Indian Institute of Technology, Kanpur

SURGE 2017

Students-Undergraduate Research and Graduate Excellence

Message from Dean, Research & Development

Dear SURGE Friends,

Congratulations to all the 2017 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 1200 applications were received from different colleges and 103 excellent students from different institutions and from IITK were welcomed 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!

S. Ganesh
Dean of Research & Development

SURGE Program - An Overview

IIT Kanpur launched an 8-week SURGE (Students-Undergraduate Research and Graduate Excellence) program in the summer of 2006. Under this program, a small number of selected undergraduate students from top engineering colleges from all over India are given an opportunity to explore research and to experience the academic atmosphere of IIT Kanpur. Students in second and third year of their academic program are selected from a large pool of applicants. 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 all the SURGE students make a poster presentation of the work carried out at IITK. The poster presentation is open to the public. It is also evaluated by faculty members.

This year, the scope of the SURGE Programme was extended to include candidates which were to be funded through projects of faculty members and also those who would not be receiving any funding at all. This desired expansion of the SURGE program was aimed at creating more impact of undergraduate internship through the established platform of SURGE.

As per current institute norms, SURGE can recently accept 60 students from Institute Funding, 120 students from Project Funding, 100 students under Self-Funded category and few students under Industry IITK tie-up. A maximum of 04 students from NEPAL + BHUTAN may be allowed to participate in the SURGE program. This year (in 2017), one SAARC student (from Nepal) was selected under SURGE program.

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

Few selected students are given stipend, all students are given a commendation certificate and those who produce exceptional quality research are given an award in addition to the certificate.

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Funding SURGE

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 2016 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

Institute Funded

This year 37 students received full support (stipend of Rs 12,500 for the eight-week summer program**)** while 2 students received partial support and one student from Nepal received full support from the funds raised from external sources.

Project Funded

This year 20 student's received stipend from institute projects (The suggested stipend for 8 weeks' duration is between Rs. 8000 to Rs. 12500).

Self-Funded

This year 43 students were selected in SURGE Program under the self-funded category.

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 instalments 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 2017 from IITK

S. N.	Name of the Participant	Project Title	Mentor
1	Aarsh Prakash Agarwal	Contact Force Calibration on Capacitive Touch-Screen	Dr. K .S. Venkatesh
2	Abhisek Panda	Simultaneous Localization And Mapping for Multi-Robot System Using Rao-Blackwellized Particle Filters	Dr. Indranil Saha
3	Abhishek Sahoo	Vortex Induced Vibrations	Dr. Arun K Saha
4	Aditi Singh	Effects of Changing Illumination Conditions on an Object, as Viewed from Different Directions	Dr. K .S. Venkatesh
5	Aditya Pratap Singh Rajawat	Characterising delamination of fiber metal composites subjected to impact loading	Dr. Venkitanarayanan
6	Agrim Bari	A Messaging Service based on Peer-to-Peer SIP	Dr. Y. N. Singh
7	Ahir Sudhendu Prashant	Control and utilization of KaMoMan	Dr. Bhaskar Dasgupta
8	Ajay Kumar	Instability of contact-line spreading of thin liquid film	Dr. Naveen Tiwari
9	Akshay Mahajan	A Study on different Plasmonic Structures	Dr. Tanmoy Maiti
10	Arjun Gupta	Economics Of Cyber-Crime	Dr. Praveen Kulshesthra
11	Ashutosh Rawat	Progressive Collapse Analysis of Bridge Truss	Dr. S K Mishra
12	Ashutosh Srivastava	Implementing Machine Type Communication System on a standard 4G LTE Release10 Wireless Communication System	Dr. Rohit Budhiraja
13	Atul Kumar Pandey	Gesture based Control in Laptops	Dr. K S Venkatesh
14	Avi Gupta	Wound healing hydrogels	Dr. Kantesh Balani

15	Ayushi Tripathi	Cancer Biomarker (Psa) Detection Using Paper Based Microfluidics	Dr. Siddhartha Panda
16	Ayushree Gupta	Whose Expectations Augment the Phillips Curve in India?	Dr. Sohini Sahu
17	Bhavy Khatri	Studying the effect of working together on the change in Social and Religious prejudices.	Dr. Debayan Pakrashi
18	Bhuvan Beejawat	Thermoelectric Modules : Analysis and Automotive Application(s)	Dr. Jishnu Bhattacharya
19	Biswajit Rath	Pulsatile flow of a non-Newtonian fluid in a channel with sudden expansion-contraction	Dr. Kamal K Kar
20	Devang Goyal	Mechanical Properties Of Graphene Helicoids	Dr. Shakti Gupta
21	Devansh Saraswat	Fabrication of low temperature p-type thin film transistors using solution processed copper oxide	Dr. Deepak Gupta
22	Homanga Bharadhwaj	An Innovative Type-2 Fuzzy Systems approach for Clustering based IdentiÃ¯Â¬Âcation of a T-S model	Dr. Nishchal Verma
23	Ishank Modi	Appropriate Damage Indicators for Structural Health Monitoring	Dr. Suparno Mukhopadhyay
24	Kawarpreet Singh	Heat And Mass Transfer For Pulsatile Flow Through A Channel With Symmetric Sudden Expansion And Contraction	Dr. Malay Das
25	Kunjal Shah	Sports Ball Aerodynamics	Dr. Sanjay Mittal
26	M. V. S. Saketh	Torsion driven Inflation and Magnetogenesis	Dr. Pankaj Jain
27	Manish Chauhan	Economic returns to being religious - Evidence from Northern Ireland	Dr. Debayan Pakrashi
28	Manish Kumar Bera	Optimising Robotic Swarm Movement	Dr. Indranil Saha
29	MOHD ABBAS ZAIDI	STTC based Robust Image and Video Reconstruction over Wireless Sensor Network.	Dr. Aditya K. Jagannatham
30	Nishkarsh Agarwal	Lead-free Inorganic Perovskite Solar Cell	Dr. Tanmoy Maiti

31	Pankaj Kumar	THF Hydrate Formation and Its Application	Dr. P K Panigrahi
32	Prabhsimrandeep Singh	HRTF Phase Synthesis and ITD Calculation using Group Delay Compensation Filter For Personalization	Dr. Rajesh Hegde
33	Prajapati Soham Jagadishchandra	Shuttlecock Analysis	Dr. Sanjay Mittal
34	Pranav Santosh Kulkarni	Control of flow in backward facing step using synthetic jet	Dr. Ashoke De
35	Prannay Khosla	End to End Learning for Text to Video generation	Dr. Vinay Namboodiri
36	Prashant Kumar	PVDF-TrFE Sensor	Dr. Deepak Gupta
37	Pratyush Garg	Reinforcement Learning for Adaptive Mobile Sink Scheduling in Clustered and Asynchronous WSN	Dr. Rajesh Hegde
38	Prince Kumar	Investigating the role of Metabolism Related Genes in development of Vertebrate Nervous System	Dr Jonaki Sen
39	Radhit Dedania	Robust Feature Extraction Using Deep Stacked Auto-Encoder	Dr. Nishchal Verma
40	Raghav Gupta	Linear Stability Analysis of flow past a Rectangular Cylinder placed in a channel	Dr. Arun K Saha
41	Raghav Mittal	Adhesion Enhancement of Conductive Inks on Non-porous Substrates for Printing Application	Dr. Anshu Gaur & Dr. Kantesh Balani
42	Rohit Kumar Bose	Music Similarity using Rabindrasangeet	Dr. Arnab Bhattacharya
43	Saakar Bhatnagar	Computational Fluid-Structure Interactions	Dr. Sanjay Mittal
44	Shreya Shree	Inflation as a Monetary Phenomenon in the Indian Context: An Empirical Approach	Dr. Surajit Sinha
45	Soumyadeep Datta	Development of Density Functional Theory Methods for Molecular Computations	Dr. Nisanth N. Nair
46	Ujjwal Pradeep Khandelwal	Control of flow separation over a Forward Facing Step	Dr. Ashoke De
47	Vishad Viplav	Design And Implementation Of A Wireless System: Machine Type Communication On LTE (Receiver Side)	Dr. Rohit Budhiraja

