension and resultant surface morphology has been investigated.

Title: On analoges of Miller-Yu theorem in Resourece-Bounded Measures.

Himanshu Shukla (IITK)
Mentor: Dr. Satyadev Nandakumar

We study the analogues of Miller-Yu theorem in Resource-bounded measures. Miller-Yu gave the first characterization of 1-randomness in terms of Plain Kolmogorov complexity. Hence closing a long standing open problem. Its analogues in Resource Bounded measures were still unknown. We explore them and discover the behaviour of existing theorems in resource-bounded measures. We present the resource-bounded version of Chaitin's inequality and present the proof for the same. Further we define randomness in resource-bounded measures and prove that the set of strings random with respect to computational paradigm in resource bounded measures is a subset of set of random strings in terms of measure-theoretic paradigm. Also prove one side of implication of Miller-Yu theorem in resource-bounded measures. We stop with a conjecture that set of computationally random strings is a "proper subset" of set of strings which are measure-theoretically random.

Title: U.S. PUBLIC OPINION ON GLOBAL WARMING: An Ordinal Probit Analysis

Isha Gupta (Madras School of Economics, Chennai)
Mentor: Dr. Mohammad Arshad Rahman

Global warming is conceivably the preeminent environmental risk confronting the world in the 21st century. Its effects dominates every aspect of human life. Global climate change has profound implications on human. Our present study analyzes public opinion on how much can be done to reduce global warming using a set of demographic and socioeconomic like age, income, political affiliation, education, race and perceived causes of global warming on public opinion whether human effort can reduce global warming. The data is taken from survey conducted by ABC News, Stanford University, Washington Post and analyzed within the framework of an ordinal probit model. The results demonstrate that race white, age, income and natural changes as perceived cause of global warming positively affect the probability that hardly anything can be done to reduce global warming and reduce the probability that a great deal can be done to reduce global warming.

Title: Distribution of Tumorigenic Potential of Various Organ-types of Drosophila melanogaster Based on a Two-Hit Approach

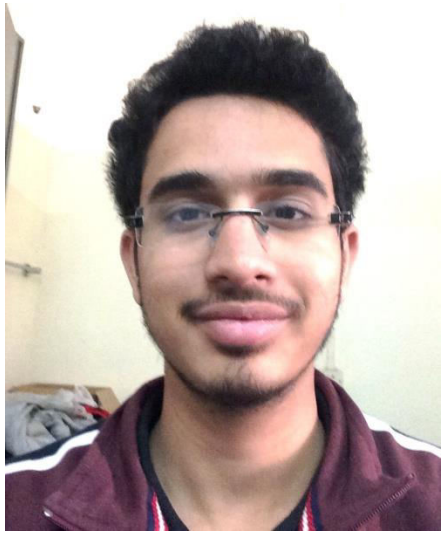
Jahnavi Bhaskaran, (SRM University)

Mentor: Dr. Pradip Sinha

Drosophila melanogaster is a model organism widely used for tumor modeling due to its amenable genetics and the existence of various homologues and orthologues between humans and the fly. In this project a Single-Hit Approach and Two-Hit Approach of tumorigenesis were carried out. In the Single-Hit Approach, oncogenic clones were alone generated in the larval and pupal stages. In the Two-Hit Approach, clones carrying simultaneous mutations of an oncogene and a tumor suppressor gene (TSG) induced at the larval and pupal stages. The genes of interest of this project are lgl (Lethal Giant Larva), a TSG involved in maintaining cell polarity and Yorkie, an oncogene acting as transcriptional coactivator. Here, we show that Two-Hit flies carrying lgl^{4} yki^{+} mutation develop larger clones as compared to Single-Hit flies carrying yki^{+} mutation. Further, the clonal induction in lgl^{4} yki^{+} does not allow the flies to develop into adults leading to pupal death. Yki^{+} mutant flies, on the other hand, survive to adulthood with outgrowths of abdominal histoblasts. These outgrowths increase progressively with accompanied bloating of the abdomen and death of the fly. This shows that Two-Hit mutation leads to aggressive tumour formation while Single-Hit mutation leads to controlled tumourigenesis. Thus, this study brings a comparative picture of Two - Hit versus Single-Hit tumor modeling involving an oncogene and a TSG.

Title: Applications of Neural Network in Aerospace Engineering

Jay Patrikar, (IITK)
Mentor: Dr. A.K.Ghosh



This project explores the work done under Prof A.K.Ghosh in exploring the various applications of Neural Networks in diverse fields of Aerospace Engineering for Feed forward Neural Networks. The first goal of the project is parameter estimations in Hansa-3 aircraft using artificial neural network training. The project further explores the use of artificial neural network training in control problems wherein the elevator deflections are modeled using a 6-DOF system coupled with a trained artificial neural network. The network is trained to give elevator deflections to achieve trim conditions. The application of artificial neural network training in artillery shell range mapping and launch angle estimations using a Point Mass Model are further explored with a artificial neural network trained to estimate the target with a given set of environmental conditions. The results are generated for a fixed bearing angle and varying bearing angle for estimating the target position and also estimating the required elevation angle and bearing for a given target position.

Title: Appification of Heritage Websites

Kshitij Jain (The LNM Institute of Information Technology, Jaipur)
Mentor: Dr. T.V. Prabhakar

The project involves appification of the Gita Super Site website. Gita Super Site is an online repository of Indian Philosophical texts that are a valuable part of our heritage. The repository includes texts like- the Srimad BhagavadGita, the Ramcharitmanas, the Brahma Sutra, the Yoga Sutra, the Valmiki Ramaynam, etc. Among all these texts, the Bhagavad Gita enjoys the highest popularity in the online user community. Hence, to provide an all time access to it to a larger audience, of which Android smartphone users are a significant share, the process of an Android application development has been undertaken and an Android app has been developed for the same.

Title: Raman spectroscopy of aligned single walled carbon nanotubes

Mahashweta Ray (National Institute of Technology Durgapur)
Mentor: Dr. Anshu Gaur

The objective of the work is to isolate and align single walled carbon nanotubes to enhance their properties like physical, electrical, thermal, and mechanical since these are superior along their tube axis. The method used here is mechanical rubbing of SWCNT on silicon and polyimide coated glass slide using aqueous and liquid crystal dispersions for isolation and alignment. The evaluation of the alignment is done by using polarized Raman spectroscopy.

The work describes different methods of aligning and creating dispersions on silicon oxide substrate and striated polyimide coated glass slides which further aids in alignment. Aqueous dispersion using SDS as surfactant was done to isolate the SWNTs and their Raman spectra was observed that gave a single RBM peak. Liquid crystals already having a tendency to align along a particular direction were used to create efficient CNT-LC dispersions which were rubbed using a brush on striated substrate visible under optical microscope. Drastic change in the intensities of the RBM peak with change in light polarization reveals alignment of isolated SWNTs to a large extent in the direction of rubbing. The orientation of a single nanotube have also been studied with half wave plate and polarizers which reveals that CNT has been aligned in X direction.

Title: Microstructure engineering of Sr2TiCoO6 based double perovskites for high temperature thermoelectric applications

Megha Acharya (NIT, Rourkela)

Mentor: Dr. Tanmoy Maiti

In the current investigation, efforts have been made to find a next generation solution to the global energy crisis as well as environmental issues like global warming, climate shift etc. Although most of the current research works have been carried out to find the process of generating clean energy, in order to meet the ever increasing demand of our planet, it is the our frugal use of existing energy which needs to be changed. Efficiency of most of the power generation plants, solar plants, manufacturing industries, automobile engines, oil drilling sites etc are less than 60%, causing 40% of the energy to be wasted. Thermoelectric materials which can convert heat into electricity using principle of Seebeck Effect which seems to be the cleanest way of generating consumable electricity scavenging these waste heat.

Title: Simulation of carburization in polycrystal

Natasha Prasad (NIT, Raipur)

Mentor: Dr. Rajdip Mukherjee

The objective of this work is to simulate the carburization process in polycrystal. Carburization is a very important heat treatment process which is used to increase the strength, hardness and fatigue resistance of material. Polycrystal consists of grains having different crystallographic orientations separated by grain boundaries. Grain boundaries are high diffusivity paths and diffusion occurs order of magnitude faster along grain boundaries as compared to diffusion inside the grains. The objective of the project is to simulate carbon diffusion in polycrystals and to analyze the carburization process as a function of grain size distribution. For simulation of carburization process, explicit finite difference method is employed (implementing in a computer code) to solve the Fick's 2nd law. At first the model is validated in 1D comparing with known analytical result and then it is used for 2D simulations to compute the rate and depth of carbon diffusion in polycrystals having different grain size distributions. The carburization process is found to be more effective in a polycrystal having finer grain size distribution.