Participants of SURGE 2017 at IITK from Other Universities

S. N.	Name of the Participant	Institute Name	Project Title	Mentor
1	Abeetath Ghosh	JADAVPUR UNIVERSITY	Interaction of a line vortex in a rotating flow field	Dr. Debopam Das
2	Abhimanyu Bandopadhyay	JADAVPUR UNIVERSITY	Thermodynamic model and exergy analysis of Dual Fluidised bed gasification of Coal	Dr. Santanu De
3	Abhinav Chadha	SMVDU JAMMU	Enhancing design of a Wire Electrochemical Machining(WECM) setup & Dynamic Analysis of CNC micromilling machine	Dr. J. Ramkumar
4	Aditya Bharat Shah	BITS PILANI	How different is a 3D textured structure from a 2D printed copy	Dr. Deepak Gupta
5	Aditya Srivastava	UPES	Detection of Cyber Attacks in Industrial Process Control Systems using Neural Networks	Dr. Sandeep Shukla
6	Aditya Srivastava	NIT TRICHY	Synthesis and Characterization of thin Cuprous oxide layer of metal-semiconductor Schottky solar cell using Thermal oxidation process.	Dr. Kamal K Kar
7	Ajeet Singh	UCE RTU KOTA	Simulation of Heating of a Flat Plate by Jet Impingement	Dr. D P Mishra
8	Alankrit Srivastava	SMVDU JAMMU	Numerical computation of diffuse view factor between planar surfaces.	Dr. Jishnu Bhattacharya
9	Aman Sharma	UCE RTU KOTA	Simulations of vortex shedding past a square cylinder near a wall	Dr. Rakesh K. Mathpal
10	Ankriti Shrivas	GITAM UNIVERSITY	Effects of heat curing on the expansion of high performance cement based composites prepared in the laboratory.	Dr. K V Harish
11	Anubhav Kumar Singh	UCE RTU KOTA	Flow Visualization in Soap Film Tunnel	Dr. Sanjay Kumar
12	Anya Chaturvedi	MNNIT ALLAHABAD	Randomized Algorithms: Theory and Practice	Dr. Surender Baswana and Dr. Satyadev Nanadakumar
13	Aranya Dan	IIT KHARAGPUR	Analysis of Flow Acoustic coupling in a Half-Dump Combustor	Dr. Ashoke De
14	Arnab Mukherjee	IIEST SHIBUPUR	Experimental Observation of Instability in Round Laminar Buoyant Jet	Dr. Debopam Das
15	Arpitrama Chatterjee	VNIT NAGPUR	Sentimental Analysis on Hindi Text	Dr. Arnab Bhattacharya
16	Ashay Anurag	BITS	BaTiO3@MnO2 based polymer nanocomposites for high energy density applications	Dr. Raju Kumar Gupta
17	D.S. Ramaswamy	NIT TRICHY	Numerical Simulation of Supersonic flow separation in Over Expanded Planar de-Laval Nozzle	Dr. Rakesh K. Mathpal

18	Debasmita Das	NIT RAURKELA	Income,wealth and mortgage stress: Analysing US data	Dr. Arshad Rahman
19	Debayani Sarangi	KIIT UNIVERSITY	Implementation of distributed database system in Rust	Dr. Satyadev NandaKumar
20	Deya Sinha Roy	IIEST SHIBUPUR	Analysis of instabilities in a 3D compressible Vortex Ring	Dr. Ashoke De
21	Diksha Swami	UCE RTU KOTA	Effect of leading edge contamination on the airfoil performance	Dr. Kamal Poddar
22	Gyanendra Pratap	MIT MANIPAL	Natural Language Question Answering System for Unstructured Data using Deep Learning	Dr. T. V. Prabhakar
23	Harsh Garg	MNIT JAIPUR	Motor and Battery Selection for Electric Light Commercial Vehicle	Dr. Sandeep Anand
24	Harshita Saraogi	HBTU	Quantum computing	Dr. Rajat Mittal
25	Jasbir Singh	IIITDM JABALPUR	General treatment of reflection of spherical waves from spherical surface for ANITA Experiment	Dr. Pankaj Jain
26	Jatin Jain	NIT ROURKELA	Annealing of CNTs coated Copper substrate	Dr. Anshu Gaur
27	Karnika Singh	MNNIT ALLAHABAD	Lignin coated iron oxide nanoparticles for removal of heavy metals from wastewater	Dr. Raju Kumar Gupta
28	Kartikey Sharma	UPES	Influence of freeze-thaw cycles on Poly (vinyl alcohol) - Salt dispersion	Dr. Yogesh Joshi
29	Kirtish Panchal	UCE RTU KOTA	Load spectrum and fatigue life of aircraft	Dr. C S Upadhyay
30	Kushal Joshi	MNIT BHOPAL	NUMERICAL SIMULATION OF FLOW PAST A SQUARE CYLINDER USING DETACHED SPLITTER PLATE IN FRONT AT LOW REYNOLDS NUMBER	Dr. Arun K Saha
31	Lovish Arora	BITS PILANI	Modeling Question Answering System using UIMA and UIMAFit	Dr. T. V. Prabhakar
32	Mahenoor Ali	IIT DELHI	ALGEBRAIC NUMBER THEORY	Dr. Sudhanshu Shekhar
33	Mansi Dubey	MNNIT ALLAHABAD	3-D Gesture based Android Authentication	Dr. K. S. Venkatesh
34	Nilesh Sharma	UCE RTU KOTA	CFD analysis of Impingement cooling of flat plate by air jet	Dr. D P Mishra
35	Ojorshy Basak	NIT	Investigating the role of cell adhesion molecules in dorsal forebrain midline invagination.	Dr Jonaki Sen
36	Palak Pandya	UCE RTU KOTA	Control of wingtip vortices by using different wingtip configurations	Dr. Kamal Poddar
37	Palak Singh	MIT MANIPAL	Design and Analysis of an ultralight aircraft	Dr. C S Upadhyay
38	Pankaj Kumar	NIT DURGAPUR	MATERIALS AND ENERGY BALANCE IN ELECTRIC ARC FURNACE	Dr. Amarendra Kumar Singh
39	Payal Jain	MNIT JAIPUR	Materials and Energy Balance in Electric Arc Furnace	Dr. Amarendra Kumar Singh

40	Pragati Satish rao	MIT CHENNAI	Simulation of Magnetorheological Abrasive Flow Finishing Process	Dr. J. Ramkumar
41	Prajwal Gaurav Sah	MNIT BHOPAL	BRIHASPATI-3	Dr. Y. N. Singh
42	Prantar Dutta	JU	Study of Reduction Characteristics of Alumina-supported Nickel Oxide	Dr. Goutam Deo
43	Riya Jindal	GCET BIKANER	A TWO-DIMENSIONAL DIFFERENCE ALGORITHM	Dr. Satyadev Nandakumar
44	Rohit Goswami	HBTU	Development of Computational Tools for Free Energy Calculations of Chemical Reactions	Dr. Nisanth N. Nair
45	Sandhaya Kumari	JEC	UIMA - AN ARCHITECTURAL APPROACH TO CONVERT UNSTRUCTURED INTO STRUCTURED INFORMATION	Dr. T. V. Prabhakar
46	Sarthak Jain	BITS PILANI	Trade-off between Distortion and Lifetime for Wireless Networks.	Dr. Ketan Rajawat
47	Sarthak Mehta	NIT HAMIRPUR	Optical Properties of Dissolved Organic Matter	Dr. Anubha Goel
48	Sarthak Rastogi	IIT PATNA	Mathematical Modelling of Viscoelastic Materials	Dr. Bishakh Bhattacharya
49	Saumya Ranjan Jha	NIT DURGAPUR	Understanding the deformation behavior of CoCuFeMnNi high entropy alloy by investigating mechanical properties of binary, ternary and quarternary alloy subsets.	Dr. N. P. Gurao
50	Shaivya Anand	HBTU	Optical Traps As Informative Nanoscale Probes	Dr. Debabrata Goswami
51	Shivangi Shukla	MANIT	MOSFET CHARACTERIZATION AND MODELLING	Dr. Y. S. Chauhan
52	Subin Pulari	NIT CALICUT	Dynamic Asymmetric Numeral Systems	Dr. Satyadev NandaKumar
53	Sufia	UCE RTU KOTA	INTERACTION OF A STRAIGHT EDGE DISLOCATION WITH A VOID DEFECT USING FINITE ELEMENT METHOD (FEM)	Dr. Anandh Subramaniam
54	Suryansh Agarwal	IIITDM JABALPUR	Pipe Health Monitoring Robot	Dr. Bishakh Bhattacharya
55	Swati Sharma	MNNIT ALLAHABAD	Effect of Coupling of Two Strings in a Musical Instrument	Dr. Anurag Gupta
56	Vikas Kumar Rathor	ISM DHANBAD	Designing Line Traps for Power Line Communication to Facilitate Smart Micro-Grid System	Dr. P. Sensarma

Participants of SURGE 2017 from IITK to Overseas University

S. N.	Name of the Participant	Project Title	Mentor
1	Ayush Gupta	Determination of release rate of urea from novel encapsulated fertilizers	Dr. Kathryn Mumford
2	Naman Jain	DNS study of flow in a 2D channel with smooth walls	Dr. Daniel Chung

Abstracts: SURGE 2017 Research projects done at IIT Kanpur

CONTACT FORCE CALIBRATION ON CAPACITIVE TOUCH-SCREEN
Aarsh Prakash Agarwal, Mentor: Prof. K.S. Venkatesh

Our objective is to implement pressure simulation on a normal capacitive touch-screen through software without a physical screen layer to detect pressure. We propose an android-app for smart phones that will work on normal capacitive touch-screen and sense different levels of pressure, most probably three, i.e., a gentle touch, a normal touch and a force touch. We are using android-studio software for developing our application which provides Java classes for accessing the size of the finger-print touching the screen and average pressure applied by the finger on the screen, both values calibrated between zero and unity.

INTERACTION OF A LINE VORTEX IN A ROTATING FLOW FIELD
Abeetath Ghosh, Mentor: Prof. Debopam Das

When line vortices are created in a pair of two counter rotating vortex they stabilize each other but they are very weak in nature when produced as a single vortex. We intend to increase the stability of a single line vortex by introducing it in a rotating flow field. We want to see how the direction of rotation can affect the stability of the line vortex. We are creating the rotating flow field by introducing four jets aimed tangentially to an imaginary circle whose radius is dependent upon the desired vorticity of the flow field. We have done some simulations on Ansys to predict how the velocity field will be under the influence of the four jets. We will use PIV technique to capture the interaction of the line vortex and the rotating flow field and already done some analysis on PIVlab of the images to understand the parameters of a line vortex like velocity, vorticity. The experimental setup is nearly ready, we are yet to carry out the experiments .

THERMODYNAMIC, KINETIC MODELING AND EXERGETIC ANALYSIS OF A DUAL FLUIDISED BED GASIFICATION OF COAL
Abhimanyu Bandopadhyay, Mentor: Prof. Santanu De

Gasification is a process of conversion of fuel into energy rich synthesis gas where the end products can be controlled and are environmental friendly. Synthesis gas can be used as a fuel in different cases like generating electricity, petroleum industries etc. But Gasification is an endothermic process so we require heat input which can be supplied from outside or from combustion of a part of fuel (dual fluidized bed gasification).

ENHANCING DESIGN OF A WIRE ELECTROCHEMICAL MACHINING(WECM) SETUP & DYNAMIC ANALYSIS OF CNC MICROMILLING MACHINE

Abhinav Chadha, Mentor: Prof. J. Ramkumar

Wire Electrochemical Machining(WECM) is the chemical counterpart of Wire Electric Discharge Machining(WEDM) with the main benefit of absence of tool wear. In ECM material removal takes place from the work piece due to anodic dissolution, which is separated from the tool(cathode) by the electrolyte. The anode work piece dissolves locally so that the shape generated is approximately negative mirror image of tool. Material is removed atom by atom hence thermal, mechanical distortions on the machined part are absent. WECM is a micromachining technique in which a thin wire which acts as the cathode is fed to the work piece. Materials with variable thickness which are otherwise difficult to machine using Wire EDM can be machined easily using this process and hence the process is employed for machining of macro and micro features in various difficult to machine materials.

SIMULTANEOUS LOCALIZATION AND MAPPING FOR MULTI-ROBOT SYSTEM USING RAO-BLACKWELLIZED PARTICLE FILTERS

Abhisek Panda, Mentor: Prof. Indranil Saha

SLAM or Simultaneous Localization And Mapping is the computational problem of constructing or updating a map of an unknown environment while simultaneously keeping track of an agent's location within it. This project mainly focuses on implementing a SLAM algorithm for a single bot in such a way that it can be extended to multiple bots(swarm) navigating the same area with only a few minor changes in the algorithm. It is assumed that suitable path planning techniques are available and hence the algorithm does not discuss about path planning.

FLOW INDUCED VIBRATIONS

Abhishek Sahoo, Mentor: Prof. Arun K Saha

The effect of natural frequency on oscillation of an infinite square cylinder was investigated. All numerical simulations were performed at a Reynolds number of 140 , which is below the critical Reynolds number of 150 at which flow past a square cylinder becomes three dimensional. The experiment was so designed that the relationship between natural frequency of the apparatus, FN and the Reynolds number is FN = 14:39=Re.

The current work deals with studying the coupled motion of a fluid and a solid. This happens all the time around us. It has many practical applications. When leaves flutter due to the wind, when the wings of a plane vibrate, and even under the sea in offshore structures, marine vessels etc.

EFFECTS OF CHANGING ILLUMINATION CONDITIONS ON AN OBJECT, AS VIEWED FROM DIFFERENT DIRECTIONS

Aditi Singh, Mentor: Prof. K.S. Venkatesh

One of the many problems in object recognition and computer vision is to track the differences coming in the image of an object on varying illumination conditions. This will be helpful to find out the lighting conditions to be met for the desirable showcasing of any particular object or any place as such. Many studies have been done on this topic and significant results have been found but the one in which this subspace of images under varying illumination has been greatly reduced in dimension is restricted to convex objects with Lambertian reflectance function.

HOW DIFFERENT IS A 3D TEXTURED STRUCTURE FROM A 2D PRINTED COPY

Aditya Bharat Shah, Mentor: Prof. Deepak Gupta

The problem statement we had was to establish a system to recognize 3D structures with 100 micron height, differentiate between 3D textured structures and their 2D clone images, classify them to be genuine and then search them in the database with least processing speed and computational space to make it scalable for use in a lightweight mobile application.

CHARACTERISING DELAMINATION OF FIBER METAL COMPOSITES SUBJECTED TO IMPACT LOADING

Aditya Pratap Singh Rajawat, Mentor: Prof. P. Venkitanarayanan

Fiber metal laminates (FMLs) are hybrid composite materials comprising interlaced layers of thin metal sheets and fiber reinforced polymers. The basic idea in developing FMLs was to combine the advantages from both the metal and the fiber-reinforce composite. The resulting hybrid structures have superior strength, fatigue resistance, fracture toughness, and impact resistance with excellent corrosion and moisture resistance whilst maintaining low density and saving costs.

Composites laminates and fiber metal laminates have several layers bonded together. Delamination between these layers can degrade the performance of these materials. Therefore, understanding their resistance to delamination is very important.

In this project, controlled experiments will be conducted to investigate the growth of delamination between layers under impact loading. Laminates will be prepared with embedded delamination in them and they will be subjected to dynamic indentation using a Hopkinson bar. The load and displacement history will be measured in real time. High-speed imaging will be used to track the growth of the existing delamination. By synchronizing the images with the load point displacement, the exact load at which delamination starts to grow will be obtained. From this information, the energy dissipated in the delamination process will be obtained.

DETECTION OF CYBER ATTACKS IN INDUSTRIAL PROCESS CONTROL SYSTEMS USING NEURAL NETWORKS

Aditya Srivastava, Mentor: Prof. Sandeep Shukla

For this we need Intelligent Intrusion detection systems that uses deep learning techniques2 like neural networks to defend against these attacks. I will develop an Anomaly based IDS using Neural Networks. To test the IDS I will develop a CPS (Cyber Physical System) simulating environment comprising of virtual plant and virtual supervisory system using Python Language and Virtualization Techniques and then create a network between virtual plant and supervisory system. Then I will deploy the IDS in virtual supervisory system and train it with data collected by supervisory system about normal operation of the plant and then induce false data injection attacks and analyze the behavior of IDS when plant operates normally and not normally.

SYNTHESIS AND CHARACTERIZATION OF THIN CUPROUS OXIDE LAYER OF METAL-SEMICONDUCTOR SCHOTTKY SOLAR CELL USING THERMAL OXIDATION PROCESS.

Aditya Srivastava, Mentor: Prof. Kamal K Kar

Cuprous oxide has been the material of great interest when it is first found to be a p-type semiconductor. Being a very cheap, easily available and nontoxic oxide properties of it, it has attracted much interest as an application as an active layer in solar cells. Now-a-days Silicon is being as a ruling element for making of solar cell, but a better synthesis of cuprous oxide can increase the efficiency of solar cell and it will be found in working in every household and industries. Cu2O (Red Oxide) has a direct bandgap of 2.1eV while CuO has 1.2eV with high absorption coefficient which implies that efficiencies of over 10% are theoretically possible in thin film cells. Due to lack of better synthesis of Cu2O, the maximum efficiency of solar cell was found to be of 3%. In our research we did the analysis of mixed oxides of Copper (Copper1 and II oxides) which was prepared using thermal oxidation process for the photovoltaic application. As metal-semiconductor junction (schottky solar cell) the results found was pretty satisfactory.

A MESSAGING SERVICE BASED ON PEER-TO-PEER SIP

Agrim Bari, Mentor: Prof. Y. N. Singh

Social Networks are a massively successful phenomenon used by millions of users to interact, and still a large number of systems deploy the centralized system version, wherein there is a relatively fixed hierarchy of routing proxies and user agents. An alternative solution for the same is a peer-to-peer overlay network wherein b oth endpoints of the communication session will implement a user-agent server and a user-agent client, enabling any two user agents to communicate directly with one another without the mediation of another central switching system, thereby improving the scalability and survivability in the event of central network outages, which we have named as B4 VoIP/Messaging.

B4 Messaging functionalities implemented so far can be classified into mutual authentication, generation of session key, encryption, message transfer and decryption.

CONTROL AND UTILIZATION OF KAMOMAN
Ahir Sudhendu Prashant, Mentor: Prof. Bhaskar Dasgupta

The robot being worked upon in this project is a mobile manipulator (referred to as KaMoMan henceforth). KaMoMan consists of a mobile robot and a robotic arm. The manipulator is mounted on top of the mobile robot. KaMoMan combines the dexterous manipulation capability offered by fixed base manipulators and the mobility offered by mobile robots.

KaMoMan is a robot built up in the Centre for Mechatronics IITK while the chassis was modelled and constructed by Robocon IITK for one of their own projects. KaMoMan has 2 quadrature encoder motor assemblies (for locomotion), 3 servo motors (in the manipulator arm), 4 ultrasonic sensors, 1 battery, 1 Bluetooth module and two Arduino Mega 2560 boards installed. With each motor assembly consisting of quadrature encoder, gearbox and motor. While one of the Arduino boards (referred to as Arduino1) carries out all the computation required for movement of KaMoMan and the manipulator arm, the other is right now used to transmit the data collected by various sensors.