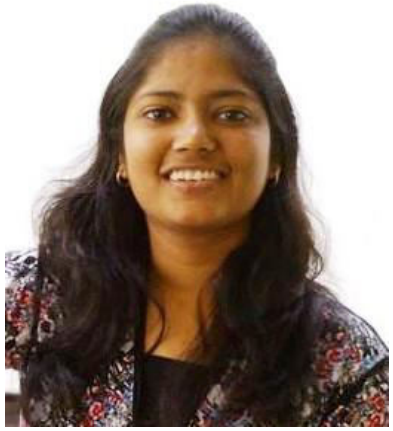
Title: Effect of change in edge charge of particle on rheological behaviour of Laponite clay suspension

Neha Chauhan (IITK)
Mentor: Dr. Y. M Joshi

The objective of this work is to study the effect of positive and negative edge charge and also effect of change in edge charge of particle on the rheological behaviour of aqueous laponite suspension. Laponite is a synthetic clay material and widely used as a rheology modifier. In this work, we have conducted experiments on aqueous Laponite(2.8 wt%) suspensions prepared at different pHvalues over a period of one month. Various rheological parameters like G', G'' ,tan delta, pH, conductivity , 0H- ions per particle, Debye length, DLVO forces have been calculated and plotted with respect to time to study the effects of aging and different pH values on the suspensions. The results observed from this work shows that for pH 10 suspension colloidal elation occurs after some time whereas for the pH 13 no gel point is achieved. The conductivity of pH 10 sample increases with time and that of pH 13 decreases. The Debye length variation decreases for both the pH values with time. In another part of this work, different Laponite solutions(2 wt%) were prepared at varying pH values ranging from 7 to 13 and the effect of change in edge charge on OH- ions/particle, DLVO forces was studied. The work shows that with increasing surface charge densities (increasing pH values) repulsive double layer forces dominate and with decreasing pH values the attractive van der waals interactions increases.

Title: Impact of Political Parties on Income Inequality and Estimation of Kuznets'Curve

Nimisha Gupta(IITK)
Mentor: Dr. Sohini Sahu



Much studies on income inequality and democracy have been carried out for a long period of time but studies relating different political parties and income inequality in Indian context lack in the literature. The objective of the work is to study if there is an existence of relationship between the political party in power and the measure of income inequality for the states of India. The method used to develop any kind of relationship between the two parameters is that of Ordinary Least Squares (OLS) in a linear regression model.

The analysis has been carried out for fourteen Indian states over the time period of 1960-61 to 2005-06.using Gini coefficient and per capita Net State Domestic Product. The political party in power is taken into account using dummy variables. The work reveals a significant relationship for 4 out of 14 states but no comment could be made on 10 other states or the all-India level.

Title: Frequency Response Characterization Of Servo Actuators And Calibration Of GY611 Gyro In Normal Mode

Paurav Abhay Sardeshmukh (R.V College of Engineering, Bangalore)
Mentor: Dr. C Venkatesan

The Objective of my research is to Calibrate the Futaba GY611 single axis-rate Gyro used in the autonomous mini helicopter at the Helicopter Lab, IIT Kanpur. A Gyro sensor is a device used to detect change in heading of the mini helicopter. It's made up of a piezoelectric crystal that vibrates along a fixed plane and produces voltage change when deflected about an axis.

My work focuses on analyzing the response of the tail servo motor of the mini helicopter in accordance with the "Normal Mode" settings of the Gyro Controller. In order to select a compatible, high performance servo for the tail actuation system, my initial phase of research deals with selection of a suitable servo, based on its frequency response characteristics. Frequency of input signal for the servos is varied from 0.5Hz to 50Hz.

Title: Development of Inverse Flight Dynamics Simulation Model for Helicopter Manoeuvres

Pawan Kumar Jha (Jadavpur University, Kolkata)
Mentor: Dr. Abhishek

Inverse Simulation is a technique to compute the controls required by the helicopter to follow a particular trajectory. It is quite efficient method over forward simulation in case of unsteady manoeuvres where complete control over time and replica of situation into mathematical model is important. This technique can be used for pilot modelling, estimating time histories of controls, evaluating handling qualities and various performance parameters for efficient and robust design. Autonomous vehicles can be the true area of application of inverse Simulation.

Our work heresies effort to develop the algorithm for inverse simulation, find its validation and to implement it over wide range of helicopter manoeuvres to find the time histories of controls. Integration based inverse method is used to simulate rigid-body helicopter model. It is found that the graphs plotted for controls well describe the lift, forward and lateral movement of the helicopter. The helicopter model used in the present work is Westland Lynx. The algorithm developed is not model specific and any craft model can be inserted easily for simulation. The characteristics of the model come into picture only in solving the vehicle equilibrium equation.

Title: Analysis and Design of Vertical Axis Wind Turbine Blade

Pradip S. Bobade (College of Engineering, Pune)
Mentor: Dr. Abhishek

The main objective of the present study, is to design Vertical Axis Wind turbine (VAWT) blade and to analyze it so that it will structurally sustain with harnessing required power output. The design process starts with optimization of geometric parameters like blade span, chord and turbine radius. The aerodynamic performance analysis is done using MATLAB code giving 0.8m turbine radius, 0.3m chord and 2m height as the best design parameters. The basic dimensions obtained are used for further structural analysis. As the bending is the main failure cause so some sections like I, C and rectangular sections are analyzed in the design of blade. By assuming some initial dimensions, factor of safety, deflections are calculated. A MATLAB program is used for the same analysis in order to optimize the design to reduce mass. From the MATLAB code I section is considered which gives FOS of 4.7 with mass of 1.8Kg.The best dimensions obtained are further used in Static, Dynamic and Modal analysis. The analysis is done in FEM based software ANSYS in order to obtain deformations and fundamental mode shapes. The deflections obtained from analytical and software (ANSYS) is compared.

Title: Interdiffusion in Fe-Cu-Ni System

Pranav Kulkarni (College of Engineering Pune)
Mentor: Dr. Kaustubh Kulkarni

Interdiffusion in Cu-Ni-Fe system is studied at temperature of 1000^0C for two binary diffusion couples made of Ni-Fe (80-20 atom %)and Ni-Cu(80-20 atom %) binary alloys for various times i.e. for 40 Hours (Couple I) and 48 Hours (Couple II). Data generated by Ugaste et al for diffusion couple between pure Ni and Ni-Cu-Fe ternary alloy has been used to obtain interdiffusion coefficients by Kirkaldy's method of intersecting diffusion path. Characterization of the diffusion couples has been carried out using SEM, EPMA. Concentration Profiles obtained by Electron Microprobe Analysis have been analyzed using MultiDiFlux software and Average Interdiffusion Coefficients obtained by Dayananda's Method are compared with the Interdiffusion Coefficients obtained by Kirkaldy's method. The ternary interdiffusion coefficients have been calculated in the two regions Fe rich and the Cu rich regions.

Title: Designing of a Single Cylinder Railway Locomotive Engines

Pratyush Mishra(IITK)
Mentor: Dr. Avinash Kumar Agarwal

The favorable economics and flexibility of a single cylinder engine when used for research and development are obvious. Single cylinder engine allows for low cost and precise work to be carried out quicker and with more flexibility than the multi cylinder engine versions. The unavailability of a medium speed single cylinder engine which would be representative of the Alco 251 made it necessary to design a model of the engine. This fact and the alternative fuels studies which were being done on multi cylinders justified the decision to embark on the single cylinder research engine program . In addition, it also requires that considerable development work be carried out in order to remain competitive in fuel economy and reliability. This project deals with the designing of the above single cylinder railway locomotive engine.

Title: CFD study of adiabatic film cooling effectiveness for a jet in cross flow

Praveen K, Amrita School of Engineering, Coimbatore
Mentor: Dr. Ashoke De

The objective of this work is to investigate the effect of combustion products on the adiabatic film cooling effectiveness for a jet in cross flow problem. Numerical results are presented for a three-dimensional discrete-jet in cross flow problem typical of a realistic film-cooling application in gas turbines. A three dimensional geometry with a single cylindrical hole is considered. Air (jet) at a relatively lower temperature is injected out of the hole to mix with the cross flow as a result of which a cooling effect is realized downstream of the injection point. The powerful GRI- Mech 3.0 mechanism along with the partially premixed model and Flame let generated manifold (FGM) reduction technique is used to capture the effect of combustion. Due to the transport chemistry and jet mixing, the temperature profile is no longer the same over the geometry. The commercially available solver ANSYS FLUENT is used. Solutions are obtained with a multi-block, structured hex dominant grid, steady, pressure based, Reynolds-averaged Navier-Stokes code with multigrid and residual smoothing type acceleration techniques. Higher order discretization schemes are used to reduce numerical errors significantly. A comparative study is done to analyze the effect of combustion on the adiabatic film cooling effectiveness downstream of the cylindrical hole. The effect of temperature and fuel mixture is also accounted in the study.

Title: Microstrip Patch Antenna with Enhanced Bandwidth by the Employment of Metamaterials

Raaghvam Nigam (People's Education Society Institute of Technology (PESIT), Bangalore.)
Mentor: Dr. Kumar Vaibhav Srivastava

In this work, considerable time has been devoted for learning along with the implementation. The work began with some theoretical advancements in the field of patch antennas, bandwidth enhancement and meta material structures. In order to further solidify the knowledge some simulations based on the same topic have been performed on HFSS. As a part of the result, a patch antenna has been designed, at a resonant frequency of 2.4GHz, with a ground EBG surface such that the structure inherits meta material characteristics. The width of the slot at the inset is increased so as to facilitate impedance matching. The results of this design show that bandwidth of the structure has increased from 2.9% to 7.4%, gain has increased from 4.796dB to 5.302dB, return loss has decreased substantially and the antenna efficiency improved. There is generally a trade off between bandwidth and gain but in this structure both the quantities are found to increase, which is an added advantage. The disadvantage of this design is the presence of a back-lobe which is produced due to increased radiation from the ground plane as a result of the slots on it. The structure has been designed for a Wi-Fi based application with a band in the frequency range of (2.3-2.5) GHz.

Title: Bioconversion of dibenzothiophene to 2-hydroxy-biphenyl using Pseudomonas putida: A step towards biodesulfurization of diesel oil

Radhika Narain (BITS Pilani, Dubai Campus)
Mentor: Dr. P. K. Bhattacharya

Sulfur removal from diesel oil is a huge problem due to the presence of recalcitrant forms of sulfur, the most common being dibenzothiophene (DBT). The use of microorganisms to remove this form of sulphur is known as biodesulphurization. It operates at mild conditions and is cost-effective as compared to the conventional methods of sulfur removal. The most commonly used pathway followed by the microorganisms engaged in organic sulfur removal is the 4S pathway as four major sulphur compunds are formed followed by a non-sulfur compound known as 2-hydroxybiphenyl (2-HBP).

In the current analysis, the desulfurization activity of *Pseudomonas putida* has been estimated by observing 2-HBP production, pH and biomass concentration for different DBT concentrations: 0.25mM, 0.5 mM and 1mM from 0-96 hours. The 2-HBP production, pH and biomass concentrations were found to be correlated. The best concentration was found to be 0.5 mM at which the biomass concentration and 2-HBP concentration was maximum, having a value of 106.5 g/L and 72 ppm, respectively.

Title: Synergistic Effect of Cross linking and Reinforcement on Bio-plastics

Raghuram K (NIT, Karnataka)
Mentor: Dr. Vivek Verma

It has been observed that agar when dissolved in water can be casted as a film at concentrations as low as 1% (wt/vol) . This property of agar which allows it to readily form a solid film has attracted the attention of engineers as a potential bio- degradable alternative for commercial plastics. But being a hydrophilic colloid, Agar lacks in quite a few ways, like Barrier properties, swelling properties and the like, as a potential alternative for commercial plastics.

This work reports the preparation of Agar–EDC.HCL–Succinic acid crosslinked films, Agar-CNT nanocomposite films and the mechanical and swelling properties of these films.

Title: Some design aspect of Flexible Solar panels and preparation of flexible substrate for the same

Rahul Shaw (NIT, Durgapur)
Mentor: Dr. Deepak Gupta

The choice of a clean energy source, which is abundant and could provide security for future's energy demand is the sun's energy. Given the potential of solar energy, it is poised to grow strongly in future. The project aims to design and develop foldable/flexible solar panels for military application. These solar panels will provide power at remote locations where it is difficult to get direct power supply. The burden of the soldiers to carry spare batteries to keep the communication devices will be reduced. We have studied about how to electrically design the circuit for providing proper power output to the device. The material requirement for making the foldable solar panel were then studied to find out the possible combinations of materials, including the type of solar cell that can serve our purpose. Different materials were taken for making the flexible substrate for the foldable panel. Sample of these substrates were prepared and tested for flexibility. Three point bend test was performed on standard size specimens produced from differ samples according to the standard test method for flexural properties of Polymer Matrix Composite materials. The results were studied for finding the maximum bend strength of the materials..

Title: Studies in Sound Localization

Ravi Tulsian (IITK)
Mentor: Dr. Nachiketa Tiwari

While the synthesis and propagation of sounds in virtual environments has been explored, there has been little work that addresses sound localization and its integration into behaviours for autonomous virtual agents. As the visual and simulation fidelities of interactive applications continue to reach new heights, there has been a growing interest to fill the void in an equally important sensory modality – hearing. The sounds in our environment contain much information, and we can often estimate the current situation from these sounds without visual information. Sound localization is a basic human ability. Humans can discern the direction of a sound source and if the source is moving, its speed and movement path. We have considered the problem of estimation of direction of arrival (DOA) of sound signals coming from the source. We have implemented various techniques to determine the source location among which Multiple signal Classification Algorithm (MUSIC) is prominent one. This algorithm estimates quite effectively the DOA of signal source.

Title: Analysis and design of very wide input voltage range, variable frequency fly back converter

Renu Kumari (National Institute of Technology Jamshedpur)
Mentor: Dr.Sandeep Anand

One of the many problems of the power supply designer is to design a switching power supply that can operate in all the power systems within their international marketplaces. Forward−mode switching power supplies typically operate over a single power system's range of voltage, that is, 90 to 130 VAC or 200 to 270 VAC. Boost−mode converters can just make the range of 90 to 270 VAC. Any higher input voltages would then require a different design. This project reviews at designing a fly back converter which can operate within the input range of 90 to 600Vac without affecting the reliability of its operation. This is done by changing the duty ratio. For fixed frequency it is not possible to extend input range as for high voltage range turn on time of power switch become so short that MOSFET remains in linear conduction mode during on time.

Title: Development of an automated technique for the estimation of true dihedral angles in a polycrystalline microstructure

Richa Agrawal (IITK)

Mentor: Dr. Sandeep Sangal

Grain boundaries (just like any interface) have surface energy associated with it depending on the relative orientation of grains. The distribution of grain boundary energies has a profound effect on mechanical properties. The relative energy of the grain boundaries can be estimated through the angles (termed as the true dihedral angles) between them at a triple edge, as shown in figure 2. The objective of this work is to develop an automated technique for the estimation of true dihedral angles in a polycrystalline microstructure. Even though the dihedral angle is an important parameter in the characterization of the geometry of poly crystals, it is one of the least used parameter because it is very cumbersome to obtain a good statistical estimate. Many scientists have calculated the planar dihedral angle (angles between grain boundary lines at a triple point on 2D sections of microstructures, as shown in figure 1). There have been attempts to determine the true dihedral angles using the serial sectioning technique, however, it is very cumbersome. The process used in this work involves analysis of the image of microstructure obtained from the two sections of the same sample, using the dissector technique. A "dissector" is a 3D sampling probe, which uses two parallel plane sections separated by a known distance.

For this work the dissector sections were obtained on Austenitic Stainless Steel (SS304) sample, which has been preheated to 950^{o}C for 2 hours. A computer program has been developed for automated detection of the triple points, and tracing the grain boundaries associated with the triple point.

Title: Local Heat Transfer Coefficient during Film Condensation of Steam-Hydrogen Mixtures

Rishav Jain (IITK)
Mentor: Dr. Sameer Khandekar

The objective of this work is to design an experimental setup which can be used to find local heat transfer coefficient during film condensation over a cooled rectangular test surface in upward and downward flow configuration for various parameters of interest in the presence of non-condensable gases. Hydrogen has been substituted with helium to simulate the effect of non-condensable gases on steam condensation rate because hydrogen can be dangerous to use in lab.

The basic dimensions of this setup were finalized by using modified *Nusselt Analysis* (including plate thickness). After that CAD model of this setup was designed in SOLIDWORKS 2014. After that standard part drawings of this setup were made so that they can be given into manufacturing.

After that, this setup was analyzed on ANSYS CFX. Velocity and Temperature variation contours were captured for steam flowing over a flat plate. Wall heat transfer coefficient was also plotted with respect to length of the plate, which was then used to plot the variation of Nusselt number across the length of the plate.

Title: Development and Characterization of Temperature Sensitive Paint to measure the transition region

Sai Sandeep Dammati (IIT Kharagpur)
Mentor: Dr. Sathesh Mariappan

Most of the conventional TSPs absorb light in the Blue spectrum (450 – 495 nm) of light. A new temperature sensitive paint for aerodynamic testing has been developed which operates in the Green spectrum (495 – 570 nm). The present work involves development and characterization of this new TSP. The newly developed TSP contains EOSIN – Y as the temperature sensitive luminophore, polyurethane as the binder and basic ethanol as the solvent. Several test samples wereprepared and calibration tests were conducted to measure the emission intensity. Relative intensity graph was plotted against temperature and therefore, relative temperature sensitivity of all the samples were calculated.