INSTABILITY OF CONTACT-LINE SPREADING OF THIN LIQUID FILM
Ajay Kumar, Mentor: Prof. Naveen Tiwari

Applied temperature gradients produce thermocapillary stresses that can force liquid films to spread along solid surfaces. These films are susceptible to a rivulet instability at the advancing solid-liquid-vapor contact line, which is linked to the development of a capillary ridge near the advancing front. It is well known that surface tension of most of the common liquids decreases linearly with temperature. Due to a gradient in temperature at the free surface, gradient in surface tension is created. This gradient in surface tension leads to a thermo-capillary force called Marangoni stress.

There are two phenomenological models that are used to capture the dynamics of the advancing contact line. The precursor film model for perfectly wetting liquids is based on the introduction of a microscopic wetting layer ahead of the advancing film while slip model which is based on relaxing the no-slip condition at the solid-liquid interface, can be used for partially wetting fluids.

SIMULATION OF HEATING OF A FLAT PLATE BY JET IMPINGEMENT
Ajeet Singh, Mentor: Prof. D P Mishra

In many industrial areas where an efficient heat transfer is required such as for drying application and food industry, wall impingement jet flow configuration are encountered due to their high heat transfer performance. A directed liquid or gaseous flow released against a surface can efficiently transfer large amounts of thermal energy or mass between the surface and the fluid. This convective heat transfer is used for its high local transfer coefficients nearby the stagnation point. Heating by jet impingement is used with various geometric configuration and fluid material. The main objective of this paper is to compare the computational result with the experimental results performed by these researchers and also study the factors affecting the heat transfer coefficient.

A STUDY ON DIFFERENT PLASMONIC STRUCTURES
Akshay Mahajan, Mentor: Prof. Tanmoy Maiti

Different types of structures have been proposed till date for these plasmonic lenses. The aim of this work is to explore some of those structures along with proposing a new structure that could manipulate these SPPs in a much better way. The study is based on Finite-difference time-domain (FDTD) simulation in Lumerical along with logical explanation of the results combining with analytical simulation for the same in MATLAB.
We have proposed a circular linearly varying width (CLVW) plasmonic lens.
This lens can be used to obtain a bright focal spot at the geometric center of thelens. Also since we have thickness varying as a function of azimuthal angle it will add different phase to the surface at different angle and we can adjust this function to get various distribution of electric field intensity which lead to higher order plasmonic vortex.

NUMERICAL COMPUTATION OF DIFFUSE VIEW FACTOR BETWEEN PLANAR SURFACES.
Alankrit Srivastava, Mentor: Prof. Jishnu Bhattacharya

The analysis of the energy exchange by radiation between two surfaces depends largely on the knowledge of view factors, accurate evaluation of which is very important for many applications. A new representation for diffuse view factors is used which replaces the usual area integrals by more flexible contour (i.e., line) integrals. The new formulation generally simplifies the calculation of view factors. The advantages of the new representation are associated with the reduced order of the integrals (i.e., double reduced to single, quadruple reduced to double) which must be evaluated to calculate the view factor. Therefore, we propose a numerical method to determine the view factor between any pair of planar surfaces, by calculating numerically the double integral definition formula using contour integration technique with MATLAB as a platform.

SIMULATIONS OF VORTEX SHEDDING PAST A SQUARE CYLINDER NEAR A WALL
Aman Sharma, Mentor: Prof. Rakesh K. Mathpal

Periodic vortex shedding occurs when there is flow over the bluff bodies. This phenomenon is important and is observed in many engineering and environmental applications. The occurrence of this flow is due to the instabilities which is due to the geometry and Reynolds number. It has often been a cause of failure of structures which are exposed to such flows. Therefore, prediction of these phenomena is of great practical importance. Alternating eddies form behind a bluff objects give rise to the fluctuating lift and drag forces. It is of considerable importance and so are the occurrences of shedding and the influence of wall proximity on the shedding. Examples of engineering applications of this type of flow are: Tube placed near heat exchanger walls, boilers, condensers wires near wall or chimneys near tall buildings, to name a few.

The objective of the project is to find out the minimum G/D ratio of a square cylinder (where G is the distance between the wall and cylinder, and D is the hydraulic diameter of cylinder) which is placed near a wall by varying the distance between the wall and square cylinder. The G/D ratio (which is also known as dimensionless gap width) at which vortex shedding starts is the required minimum G/D ratio and the Reynolds number of that flow is known as critical Reynolds number.

EFFECTS OF HEAT CURING ON THE EXPANSION OF HIGH PERFORMANCE CEMENT BASED COMPOSITES PREPARED IN THE LABORATORY

Ankriti Shrivas, Mentor: Prof. K V Harish

Curing is an important process in the development of Portland cement based composites for controlling the rate and extent of moisture loss, ensuring an uninterrupted hydration process and maintaining adequate temperature during the early ages, all of which eventually affects their strength gain. Over the last few decades, heat curing has been used to develop high early strength composites for precast applications such as railway sleepers, waffle panels for bridge decks, girders, etc., which gives an equivalent strength provided by the same composite when normal water curing would have been followed for a 28-day period. However, during the application of heat, the composites tend to undergo expansions based on the temperature and relative humidity maintained during the curing process. These expansions are tensile in nature and the ability of the composite to withstand such expansions depend upon several variables including mixture proportions used, dosage of supplementary cementitious material (if used) and other parameters used during heat curing.

FLOW VISUALIZATION IN SOAP FILM TUNNEL

Anubhav Kumar Singh, Mentor: Prof. Sanjay Kumar

Soap film is a thin film made by the mixture of soap solution and water in a proportionate manner mixed thoroughly. Soap film is an approximate realization of 2D fluid flow. To produce this soap film there is requirement of experimental setup so we will be working on Soap film tunnel. Soap film tunnel is an experimental setup to visualize the flow through camera or any high quality photographic device which can capture the Karman Vortex Street formed on the soap film. Soap film tunnel can be of two types i.e., horizontal inclined soap film tunnel and vertical soap film tunnel. In vertical soap film tunnel flow is vertically downwards so it can be through the simple force of gravity. In horizontal inclined soap film tunnel flow is due to force of g ravity as well as its experimental design.

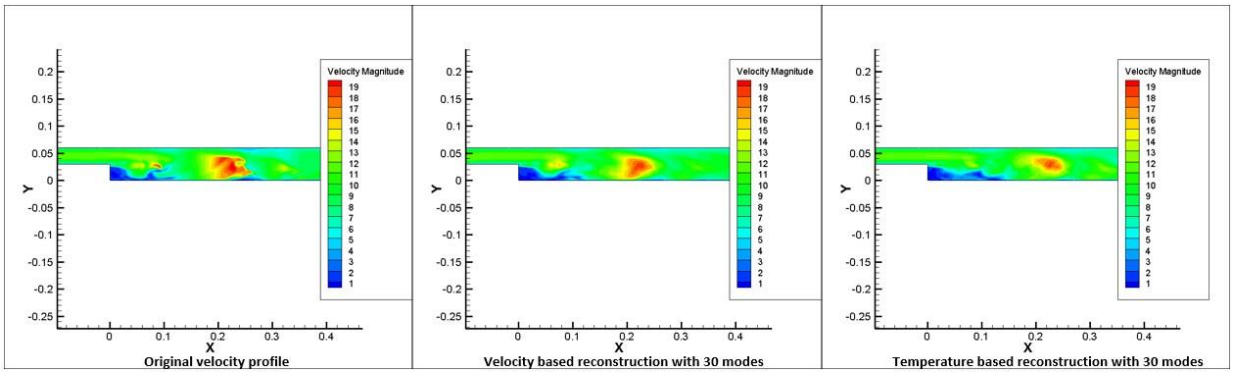
RANDOMIZED ALGORITHMS: THEORY AND PRACTICE

Anya Chaturvedi, Mentor: Prof. Surender Baswana and Prof. Satyadev Nanadakumar

A randomized algorithm for a given problem makes use of random bits during its execution on any given instance of the problem. The sequence of instructions carried out by the algorithm depends upon the random bits picked by the algorithm. As a result, either the running time of the algorithm varies over a wide range or the output itself might be wrong with some probability. This leads to a common belief especially among students at undergraduate level that the randomized algorithms are inferior to the deterministic algorithms. This is evident from the fact that almost every student would prefer merge sort to randomized quicksort until he/she carries out an experimental evaluation of the two sorting algorithm to realize that randomized quick sort almost always outperforms merge sort. In my project I am focusing on practically testing the linear time randomized algorithm for this problem given by Karger, Klein and Tarjan in 1995. Currently I am working on its implementation in which I am having to put in my own ideas for it to be as simple and straightforward as possible because the existing algorithm is too complex.

ANALYSIS OF FLOW ACOUSTIC COUPLING IN A HALF-DUMP COMBUSTOR
Aranya Dan, Mentor: Prof. Ashoke De

Numerical Simulations are carried out for a methane-air non-premixed half-dump combustor at Re=18000. To simulate turbulence, detached-eddy simulation in conjunction with steady flame let model (SF) is adopted and Light hill's acoustic analogy is used for computing the acoustic field using computational aero-acoustic simulation. Different post-processing statistical methods are used to analyses the results and study the structures formed.