Title: Vehicle Trajectory Prediction using a Catadioptric Omnidirectional Camera

Saksham Agarwal (IITK)
Mentor: Dr. K. S. Venkatesh

A practical method has been presented to predict the future spatial-temporal trajectories of multiple vehicles at road intersections in real time using a catadioptric omnidirectional camera with an Equiangular mirror. Tracking is done using CamShift algorithm running alongside a Kalman Filter to handle occlusions. Domain transformation of tracked object's location and velocity from image space to real world is done using a geometrical model. A computationally effective model for trajectory prediction has been presented along with the experimental results obtained using it. The applications of our model such as collision prediction and tracking any event of interest with a dual-camera system are also discussed briefly.

Title: On Vortex Induced Vibration of the cylinder

Samvit Kumar (IITK)
Mentor: Dr. Sanjay Mittal

In this study, the problem of vortex induced vibrations was considered. The study was purely computational in nature. It was undertaken in two parts .The first part focused on the cylinder response at a high Re range (Re=1356 to Re=8814). Intermittency and hysteresis were observed and multiple solutions obtained were analysed. The response branch obtained was compared with vortex shedding mode data from previous studies. The second part of the study was focused on that range of Re where the flow transitions from 2D to 3D.The Re considered were Re= 250 Re=500 and Re=750.The flow obtained was analysed.

Title: Effect of composition on Polarization Behaviour of a Cu-Ni diffusion couple

Sheetal Mohapatra (National Institute of Technology Durgapur)
Mentor: Dr. Kaustubh Kulkarni and Dr. Kallol Mondal

The chosen system was a Cu-Ni diffusion couple. They form an iso-morphous system. Variation in polarization data due to dissimilar structures can be avoided as both have FCC structure. The polarization data will then be a function of composition only. Due to different diffusivities of Cu and Ni at the same temperature and that of copper being greater is seen to have left behind, what we call, Kirkendall pores.

The diffusion zone sets up a profile of different compositions. Surfaces with varying content of Cu and Ni are subjected to polarization test. The diffusion zone sets up a profile of different compositions. Surfaces with varying content of Cu and Ni are then subjected to polarization test. To expose these varying composition planes polishing up to 50µm has to be done every time, starting right from the pure Cu end and extending till the pure Ni end.

Title: Study of Flow Behind A backward Facing Step In Slip Flow Regime

Shinjan Ghosh (Jadavpur University)
Mentor : Arun K Saha

Backward facing steps are often encountered in complex drug delivery networks made of micro channels. A study has been made to understand the vortex formation behind the step, owing to separation of flow, for a given expansion ratio of 1.94 at varying Reynolds numbers(Re=5 to Re=20). The Knudsen number($Kn = \lambda / L$) value was taken as 0.02. Thus the simulation was made in slip-flow regime. The free slip boundary conditions are not valid due to non-equilibrium effects in the boundaries. Thus Maxwell's slip model can be used as boundary conditions. Simulations of this flow was carried out using MAC(Marker and Cell) algorithm, which uses a predictor-corrector approach for solving the Navier Stokes equation. A non-uniform staggered grid of dimensions 198 x 104 was made, with a minimum grid size of 0.005. Maxwell's velocity slip equation of the first order is generally considered as accurate for the slip flow regime, but the second order slip equation is supposed to give a more feasible simulation, as it uses the higher order term neglected by the first order equation. The recirculation length was found to be increasing with increase in the Reynolds number of the flow.

Title: Fabrication and Characterization of Peltier Device

Shivam Sharma (National Institute of Technology Raipur)
Mentor: Dr. Monica Katiyar

The objective of this work is to fabricate an Organic Peltier device and understand the basic characterization of device like measurement of its electrical conductivity, Seebeck coefficient and thermal conductivity of the Peltier device to determine its Figure of merit. The work describes an organic Peltier device that is fabricated using Poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS). Peltier device works on the principle of Peltier effect which describes how an electrical current can create a heat flow. The electrons transfer heat by carrying the internal kinetic energy during transport. The structure used for Peltier device fabrication is PET/ITO/PEDOT:PSS/Al. The electrical conductivity (15625 S/cm) is measured using four point probe method and thickness(49.23 nm) is determined using Profilometer. The seebeck coefficient measured is 11.86 μV/K. The motivation behind this study is to integrate an organic Peltier device and an OLED on a same substrate so that we can have a high brightness OLED working at a reduced temperature during its operation.

Title: Effect of Colchicine on Human Insulin Aggregation

Shivani Narang (Vellore Institute of Technology, Vellore)
Mentor: Dr. Sandeep Verma

Insulin, an important component of glucose metabolism.The formation of insulin aggregates takes place in almost all biopharmaceutical processes, thus making its storage difficult. The present study describes the inhibitory effects of colchicine towards fibrillation of insulin as investigated by thioflavin T assay, circular dichroism (CD), atomic force microscopy (AFM), and scanning electron microscopy (SEM). The potential inhibitory action of colchicine was monitored at various concentrations by performing time dependent studies, which revealed delay in the process of insulin aggregation.

Title: Damage detection in large structures using modes shapes and its derivatives

Shubi Agarwal (BITS Pilani, Hyderabad Campus)
Mentor: Prof. Samit Ray Chaudhauri

Many techniques for structural damage detection involve modal parameters have widely been under extensive research over the past few years. This is because the modal parameters of a structure are easily obtained from forced, free or ambient vibration measurements. Many of techniques have shown that mode shape curvature has been used for localization of damage and preferably the reliable result. In this report, a numerical model of steel bridge, a discrete system, is used to check the validity of the mathematical model developed for continuous shear beam and develop a mathematical model based on the results obtained by this. The structure taken in this is the Chambal Railway Bridge. For a bridge structure, this approach demonstrates that the change in the fundamental mode shape due to any damage is an excellent indicator of damage localization as it is found to be discontinuous at the location of damage. Further, the change in higher derivatives (i.e., slope and curvature) of the fundamental mode shape is shown to be sensitive enough in damage localization. The mode shapes of the damages cases are plotted in X, Y and Z direction and the results are compared with mathematically model given. The mathematically model required in this case is slightly different from the case of the continuous shear beam. For these techniques to have real time applications we also need to have an additional system reject the extra noise which can deviate the results.

Title: One dimensional modeling of turbojet engine

Sindhuja Priyadarshini, Malla Reddy College Of Engineering, Hyderabad

Mentor: Dr. Ashoke De

A small gas turbine performance modelling and testing project has been completed as part of a SURGE Program. Our main objective is to enhance capability in understanding and modelling the thermodynamic and performance characteristics of gas turbine engines. Main objectives of the program included the investigation of the single spool and two spool turbojet engine modelling and analysis. A test program designated for performance characteristics and transient performance simulation for simple turbojet layout gas turbine engine has been developed and tested for calculation of the speed of the shaft due to the increase in the fuel flow. This report presents the results of both the investigations: one is by the developed code and other one is obtained using GASTURB SOFTWARE. The results of two different test cases are compared and presented for varying turbine inlet temperature, compressor pressure ratio and mass flow rate.

Title: Direct Numerical Simulation of Swept back Wing in Transonic Regime for Leading Edge Contamination Effect

Sparsh Sharma

Mentor: Dr. Tapan K. Sengupta

Concorde left the skies 12 years back and the contemporary civil aviation is still restricted to 0.84 Mach (maximum). The research work is concentrated on extending the flight speed envelope in the transonic regime. Turbulent flow is one thing that makes things go on compromising level with power required to overcome the Drag. The leading edge of the swept back wing that is in contact with the fuselage is seen to experience abrupt transition via the appearance of the continuous turbulent puffs along the attachment-line whenever Reynolds number based on momentum thickness is greater than 100.

In swept wing, the flow becomes turbulent from the leading edge only; the contamination is shown as due to either a convicting or a stationary vortex far outside the attachment-line boundary layer at the leading edge [1].

Title: Synthesis of Propargyl Substituted Adenine and its Transition Metal Complexes

Srishti Srivastava (University of Allahabad)
Mentor: Dr. Sandeep Verma

We have taken up the challenge of synthesizing propargyl substituted adenine ligands which are envisaged with number of active sites for hydrogen bonding necessary for the stabilization of DNA. And further, we aim to complex these ligands individually with gold(I) and copper(I). Just as adenine with the transition metal ions like Hg(II) and Ag(I), makes up supramolecular systems having varied applications in the field of catalysis, sensing, gas adsorption, surface patterning, luminescence properties and anti-cancer properties, propargyl substituted adenines are too expected to exhibit the similar properties being somewhat enhanced.

Title: Synthesis of water soluble NHC ligand

Subhadeep Paul (IITK)
Mentor: Dr. Sabuj K Kundu

The objective of the project is to synthesize water soluble NHC ligand, containing water soluble groups as substituents on Nitrogen atoms. We start with 5-amino isophthalic acid and generate 1,3-Bis (3,5-diethyl carboxyphenyl) imidazolium chloride, which is the precursor of corresponding water soluble NHC. After metallation and followed by hydrolysis of ester groups can generate the water soluble NHC- transition metal complex which can be used in different catalytic reactions in aqueous medium.

Title: Design of Tapered Bandgap using variable size Quantum Well

Suman Kumar (NIT, Agartala)
Mentor: Dr. Utpal Das

The objective of this work is to design a Tapered Bandgap structure for semiconductor device mainly for PIN Photodetector using variable size Quantum Well and optimize its geometry so as to provide better efficiency and high speed of the device. There are two method which would provide desire tapered bandgap structure. One is by varying the composition of material used for quantum well and other one is by varying size of quantum well. The reason to choose the variable size quantum well is to provide a better and easy fabrication for device as compared to varying the compositional value of material.

The work describes the variation of band energy in accordance with well width variation. This design exploit the symmetrical variation of band energy due to symmetrical structure. A large number of quantum well is used in intrinsic region having variable width and constant barrier. Preliminary studies shows that as the width of quantum well increases band energy decreases and as width of well decreases band energy again increases while all the region and substrate is undoped. However barrier width remain constant throughout the structure. Further design was extended and converted it into complete structure with doping and an extra region of material indium gallium arsenide phosphide (InGaAsP) was added in between Indium phosphide (InP) substrate and intrinsic region having quantum well on both side. Where composition of individual atoms of InGaAsP was average composition of individual atom present in intrinsic region. For optimization purpose further studies shows that cathode current legs the source or available photocurrent by a fraction of nanosecond.

Title: Calculation of light out coupling efficiency in OLED by analysis of light Propagation in complex media

Suvajeet Das (NIT, Durgapur)
Mentor: Dr. Deepak Gupta

This project aims at developing a code for calculating the light out coupling efficiency of OLEDs using micro lenses. Use of micro lenses have proved to provide better efficiencies of transmitted light, often increasing them by up to 20% than normal OLEDs. The program is developed in C and makes use of the formulas suggested by Snell Descartes' Laws for interaction of light at the interface of two mediums possessing complex indices of refraction. This code can further be modified to be used on various platforms and devices.

In case of complex mediums it has been found that due to the presence of the complex part of the refractive index, the light rays are no longer homogenous, but are termed as inhomogeneous. The respective properties and expressions of such waves were analyzed and have been used to implement the formulas in the code. The code takes input in the form of the number and refractive indices of the dielectric slabs, the coordinates and the angle of the photon at which it is generated. The wavelength of the Photon generated is assumed to be constant at first. The intensity and the angle of the respective reflected and refracted rays are stored in arrays. The intensity and angle of the light coming out through the top surface is displayed as the final ray. The rays which exit through the side walls of the device are neglected. Also if the intensity of a particular light ray after subsequent refractions and reflections falls below a pre-determined value, that ray is discarded. The whole process can be conducted for light of various wavelengths to find out their respective refracted intensities.

Title: Self-gravitating systems- structure and properties

Uddipan Banik (IITK)

Mentor: Dr. Kaushik Bhattacharya

We have researched on the steady state dynamics of large scale self-gravitating structures like galaxies, clusters and dark matter halos considering the systems as self-gravitating fluids. We have theoretically analyzed the systems using the hydrodynamic and Poisson equations to obtain profiles for density, pressure and average velocity in the systems. The well-known density profiles like NFW and isothermal sphere profiles have been studied not only in the hydrostatic equilibrium case but also in a fluid under radial motion. Tangential motion has been studied in some theoretically obtained density profiles. We have obtained entirely theoretically an interesting density profile for a spherically symmetric system with only tangential velocity- the density profile agrees reasonably well with the NFW and the isothermal sphere profiles which were obtained previously by N-body simulation and the corresponding rotational velocity profile also agrees well with the observed galactic rotation curve towards the outer parts of the galaxies.

Title: Reliability of Wireless Communication for Dynamic State Estimation in Smart Grid

Varun Gupta (IITK)

Mentor: Dr. Aditya K Jagannatham

The objective of the work is to study the viability of wireless communication based Smart Grid architecture and design an algorithm for robust communication in smart grid. In Smart Grid, the measurement data can be communicated from measuring devices to the SE processor through wired or wireless channels. Wireless Communication has benefits over wired communication such as low installation cost, rapid deployment, mobility and suitability for remote applications. However, the reliability of wireless communication for smart grid is a critical issue due to the fading nature of the wireless channel caused by multipath induced fading and shadowing effects. Our work concerns with the improvement in the reliability of the wireless channel for dynamic state data communication in Smart Grid. We have proposed a total variation (TV) regularization based detection technique at the receiver (processor) which employs the temporal correlation of the measurement data leading to a robust data reconstruction. A TV regularization based scheme employs a novel L_1 norm regularization factor to exploit the bounded variation (BV) property of the state data for reconstruction. Simulation results demonstrate superior performance of the TV based recovery method over the conventional ML scheme.

Title: Fabrication of Solution Processed Reduced Graphene Oxide Films as Transparent Conductors

Vedant Pravin Sumaria (University of Petroleum and Energy Studies, Dehradun)
Mentor: Dr. Monica Katiyar

The objective of this work is to design and fabricate graphene thin films as a transparent electrode to eliminate the use of costly ITO electrodes in electronic devices. Graphene oxide sample was made with improved Hummers method. We instead used method excluding the $NaNO_3$, increasing the amount of $KMnO_4$ and performing the reaction in a 9:1 mixture of H_2SO_4 and H_3PO_4. This method improved efficiency of the oxidation process. It provided a hydrophilic oxidised graphene material with easy temperature control and no toxic gas release.We spin coated GO thin films over quartz and glass substrate which was reduced using Hydrazine vapour treatment followed by 400 C thermal annealing under Argon gas flow. Films with sheet resistance of 26.50 k/sq and 70% transmittance at 550 nm light were fabricated. X-Ray Diffraction and Raman Spectroscopy was done to confirm graphene and GO films. AFM and FESEM images were taken to study the surface topography and morphology of the substrates.

Title: Reconstructing Unique Inversions with Deep Model of Motion

Vikas Jain (IITK)
Mentor: Prof Amitabha Mukerjee

We learn representations of object models using an inverted *Convolutional Neural Network* which can generate back images given deterministic input parameters. We apply this regenerative model to reconstruct intermediate poses of a robot arm using training data consisting of a large set of images of random poses of the arm. The parameters we used during training were the *joint angles* of the robotic arm with three degrees of freedom. The local path planner of the robot arm can be implemented using these reconstructions to determine whether two poses are *traversable*, by checking overlap of obstacle with the generated intermediate poses. The reconstructed images can also provide a better understanding of how a network *interpret* and *analyze* an object model. The image dataset of the random poses and of obstacles was obtained using the CRS Robot, from a single viewpoint.

Title: Path Planning of UAV

Vikram Shree (IITK)

Mentor: Dr. Mangal Kothari

To find computationally efficient and robust path for a UAV in an obstacle rich environment is a sound area of research today. Although, there are many offline and some online planners available, still, finding an optimal path in limited time is a challenge. Our work presents a sampling based algorithm which finds a near optimal path from the starting position to the goal location for the UAV. It has its inherent benefit lower computational complexity. Further, we have taken into account the uncertainty due to the non-ideal nature of the sensors and noise from the environment. We have used Markov Chains to estimate the state of UAV in future time and constrained the probability of obstacle collision below a chosen upper bound. So, finally we have achieved a probabilistically robust path in real time.

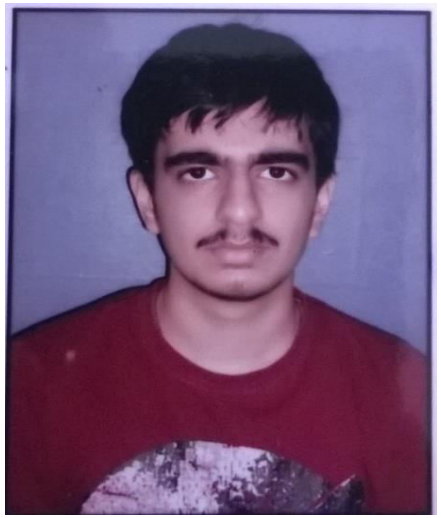
Title: Flow past a Circular Cylinder with Attached Splitter Plate: Search for Multiple Solutions

Vishnu Mohan (NIT, Calicut)

Mentor: Dr. Sanjay Mittal

In the present work we are investigating the presence of multiple solution to the flow past a flat as well as a curved splitter plate. In order to obtain multiple solution, a bias was introduced by blowing and suction. Suction was introduced at the lower surface and blowing was introduced at the upper surface. After a steady state solution was obtained, no slip condition over the slitter plate was imposed. An asymmetric flow was observed over the splitter plate on reaching a steady state with the no slip condition imposed. This asymmetry varied with the velocity with which blowing and suction occurred. Various solutions were also observed for a curved splitter plate. These solutions varied with the value of blowing and suction. The Cp distributions over the cylinder with attached splitter plate corroborate the Cl value obtained.