ECONOMICS OF CYBER-CRIME
Arjun Gupta, Mentor: Prof. Praveen Kulshesthra

In the recent years, with the advancement of technology, the number of people using the internet has increased and simultaneously, there has been a large increase in the number of cyber-attacks and failure of security systems. The past few months saw cyber-attacks on various university websites with attackers demanding ransom to give back access to the websites. Moreover, the increased purchase of goods from online market in recent years makes the study of dynamics of these markets, a relevant topic.

EXPERIMENTAL OBSERVATION OF INSTABILITY IN ROUND LAMINAR BUOYANT JET
Arnab Mukherjee, Mentor: Prof. Debopam Das

Verification of the Critical Reynolds Number where transition occurs in a viscous buoyant laminar round jet. The jet in question is a water jet which is directed into a large water tank horizontally. No artificial disturbances are induced and the general surrounding of the test section is to be kept as disturbance free as possible (avoiding temperature based disturbances, physical disturbances).

The primary objective is to perform flow visualization of such jets using dyes and attempting to observe the jet evolution and the modes of instability at very low Reynold's Number of the range 5 to 200.An experimental setup is to be built from the ground up to perform this experiment.

SENTIMENTAL ANALYSIS ON HINDI TEXT

Arpitrama Chatterjee, Mentor: Arnab Bhattacharya

Sentiment analysis, also known as opinion mining refers to the use of natural language processing, text analysis, computational linguistics, and biometrics to systematically identify, extract, quantify, and study affective states and subjective information. Sentiment analysis aims to determine the attitude or opinion of a speaker or writer, with respect to some topic, or the overall contextual polarity or emotional reaction to a document, interaction, or event. Sentiment analysis is widely applied to voice of the customer materials such as reviews and survey responses, online and social media messages, and healthcare materials for marketing, better customer service and clinical medicine.

BATIO3@MNO2 BASED POLYMER NANOCOMPOSITES FOR HIGH ENERGY DENSITY APPLICATIONS

Ashay Anurag, Mentor: Prof. Raju Kumar Gupta

Capacitors are energy storage devices that have a wide range of applications which include bypassing, coupling/decoupling, filtering, energy discharging and various others. Incorporating inorganic nanoparticles (NPs) within polymeric matrices (dielectric) have great potential for capacitors with high energy density. This strategy employs nanostructures with specially designed morphology as fillers that would notably improve the energy storage. Various fillers including barium titanate (BaTiO3), calcium copper titanate (CCTO), titanium dioxide (TiO2), etc. have been used for polymer nanocomposites based capacitors. BaTiO3 NPs based fillers are widely used for its high dielectric constant, low dielectric loss and other excellent electrical properties. It has been widely documented that the properties of BaTiO3-based ceramics can be tailored to a large extent by incorporating different nanocomposites or functional groups. Interest in manganese dioxide (MnO2) based nanomaterials is shown because of their low cost, nontoxicity and availability in wide range of crystalline structures which allows their use in a range of applications namely batteries, supercapacitors, dopant for carbon nanotubes (CNT), etc.

PROGRESSIVE COLLAPSE ANALYSIS OF BRIDGE TRUSS

Ashutosh Rawat, Mentor: Prof. S K Mishra

Progressive collapse denotes an extensive structural failure initiated by local structural damage, or a chain reaction of failures following damage to a relatively small portion of a structure. This can be also characterized by the loss of load-carrying capacity of a relatively small portion of a structure due to an abnormal load which, in turn, triggers a cascade of failures affecting a major portion of the structure. Progressive collapse has played a role in such catastrophic events as the collapse of the Alfred P. Murrah Federal Building (Oklahoma City, 1995) and the World Trade Center towers (New York, 2001), but in a large number of less dramatic failures as well which also include some bridge collapses. The aim of my project is to analyse the robustness and collapse resistance of a bridge truss structure and come up with better design of truss to increase the collapse resistance.

IMPLEMENTING MACHINE TYPE COMMUNICATION ON A STANDARD 4G LTE RELEASE10 WIRELESS COMMUNICATION SYSTEM

Ashutosh Srivastava, Mentor: Prof. Rohit Budhiraja

3GPP Release 8(2008) introduced LTE for the first time, with a completely new radio interface and core network, enabling substantially improved data performance compared with previous systems. The release 10(2010) introduced the LTE advanced (4G LTE) technology which provided a significant uplift to the capacity and throughput of the system. 4G- LTE is currently the predominant technology in wireless communication as it is a very good, easily deployable network technology, offering high speeds and low latencies over long distances. Mobile Telephony, mobile broadband and media delivery are the main applications supported by these technologies. These applications are examples of information being communicated to and from human beings. The aim of this project is to refashion a standard 4G LTE communication system so that it can be utilized for Machine Type Communication. MTC does not require the very high data rates provided by the LTE but there are certain other requirements which need to be met. These are Lower Complexity leading to low cost, Enhanced Data Coverage and Low Power Consumption.

GESTURE BASED CONTROL IN LAPTOPS

Atul Kumar Pandey, Mentor: Prof. K.S. Venkatesh

As technologies are advancing, people are trying to minimise the communication gap between human and devices. Earlier keyboard was the only medium of communication with computers then came mouse then touch screen and so on. In recent years, gestures are becoming an intuitive and effective way of conveying commands to the machine. Gestures are expressive, meaningful body motions involving physical movements of the fingers, hands, arms, head, face, or body. In this project, hand gestures have been used. The idea of our project is to control laptops with simple commands which people use generally. While watching images- next, previous, rotate are the common commands whereas while web surfing click, double click, scroll up, scroll down and cursor control are mostly used. We have implemented all these commands in our project. You just have to wave your hand as you are talking to a friend and computer will do all you want.

WOUND HEALING HYDROGELS

Avi Gupta, Mentor: Prof. Kantesh Balani

Wound dressings form an integral part of the medicare industry worldwide. The number of wound healing dressings in UK increased from 4 in 1988 to 57 in 1998. As reported in 2007, this number increased upto 262. According to WHO∗, the number of deaths due to burns was 265,000 as reviewed in 2016. Transdermal drug delivery systems have various advantages over the traditional drug delivery methods such as oral, intravenous, tropical etc. The patch is capable of effective exudate management, maintains a moist environment for regeneration and provides a controlled release of medication along with the elimination of first pass effect. Thus, they are responsible for improving the regenerative efficacy of wounds along with the effective delivery of drugs. In this study, we mainly focused on chitosan based hydrogels which are mainly used for treatment of moderate and high exuding wounds such as burns and diabetic ulcers.

CANCER BIOMARKER (PSA) DETECTION USING PAPER BASED MICROFLUIDICS
Ayushi Tripathi, Mentor: Prof. Siddhartha Panda

Microfluidic paper based analytical devices are an emerging field of point of care diagnostic that are inexpensive, easy to use and designed for various purposes such as health diagnostics, environmental monitoring as well as food quality testing. An attempt is being made to develop such a device to detect PSA antigen in serum which is indicative of prostate cancer. We studied the commercially available HCG detecting strips and tried to fabricate PSA detection paper based strips taking their help.

WHOSE EXPECTATIONS AUGMENT THE PHILLIPS CURVE IN INDIA?
Ayushree Gupta, Mentor: Prof. Sohini Sahu

Inflation Expectations are known to influence actual inflation dynamics in an economy. It is thus important to study inflation expectations. Through this project, I have tried to estimate the Phillips Curve for the Indian economy using the inflation expectations of various socio-economic and demographic groups. I have tried to find out whose expectations influence inflation dynamics of the Indian economy the most. The study of survey based inflation expectations is quite new to India, not a lot of work has been done related to this. This is why I have chosen to work with the Inflation Expectations Survey of Households (IESH) data and shall be estimating the Phillips Curve using the General Method of Moments (GMM) technique. A similar study has been done by Carola Conces Binder, who used the data from the Michigan Survey of Consumers to find out whose expectations influence inflation in the US economy. She concluded that it was the expectations of high-income, college-educated, male and working people whose expectations play the largest role in inflation dynamics in the economy. I have been following this paper for my work.

STUDYING THE EFFECT OF WORKING TOGETHER ON THE CHANGE IN SOCIAL AND RELIGIOUS PREJUDICES.
BHAVY KHATRI, Mentor: Prof. Debayan Pakrashi

The Caste system in India has very deep roots, which dates back from Vedic Period. Caste is an age-old system of rigid social and ritual stratification of Indian society, implying the total exclusion of certain groups from the rights and opportunities for advancement. The most marginalized groups are the Scheduled Castes (SCs or Dalits) and the Scheduled Tribes (STs or tribals living in remote areas, or Adivasis). Caste status is endogamous, rarely can be changed (except through religious conversion) and implies a rigid occupational specialization. The modern day Caste system is subdivided into almost 3,000 jati groupings, that are related in a complex way to the original varna subdivision. Religion is one another facet of diversity in India, along with Caste. Hinduism largest religion professed by 80.5% people whereas Islam comprises of 13.4% population of India. However, some incidents like Partition, Babri mosque destruction, Godhra train burning, Gujarat violence, Assam violence, Muzzafarnagar riots has left deep scars between the peoples of different religions and leading civil unrest.