Abstracts: SURGE 2015 Research projects done in Overseas Universities



A Study of Thermal Decomposition of Trimethylbenzenes

Akash Bajaj (IITK)
Mentor : Dr. Gabriel da Silva

Aromatic hydrocarbons are important constituents of gasoline-based fuels. Kinetic models incorporating the combustion reactions and mechanisms for many such hydrocarbons are limited. In this study, we have attempted to bridge this gap by analyzing possible decomposition pathways for the three trimethylbenzene molecules, which constitute the C-9 fraction in such fuels. The hydrocarbons that we studied were: 1,2,4-trimethylbenzene (TMB), 1,2,3-trimethylbenzene and 1,3,5-trimethylbenzene. We first reviewed similar mechanisms found in literature for the xylene molecules. Based on them, we outlined several possible pathways for the three target molecules of our study. The enthalpy changes and heats of formation of the products so formed were then computed for each such reaction using Gaussian09. We found that the initiation step is likely to be that of a benzyl hydrogen atom abstraction. This will further be followed by another such hydrogen atom abstraction step.

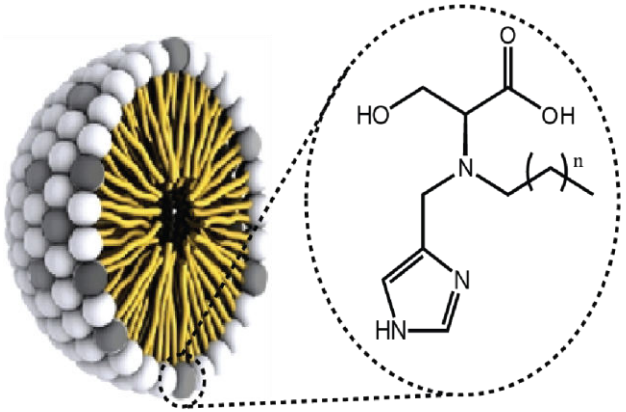
As a result, the 1,2,3-TMB is likely to yield 1-methyl o-xylylene. The 1,2,4-TMB is likely to yield 2-methyl o-xylylene and 1-methyl p-xylylene. The 1,3,5-TMB was found to form radicals which rearrange to those formed during 1,2,4-TMB decomposition, and further lead to the formation of 1-methyl p-xylylene. This result of ours was in accordance with the experiments carried out on 1,3,5-trimethylbenzene. Thus, our proposed mechanisms can help improve kinetic models based on 1,3,5-TMB decomposition. We also studied further decomposition of these methyl xylylenes, in order to explain the formation of indene in 1,3,5-TMB decomposition. We have proposed a mechanism for the same, and in the process, found two new radicals that form as intermediate structures, whose heats of formation were computed for the first time in our study. Due to a dearth of such models for the other two molecules, our study only provides a possible pathway that may be adopted and can further assist any future experimental work carried on the same.

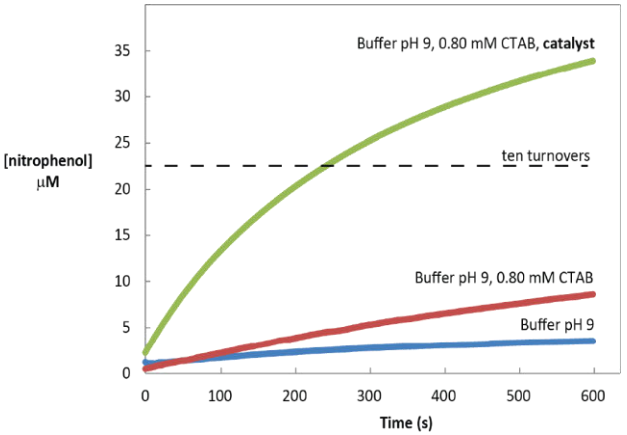
Bio-Inspired Artificial Catalytic triads

Shashank Kamdar(IITK)

Mentor : Dr. Luke Connal

Enzymes are without doubt the most important and widespread types of catalyst in the modern world for not only biological but also industrial reactions. At the heart of these exquisite catalysts is a relatively small functional area – the active site – to mediate their important reactions. The active site of hydrolytic enzymes such as proteases and lipases is often comprised of three spatially close amino acid residues; Histidine, Aspartate and Serine, known as the catalytic triad which are believed to be crucial for catalytic activity. We developed a simple, high-yielding synthesis of an artificial catalytic triad (ACT) that contains the three functional groups (alcohol, imidazole and carboxylate) on a single molecule. We further developed a synthetic strategy using reductive amination to further functionalize the ACT by the addition of anlong carbon length chain creating a surfactant with the ACT as the head group. These bioinspired catalysts have been assayed for the esterolysis of 4-nitrophenyl benzoate in a co-micelle system with Cetyl trimethylammonium bromide (Surfactant). Catalysis assay was performed using UV-Visible Spectroscopy. Esterolytic rate enhancements greater than 2.6*103 above the background rate were observed for the ACT surfactants.





SURGE 2015 –Popular lectures

Dr. Bharat Lohani

Prof. Bharat Lohani is currently the professor in the Department of Civil Engineering at Indian Institute of Technology, Kanpur. His area of interest is Research and consultancy in area of Geoinformatics.

Title: LiDAR Technology-A new method to map our Earth

Dr. B. V. Phani

Prof. B. V. Phani is currently the professor in the Department of Industrial. & Management Engineering at Indian Institute of Technology, Kanpur. His research interests are Financial Intermediaries, Credit Risk Modeling, Securitization, Entrepreneurial Finance, Market Microstructure and valuation, Corporate Governance etc.

Title: Entrepreneurship-Innovation Eco system at IIT Kanpur

Dr. C. S. Upadhyay

Prof. C. S. Upadhyay is currently the professor in the Department of Aerospace Engineering at Indian Institute of Technology, Kanpur. His area of interest is Solid Mechanics, Adaptive Finite Element Methods, Structural Optimization.

Title: Nature under threat: Critical Scientific and Technological Challenges

Abstract: The talk is meant to excite discussion and scientific investigation of several crises, either man-made or natural, that threaten to devastate life as we know. The talk will flag off areas of serious concern in the Indian context. It will range from problems related to glacier dynamics, river science and groundwater crisis, hill slope stabilization, waste-management, heritage structures, etc. How can technological solutions to these crises be obtained? We will touch upon modeling issues and open questions in these areas. Further, we will also look at some possible technological solutions to some of these problems, and a few success stories. We will also discuss some immediate challenges - predictive modeling of natural phenomenon, local solutions for sustainable natural energy resources. The talk will try to sensitize the engineers of the future on some of the critical technological needs of this country.

Dr. Harish C Verma

Dr. Harish C Verma is an Nuclear Experimental physicist, whose chief interest lies in Condensed Matter and Materials Applications. Currently, he is working on Nanocrystalline Magnetic Materials and Alloys Systems. Dr. Verma is also interested in Earth Science problems such as meteorites and extinction boundaries. He has authored several books including Concepts of Physics at introductory college level and Quantum Physics at collerge level. He is presently working on a book on Electromechanics.

Title: Experiments in Physics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Dr. Elizabeth and Dr. Verkey Cherian award for SURGE 2015 best project

S.N	Name of the Participant	Home Institute	Project Title	Department	Mentor
1	Kshitij Jain	The LNM Institute Of Information Technology Jaipur	Appification of Heritage websites	Computer Science & Engineering	Dr.T.V. Prabhakar

SURGE 2015- outstanding poster award

S.N	Name of the Participant	Home Institute	Project Title	Department	Mentor
1	Anirudh Muralidharan	SASTRA University	Numerical Analysis of Turning operation in DEFORM 3D software and Experimental Analysis of Wire Electric Discharge Machining on AZ31 Magnesium alloy.	Mechanical Engineering	Dr. J. Ramkumar

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The faculty mentors at IIT Kanpur and the students for their enthusiastic participation. The generous donors who made contributions to support the program.

Members of the Advisory Committee, Departmental Representatives, Lecture hall staff and numerous other faculty members who helped in the program.

Saman K. Halgamuge, Associate Dean, International and Tamara Djurovic, Recruitment co-ordinator International at University of Melbourne for developing cooperation .