THERMOELECTRIC MODULES: ANALYSIS AND AUTOMOTIVE APPLICATION(S)
Bhuvan Beejawat, Mentor: Prof. Jishnu Bhattacharya

Thermoelectric modules are solid state energy converters. Thermoelectric materials are simply those materials which show thermoelectric effects in a strong and convenient form. The thermoelectric effect is the direct conversion of temperature differences to electric voltage and vice versa. A thermoelectric device creates voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, it creates a temperature difference. TEM devices can typically be classified into thermoelectric generators (TEGs) and thermoelectric coolers (TECs). TEGs convert thermal energy from a temperature gradient to electrical energy (Seebeck effect), whereas TECs convert electrical energy into a temperature gradient (Peltier effect).

PULSATILE FLOW OF A NON-NEWTONIAN FLUID IN A CHANNEL WITH SUDDEN EXPANSION-CONTRACTION
Biswajit Rath, Mentor: Prof. Kamal K Kar

Flow in a channel with a suddenly expanded part arises in many important engineering applications and fluid machineries. One such important area is the field of bio-fluid mechanics. The goal of the present study is to investigate the bifurcation behavior of steady and pulsatile flow of blood in a channel with sudden expansion followed by sudden contraction type of geometry. The effect of arrhythmic pulsation and physiological variation of blood viscosity will be the main highlights. Arrhythmia refers to any change in the normal sequence of electrical impulses of the heart. Studying arrhythmia through its symptoms is a very difficult task. Hence it is important that the consequences of arrhythmia on hemodynamics be studied properly.

NUMERICAL SIMULATION OF SUPERSONIC FLOW SEPARATION IN OVER EXPANDED PLANAR DE-LAVAL NOZZLE
D.S. Ramaswamy, Mentor: Prof. Rakesh K. Mathpal

In a Convergent – Divergent Nozzle, separation of the supersonic flow occurs when the nozzle operates at pressure ratios well below that of its specified design value. That is due to the adverse pressure gradients because of the low NPR (Net Pressure Ratio) which is accompanied by a shock wave formed exactly at a position where the flow is compressed in order to match the specified pressure conditions. Hence the flow downstream separates from the walls of the nozzle. Separation of supersonic flow in a convergent–divergent nozzle is a phenomenon that occurs in a variety of aerospace applications. In the one-dimensional, inviscid treatment the shock is normal and the flow past the shock stays attached to the wall, thus compresses subsonically to the ambient static pressure. In reality, flow detaches and forms a separation region near the wall. This is illustrated by the large discrepancy between predictions of quasione-dimensional inviscid theory and the actual behavior of the flow, as shown by Papamoschou.

In this paper, the flow discontinuity in a planar over expanded de-Laval nozzle is studied numerically for two-dimensional (2D) and three-dimensional (3D) nozzle geometries. It is done by simulating various mathematical models for moderate Area Ratios and Net Pressure Ratios (NPRs).

INCOME,WEALTH AND MORTGAGE STRESS: ANALYSING US DATA
Debasmita Das, Mentor: Prof. Arshad Rahman

The purpose of this report is to conduct a panel study of the US data relating to the housing market using sociodemographic and economic factors. The data to be analysed has been collected from PSID over the years 2001 to 2015, the data type being family level, which is available biennially. The difference between homeowners and renters has been examined in this regard. Among the homeowners, we also scrutinise the ones with mortgage and the ones not availing the mortgage facility. This report will try to study the mortgage stress on the US housing market over the years.

IMPLEMENTATION OF DISTRIBUTED DATABASE SYSTEM IN RUST
Debayani Sarangi, Mentor: Prof. Satyadev NandaKumar

The aim of this project is to emulate distributed database, Mnesia which is packaged with Erlang, in the Rust programming language. Mnesia is a multi-layered database, which includes a transaction layer on top of ETS (Erlang Term Storage) and DETS (Disk ETS). The project works on the implementation of ETS tables in Rust using in-memory B+ trees and DETS tables using on-disk B+ trees, which concludes the base layer of a multi-layered database architecture.

Rust is increasingly used as systems programming language, due to many advantages over C & C++. The primary advantage of rust over C & C++ is, it provides memory safety through the features of ownership, borrowing and mutability. Rust doesn't have a garbage collector, is nearly as fast as C and offers much more modelling power as C++.

Distributed database is a database in which portions of the database are stored in mutiple physical locations and processing is distributed among multiple database nodes. The advantages of using distributed systems is that it distributes the server across the resources available. Distributed databases can also be combined with concurrency and fault tolerance. Load balancing can be used to distribute the server loads across multiple nodes.

MECHANICAL PROPERTIES OF GRAPHENE HELICOIDS
Devang Goyal, Mentor: Prof. Shakti Gupta

Advancement of nanotechnology has greatly accelerated the miniaturization of mechanical and electric devices, particularly, the Nano electromechanical system (NEMS). Nanostructures are those structures that range between 1 nm (molecular scale) and 100 nm in at least one dimension. Most are synthetic and can be engineered to wide range of physical properties. Cylindrical nanotubes, Fullerenes and Nano spheres are common nanostructures. Among the most fascinating nanostructure morphologies are Graphene Helicoids.1-2The graphene helicoid (GH) structure was constructed according to the screw dislocations as observed abundantly in annealed pyro lytic graphite. We carry out the tensile test of Graphene Helicoids and calculate the total energy of the minimized structure (minimum energy configuration) at each point of this test using Molecular Mechanics and Molecular Dynamics simulations. Effect of passivation of H atom on the stretching process of these graphene helicoids is also studied.

FABRICATION OF LOW TEMPERATURE P-TYPE THIN FILM TRANSISTORS USING SOLUTION PROCESSED COPPER OXIDE

Devansh Saraswat, Mentor: Prof. Deepak Gupta

Our objective is to implement pressure simulation on a normal capacitive touch-screen through software without a physical screen layer to detect pressure. We propose an android-app for smart phones that will work on normal capacitive touch-screen and sense different levels of pressure, most probably three, i.e., a gentle touch, a normal touch and a force touch. We are using android-studio software for developing our application which provides Java classes for accessing the size of the finger-print touching the screen and average pressure applied by the finger on the screen, both values calibrated between zero and unity.

ANALYSIS OF INSTABILITIES IN A 3D COMPRESSIBLE VORTEX RING

Deya Sinha Roy, Mentor: Prof. Ashoke De

Simulation of compressible vortex rings forming at the open end of a shock tube in three dimension, captures the instability that develops in the ring, as it propagates away from the shock tube. The simulation has been carried out for the following flow regime by varying the shock Mach number, at constant driver length and shock tube diameter: 1. Ms=1.26 corresponding to subsonic jet regime In the above case, instability arises in the ring in the form of azimuthal waves breaking out on the circumference of the ring. In this analysis, the development of the instability and its effect on the ring parameters has been investigated.

EFFECT OF LEADING EDGE CONTAMINATION ON THE AIRFOIL PERFORMANCE

Diksha Swami, Mentor: Prof. Kamal Poddar

A series of experimental investigation on cambered airfoil M300 ADS has to be carried out to detect a boundary layer transition, using pressure measurement by ESP scanners at different angles of attack at Low Reynolds number (105-106). The objective was to determine the effect of leading edge contamination on the airfoil performance by using emery paper of various grit numbers and to compare the effect of angle of attack and Reynolds number on transition location and characterize laminar separation bubble if present with the plain surface of the airfoil. The primary measurement device used for this purpose is the ESP scanners.

The experiment was carried out in a 2D closed circuit wind tunnel having a test section of (60*12*48) cubic inches and maximum airspeed of 50m/s. The M 3 0 0 A D S c a m b e r e d a i r f o i l m o d e l u s e d f o r t h i s study has chord length and span of 244mm and 305mm respectively. The model contains 62 pressure ports, 35 on the top surface and 25 on the bottom surface, one at the leading edge and one at the trailing edge as shown in the figure1and2.The pressure measurement system consists of Electronic scanned pressure (ESP), multiplexer, and NI_ PXI data acquisition (DAQ) board. The pressure data acquisition was connected to motion control system which consists of geared DC servo motor.

NATURAL LANGUAGE QUESTION ANSWERING SYSTEM FOR UNSTRUCTURED DATA USING DEEP LEARNING

Gyanendra Pratap, Mentor: Prof. T. V. Prabhakar

Question Answering (QA) is a computer science discipline within the fields of information retrieval and natural language processing, which is concerned with building systems that automatically answer questions posed by humans in a natural language. In this project we have tried to implement a QA system using End to End Memory Networks. We have used a rule based QA generation system to generate training and testing data for the deep learning model. End to End Memory network is a Recurrent Neural Network (RNN) architecture model that takes a discrete set of inputs x1, ..., xn that are to be stored in the memory, a query q, and outputs an answer a. Each of the xi , q, and a contains symbols coming from a dictionary with V words. The model writes all x to the memory up to a fixed buffer size, and then finds a continuous representation for the x and q. The continuous representation is then processed via multiple hops to output a. This allows backpropagation of the error signal through multiple memory accesses back to the input during training. Using this deep learning approach, we are working to improve the accuracy of our QA system.