Department faculty coordinator and the mid term project evaluation teams.

Ms. Shobhi Srivastava of DORA office for coordinating the SURGE program and other staff members of the office.

SURGE 2015 Committee

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Naveen Tiwari (Chemical Engineering)
Anand Singh (Chemistry)
Sarvesh Chandra (Civil Engineering)
Vinay Namboodiri (Computer Science & Engineering)
Ketan Rajawat (Electrical Engineering)
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Rajdeep Mukherjee (Materials Science & Engineering)
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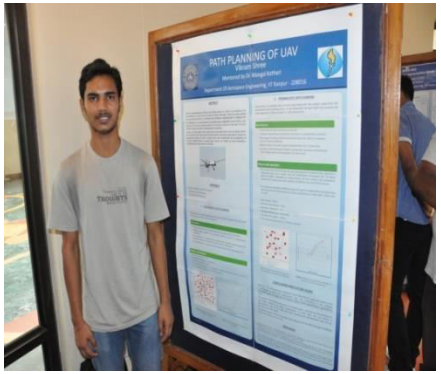
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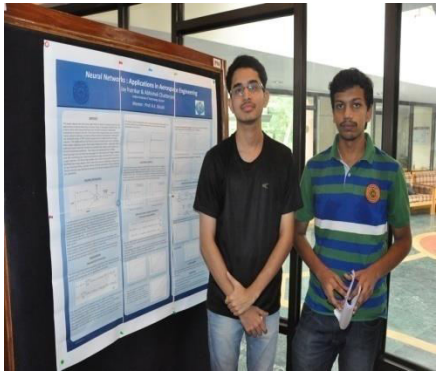
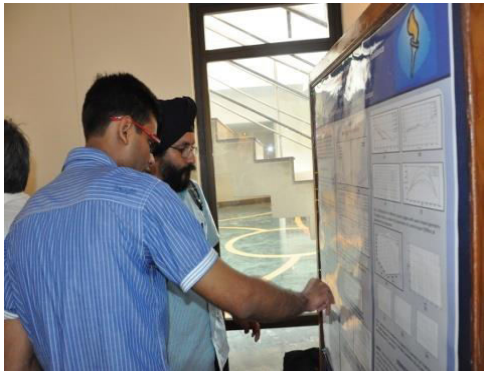
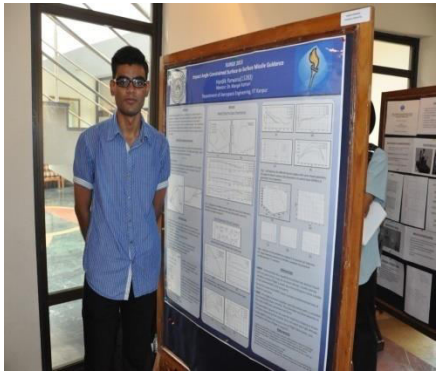
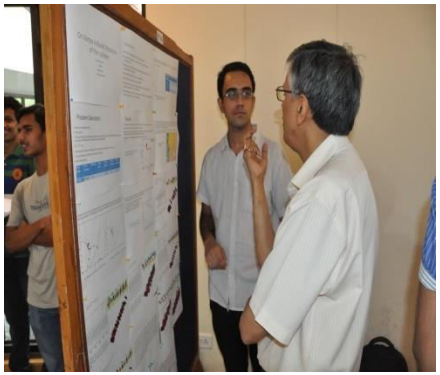
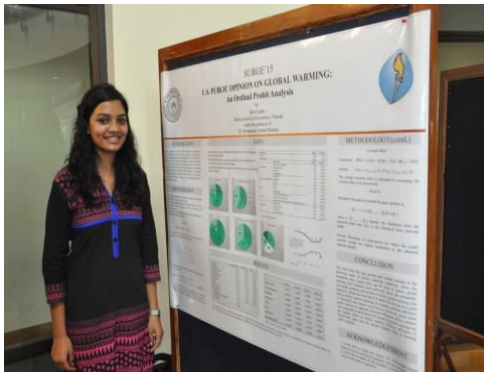
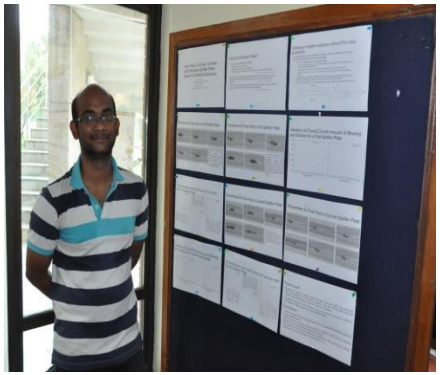
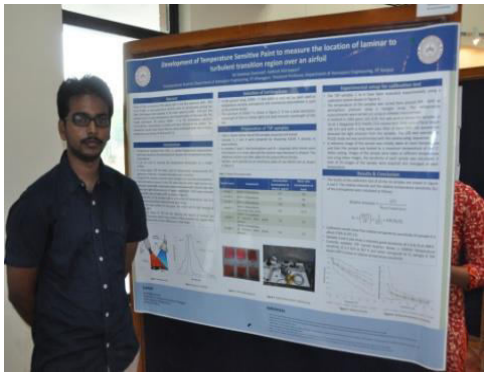
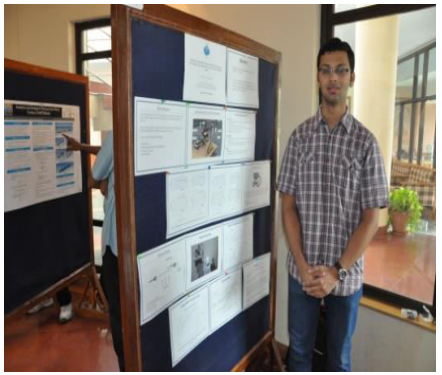
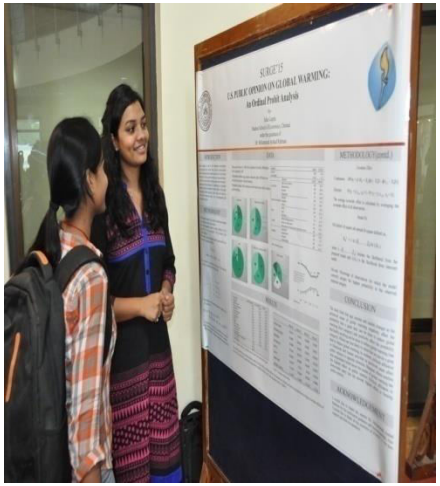
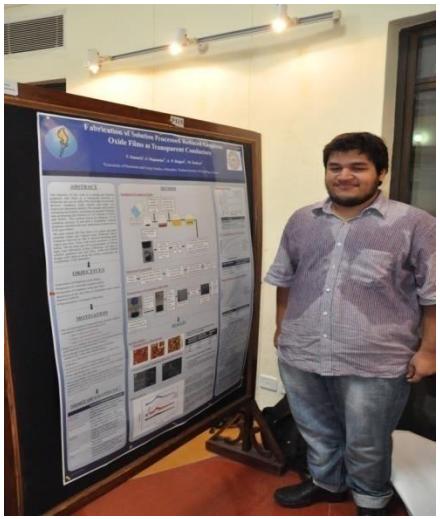
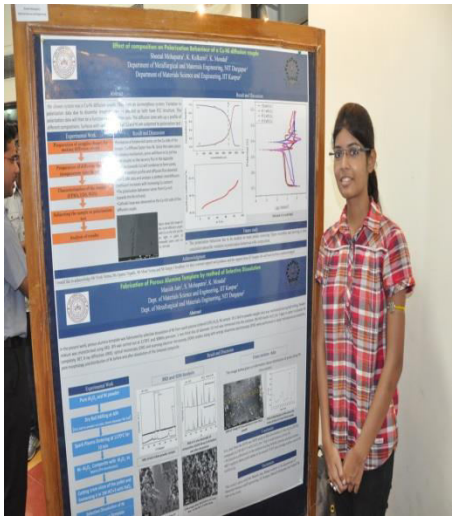



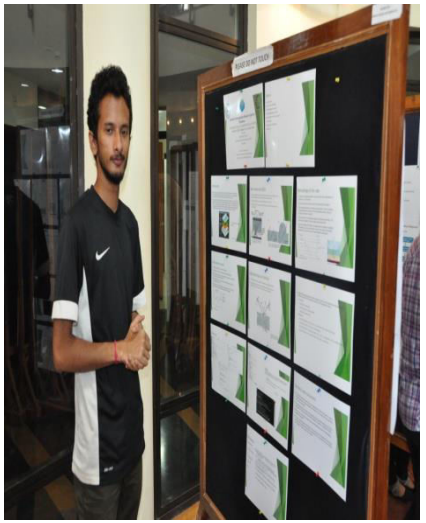



SURGE'15
U.S. PUBLIC OPINION ON GLOBAL WARMING:
An Ordinal Probit Analysis
METHODOLOGY
CONCLUSION