MOTOR AND BATTERY SELECTION FOR ELECTRIC LIGHT COMMERCIAL VEHICLE

Harsh Garg, Mentor: Prof. Sandeep Anand

Main challenges of an electric vehicle are limited driving range, high cost, and long charging time. In order to overcome these barriers, it is necessary to select the best power train components which can provide optimum efficiency as well as meet the vehicle specification requirement. Motor and battery pack ratings are the most important and influential parameters of a drive train which will decide the cost and range of the vehicle. Energy or power demanded by a vehicle is obtained by determining the various forces acting on a vehicle that opposes its motion.

QUANTUM COMPUTING

Harshita Saraogi, Mentor: Prof. Rajat Mittal

Every so often a new technology surfaces that enables the bounds of computer performance to be pushed further forwards. But conventional approaches to fabrication of computer technology are beginning to run up against fundamental difficulties of size. Quantum effects are beginning to interfere in the functioning of electronic devices as they are made smaller and smaller. In 1982, the Nobel Prize winning physicist Richard Feynman thought up the idea of ‘quantum computers’, a computer that uses the effects of quantum mechanics to its advantage.

Quantum computing takes advantage of the strange ability of subatomic particles to exist in more than one state at any time. Due to the way the tiniest of particles behave, operations can be done much more quickly and use less energy than classical computers. In classical model of computation, the most fundamental building block, the bit, can only exist in one of the two distinct state 0 or 1 whereas in quantum computers the rules are changed.

AN INNOVATIVE TYPE-2 FUZZY SYSTEMS APPROACH FOR CLUSTERING BASED IDENTIFICATION OF A T-S MODEL

Homanga Bharadhwaj, Mentor: Prof. Nishchal Verma

Techniques of modeling based on input - output data have been popularly used since time immemorial to devise models for nonlinear systems. The use of fuzzy logic in particular has been of great utility in describing complicated nonlinear dynamics in the presence of large uncertainty in data. Type 1 fuzzy logic was originally proposed by Zadeh for modeling systems by incorporating linguistic rules. Although this performed well in less data intensive situations, due to crisp membership values the scope of its ability to deal with high uncertainty in data was limited. Thus emerged Type 2 fuzzy logic, where the membership value of each data point is itself a Type 1 fuzzy set. Type 2 fuzzy logic is especially useful in this regard because it allows a more robust system identification even with the use of noisy data. Further, higher abstractions in system dynamics can be efficiently captured by employing a Type - 2 fuzzy system model. Among the various fuzzy models proposed till date, the Takagi Sugeno Fuzzy model continues to be among the most popular ones.

APPROPRIATE DAMAGE INDICATORS FOR STRUCTURAL HEALTH MONITORING

Ishank Modi, Mentor: Prof. Suparno Mukhopadhyay

Early identification of damage in a structure is of paramount importance in its service life; it is advantageous to avoid any undesirable failure of the structure. Several structures suffer from various kinds of damage in their life cycle. Examples include creep loading in historical monuments, live and dynamic loading on bridges, or just corrosion of the structural components. This study attempts to identify, assess, and localize the damage is the structure to help timely plan the suitable restoration measures which are both sustainable, as well as economic. In this study, appropriate numerical analysis will be performed to assess the available methods under the frequency domain, which primarily identify the structural damage, and further attempt to localize it.

GENERAL TREATMENT OF REFLECTION OF SPHERICAL WAVES FROM SPHERICAL SURFACE FOR ANITA EXPERIMENT

Jasbir Singh, Mentor: Prof. Pankaj Jain

The Antarctic Impulsive Transient Antenna (ANITA) experiment has been designed to study ultrahigh-energy (UHE) cosmic neutrinos by detecting the radio pulses emitted by their interactions with the Antarctic ice sheet using an array of radio antennas suspended from a helium balloon flying at a height of about 37,000 meters. The air shower produced by the interaction of the incoming Ultra High Energy Cosmic Rays or Neutrinos with the air molecules releases radiofrequency signals which are detected by the payload which can measure the angle of incident of the radiation and hence the detector can distinguish between the radiation incident directly from the air shower as well as the radiation incident after reflection from the Antarctic ice.

ANNEALING OF CNTS COATED COPPER SUBSTRATE

Jatin Jain, Mentor: Prof. Anshu Gaur

Carbon nanomaterials have revolutionized the field of material science in recent years. Individual carbon nanomaterials offer a wide range of useful properties pertaining to electrical conductance, thermal resistance, and exceptional strength, making them very interesting materials to a board range of industries. Graphene, a two dimensional monolayer of sp2-bonded carbon atoms has also attracted tremendous interest due to its electronic properties that makes it a promising candidate for Nano-electronics. The Growth of high-quality single layered graphene on copper has developed significant research thrust in the field of graphene based deposition of high quality and uniform thin films over large areas. Low solubility of C in Cu, along with its catalytic activity towards hydrocarbon gases render Cu a unique catalyst for scalable synthesis of graphene with controlled thickness. The mechanism is surface related due to peculiar interactions between Cu and atomic C (from hydrocarbon reduction) leading self-limiting growth of single layer of graphite.

LIGNIN COATED IRON OXIDE NANOPARTICLES FOR REMOVAL OF HEAVY METALS FROM WASTEWATER

Karnika Singh, Mentor: Prof. Raju Kumar Gupta

Nanotechnology has been proved to be the latest technology that has found its application in wastewater treatment. The aim of the present study is to synthesize iron oxide (Fe2O3) nanoparticles (NPs) coated with a biopolymer lignin and to use them as a nano-adsorbent for the removal of toxic heavy metals from wastewater. The iron is used as it is present abundantly in earth's crust and is cheaper than other metals. The heavy metals include copper, cadmium, lead, mercury, nickel, chromium, arsenic present in water. The polymer functionalized nanocomposite (PFNPs) formed possess the chemical and physical properties of both NPs and polymer such as high surface to volume ratio and high interfacial reactivity. The bare iron nanoparticles (Fe2O3) may agglomerate so PFNPs are preferred. The Iron nanoparticles(Fe2O3) are nontoxic and can be easily separated from the solution through magnetic separation.

INFLUENCE OF FREEZE-THAW CYCLES ON POLY (VINYL ALCOHOL) - SALT DISPERSION

Kartikey Sharma, Mentor: Prof. Yogesh Joshi

Poly(vinyl alcohol) (PVA) is a water soluble polymer that exhibit excellent film forming, emulsifying and adhesive properties. Due to its biocompatible nature, it has been extensively used in drug-delivery systems, biomaterials, sensors, membranes etc. PVA cryogels are formed as a result of the freezing of the concentrated solution, storage in frozen state and subsequent thawing. In these cryogels, the linkages of three-dimensional network of polymer chains are formed through non-covalent interactions. The properties of PVA cryogels depends on the number of freezing and thawing cycles, molecular weight and concentration. The aim of this work is to study how the addition of salt leads to modification of PVA gels properties. Addition of Salt could tailor the PVA gels properties and thus could enlarge its application fields. Here, the rheological behaviour of PVA-Salt system is investigated using Freeze-Thaw method.

HEAT AND MASS TRANSFER FOR PULSATILE FLOW THROUGH A CHANNEL WITH SYMMETRIC SUDDEN EXPANSION AND CONTRACTION

Kawarpreet Singh, Mentor: Prof. Malay Das

Fluid flow in a two-dimensional symmetric channel with sudden expansion and contraction is one of the classical problems in fluid mechanics. The above geometry is quite common in various engineering applications like heat exchangers, fuel cells, reactors. The geometry plays an important role in applications like burners, spray dryers.
Magnetohydrodynamic (abbreviated as MHD) flows are important in many industrial equipment like MHD generators, pumps, bearings. MHD is also used in metallurgy, ship propulsion and fusion reactors. In all the above applications, the fluid is electrically conducting.
The conventional heat transfer fluids, like water, have low thermal conductivity. Researchers are working to enhance the heat transfer and compactness of system. Free convection heat transfer in the presence of magnetic field was studied by Sheikholeslami et al.

LOAD SPECTRUM AND FATIGUE LIFE OF AIRCRAFT

Kirtish Panchal, Mentor: Prof. C S Upadhyay

Our objective is to design a MATLAB modelling for load spectrum of aircraft components and calculate their fatigue life. To perform modelling for the above experiment it is required to learn the concepts of MATLAB programming. For this project we require to gain theoretical knowledge about basic Fatigue terminologies such as fatigue life, safe life, damage tolerance, endurance limit, SN curve, Miner Rule etc. To calculate fatigue life of the aircraft first we need stress history of that component for which fatigue life is to be calculated. This can be obtained from the strain gauge equipment installed on the surface of the component, then we have to prepare a histogram (load V/S time graph) from the strain gauge data. After this we have to now split loads into load levels and make another histogram to calculate number of stress exceedances from the curve. Now draw another curve between load levels and number of stress exceedances. This series of curves are known as load spectrum. Now we have to extract data from the load spectra and calculate fatigue life of the component using MINER'S Rule.