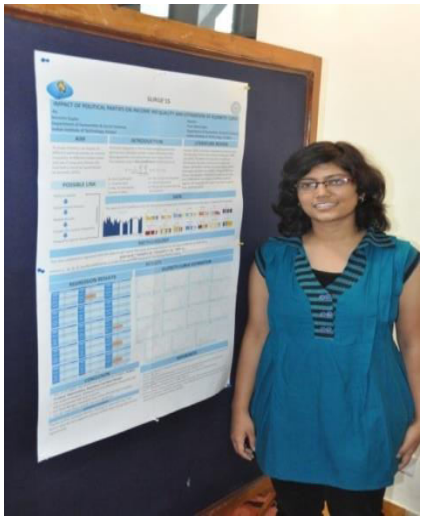



Development of Temperature Sensitive Paint to measure the location of laminar to turbulent transition region over an airfoil


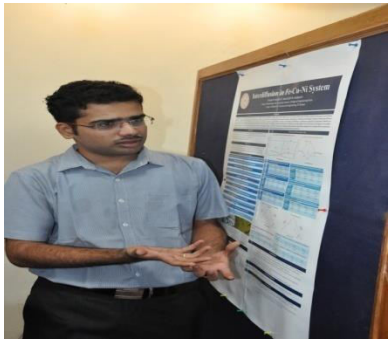


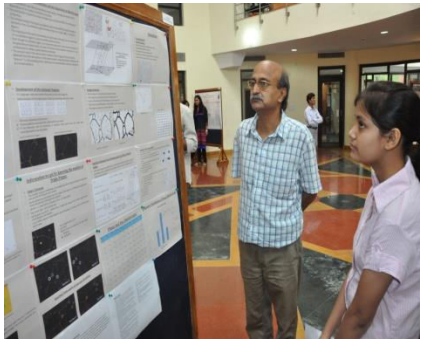
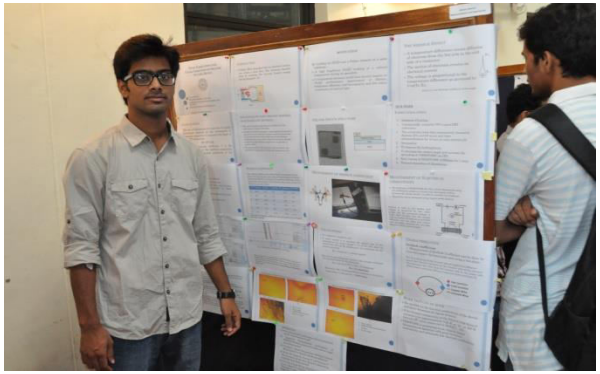
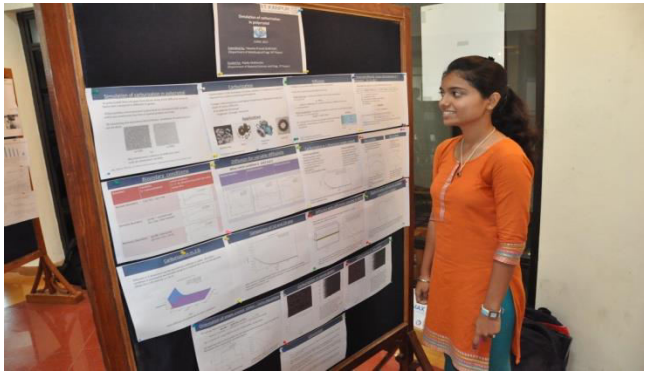
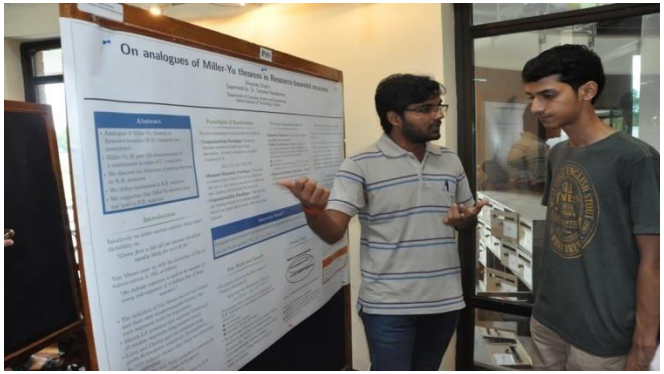
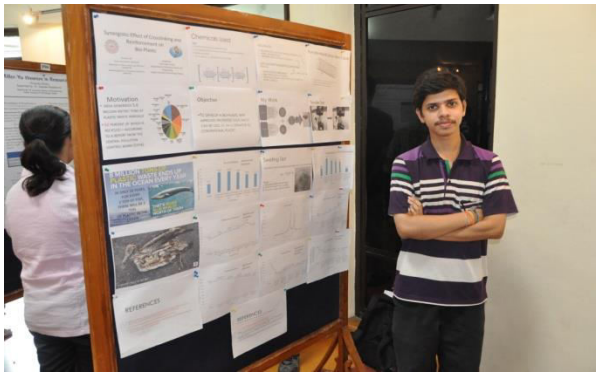


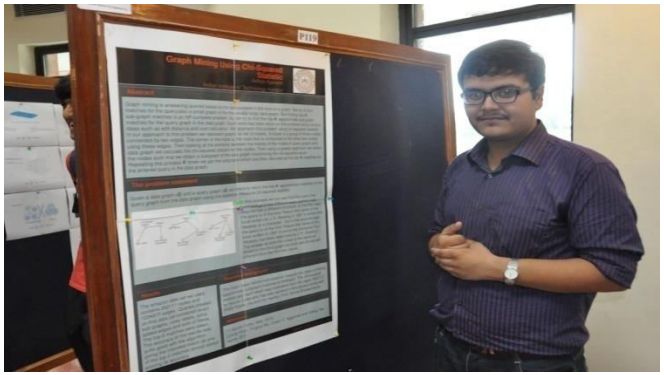


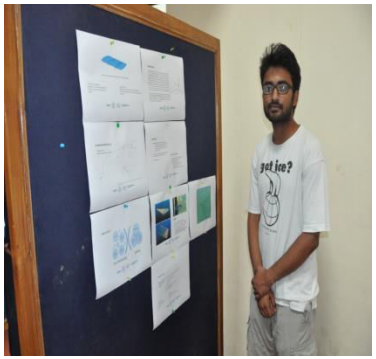
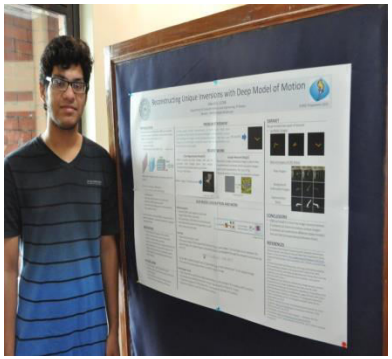
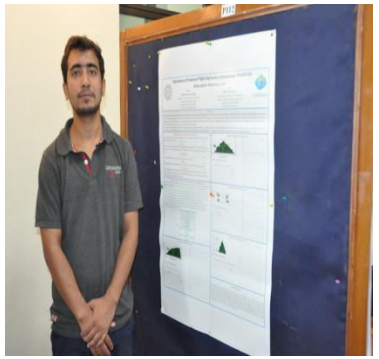










On analogues of Miller-Yu theorem in Banach-Mazur extension



Graph Mining Using Chi-Square Statistic



Reconstructing Unique Inversions with Deep Model of Motion



From top to bottom

Row 4 (Right to Left) : Ms. Shobhi Srivastava, Ms. Ankita Shukla, Mr. Saurabh Garg, Mr. Vaibhav Gupta, Mr. Sanjeev Yadav, Mr. Sujay Kumar Gupta, Dr. Samit Ray Chaudhuri, Dr. Prabhat Munshi, Dr. Sudhir Kamle, Dr. Anubha Goel, Mrs. Babita Lohani, Dr. Anoop Singh

Row 3 (Right to Left) : Mr. Sanjay Dashmana, Mr. Nikhil Gupta, Anirudh, Himanshu, Ashutosh, dilsher, Ravi, Uddiapn, Harsh, Arpit, Abu Saleh, Subhadeep, Pratyush, Raghuram.

Row 2 (Right to Left) : Ashutosh, Hardik, Samvit, Vikram, Himanshu, Varun, Eeshan, Saksham, Suvjeet, Rahul, Sai Sandeep, Abhishek

Row 1 (Right to Left) : Richa, Nimisha, Neha, Renu, Ankita, Megha, Chndramouli Pawni, Sheetal, Mahashweta, Isha, Mrs. Nidhi Verma

SURGE 2015

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