SPORTS BALL AERODYNAMICS

Kunjal Shah, Mentor: Prof. Sanjay Mittal

Aerodynamics plays a prominent role in defining the flight of a sports ball travelling through the air. The different forces acting on a sports ball define its trajectory and are responsible for interesting flight phenomena associated with these sports, for example, the swing of a cricket ball, the knuckleball effect on a slowly rotating football or the curveball effect on a baseball pitched with top spin. The aim of this project is to measure the force coefficients on various sports balls in a low turbulence wind tunnel. The data generated can be utilized in modeling the trajectory of the ball. The balls chosen for testing are golf ball, hockey ball, baseball, football, tennis ball, volleyball and shuttlecock (synthetic, feather and gapless). Despite not being used in actual matches, gapless shuttlecocks were also chosen to understand the effect of the gaps in the skirt of the shuttlecock, which has been discussed in a previous computational study by Verma et al. (2013).

NUMERICAL SIMULATION OF FLOW PAST A SQUARE CYLINDER USING DETACHED SPLITTER PLATE IN FRONT AT LOW REYNOLDS NUMBER

Kushal Joshi, Mentor: Prof. Arun K Saha

The effects of detached splitter plate kept in front of square cylinder at different gap ratios, on vortex formation behind the square cylinder, when an incompressible fluid flow past it, were investigated numerically. The length of the splitter plate is taken equal to the dimension of the square cylinder (D) and thickness of the plate is taken as 3% of its dimension (D). The grid used for this simulation is a non-uniform grid with minimum spacing of 0.005. The method adopted for solving the Navier Stokes equation for incompressible fluid is Marker and cell (MAC) method which uses Finite Difference Discritization. The numerical study is done for six different gap ratios (G/D) which are 0.25, 0.5, 1, 2, 2.5 and 3. Furthur, for each gap ratio (G/D) the z-vorticity is calculated and plotted to analyze the vortex shedding for each case. The accuracy of the Navier stokes solver is validated by the simulation of flow past the square cylinder without the splitter plate. The overall discharge coefficient is calculated and plotted to know the nature of suppression at different gap ratios.

MODELING QUESTION ANSWERING SYSTEM USING UIMA and UIMAFit

Lovish Arora, Mentor: Prof. T. V. Prabhakar

Unstructured information may be defined as the direct product of human communication. According to web, around 80−90% of all potentially usable information is in unstructured form. There exists a wide variety of artifacts (segment of unstructured content) including speech, video and audio apart from text. The purpose of this study is to use unstructured information in text form for utilization by NGOs for its operations. An example query could be 'How to raise funds for a given NGO for a specific purpose?' In order to achieve stated purpose, work has been done to provide a Question Answering platform which end users can query by entering factoid type questions. UIMA is an acronym for Unstructured Information Management Architecture.

TORSION DRIVEN INFLATION AND MAGNETOGENESIS

M. V. S. Saketh, Mentor: Prof. Pankaj Jain

Torsion in Poincare gauge theory, is the antisymmetric part of the lower indices of the Affine connection which naturally arises when the most general set of Gauge fields are chosen for coupling matter fields to gravitation [9]. For the standard Gravitational Lagrangian R; It couples directly and linearly with the intrinsic angular momentum of fields. However, when the electromagnetic largrangian is minimally coupled with curvature and torsion, it loses its gauge invariance which is a very crucial feature of electromagnetism. To fix this, Hojjman proposed a restricted form of torsion [10] which is equivalent to restricted the Gravitational Gauge fields which could be generated through the derivatives of a single scalar field which he called the \taplon" field. This preserves the gauge invariance of electromagnetism and also allows the contribution of torsion to the gravitational lagrangian as that of a simple scalar field.

ALGEBRAIC NUMBER THEORY
Mahenoor Ali, Mentor: Prof. Sudhanshu Shekhar

Fundamental theorem of arithmetic says that every integer greater than 1 can be written as product of power of primes uniquely up to order of the factors. This property of unique factorization of numbers into power of primes fails in a general number field.
A suitable notion is the unique factorization of ideals into product of power of prime ideals. The questions of primary importance in number theory, like the existence of solutions to Diophantine equations can be resolved through the properties such as whether a ring admits a unique factorization, the behavior of ideals and Galois groups of fields.

ECONOMIC RETURNS TO BEING RELIGIOUS - EVIDENCE FROM NORTHERN IRELAND
Manish Chauhan, Mentor: Prof. Debayan Pakrashi

Northern Ireland has been and continues to be deeply divided on the basis of religion I.e. on Catholics and Protestant lines. It saw great violence in the past arising out of conflicts b/w the Catholics and the Protestant.
We wish to look whether factors like religion, degree of religiousness, education, marital status among many other factors impact economic returns of an individual or household. We would further be analyzing whether there is a negative (or positive) impact of mingling with the other religion group.

OPTIMISING ROBOTIC SWARM MOVEMENT
Manish Kumar Bera, Mentor: Prof. Indranil Saha

Describing complex spatial specifications for swarms is a non-trivial task. Our goal is to optimize the cost of the collective motion of the robots from initial configuration to final configuration.

We consider a grid A of size n × n. We will refer the collection of all the robots in the grid as swarm. We will have R number of robots. No two robots can occupy the same cell of the grid, and a robot will occupy only a single cell of the grid. In a time-step, each robot can either move to an adjacent cell, or may remain in the same cell. We define a time step as the time period after which a robot can execute a move.

We wish to extend the developed implementation to include more complex motion primitives for smoother trajectories. We also wish to optimize the motion primitive cost using MAX-SAT. We further hope to enhance the computation speed using techniques like multi-threading, and optimization methods such as pre-computation of constraints.

3-D GESTURE BASED ANDROID AUTHENTICATION
Mansi Dubey, Mentor: Prof. K. S. Venkatesh

3-D Gesture based Authentication system in Android is basically a Motion dependent system which enables the user to make gestures in the air holding their Android device and results in launching the desired app or perform some other specified action like unlocking, calling etc. assigned to the corresponding gesture. Here we are potentially using our Android device having an inbuilt accelerometer sensor as an IMU. An IMU works by sensing motion including the type, rate, and direction of that motion using a combination of accelerometers and gyroscopes. We are limiting our Gesture sensing using Accelerometer readings alone. However, for enhanced accuracy, Gyroscope sensor's (present in a few Android devices) readings can also be employed for the angle detection (rotational) purpose.

STTC BASED ROBUST IMAGE AND VIDEO RECONSTRUCTION OVER WIRELESS SENSOR NETWORK.
Mohd Abbas Zaidi, Mentor: Prof. Aditya K. Jagannatham

The project aims to achieve robust reconstruction based on STTC coding towards image/ video reconstruction after transmission in a wireless sensor network. The aim is to use channel coding to improve the existing levels of quality over media transmission and thus to allow applications with severe fading. It is planned to use channel coding along with the existing work to achieve better results. STTC or Space Time Trellis Code transmits multiple redundant copies of the same data(trellis) distributed along space (through multiple antennas) and time (at different instants). The probability of error decreases since the same data is being transmitted along different streams. The task also includes coming up with a decoder which simultaneously decodes the channel coded signal with algorithm in also applied to it. STTC can provide coding gain because of the trellis structure which creates a code relationship between the space and the time domains. In order to reduce the BER at a given SNR, a coding gain is required which can be achieved by STTC.

CFD ANALYSIS OF IMPINGEMENT COOLING OF FLAT PLATE BY AIR JET
Nilesh Sharma, Mentor: Prof. D P Mishra

All the modern machineries and electrical equipment works on principle of energy conversion. A part of this energy gets converted into heat and thus raises the temperature of the equipment which many a times exceeds the operating temperature due to thermal properties of the components. The prime solution of this problem is the cooling of the concerned part (electrical appliances), many times it is also desirable to increase the efficiency of the machine(turbine). Various cooling techniques have been employed nowadays out of which impingement cooling is preferred mostly due to high heat transfer.
This project is focused on CFD analysis of cooling of a flat plate by an impinging air jet to obtain the value of Nusselt number. Computations are performed by SST k- ω turbulence model and the effect of different performance parameters (nozzle to plate spacing; Reynolds number and Prandtl number) is analyzed.

LEAD-FREE INORGANIC PEROVSKITE SOLAR CELL

Nishkarsh Agarwal, Mentor: Prof. Tanmoy Maiti

Solar energy is a promising sustainable energy source that provides an environmentally friendly supply of energy and has been considered as one the main candidates to overcome the future energy crisis. However, the present market comprises mostly of first generation (crystalline silicon) cells and some percentages of second generation (amorphous silicon, CdTe) cells. Hence, it is necessary to reduce the total cost of solar energy, either through increased efficiencies or lower cost per photovoltaic cell. Third generation cells seem to meet with these issues especially sensitized solar cells. Dye-sensitized solar cells solved the problem to some extent but use of liquid electrolyte result in their poor stability and higher packaging cost. The advancements in solid state DSSCs brought a revolution in solar cells. Perovskite solar cells (PSCs) have emerged recently with low materials cost and power conversion efficiencies (PCE) similar to the well-known CIGS and CdTe solar cells and became the fastest improving solar cell technology we have ever seen.

INVESTIGATING THE ROLE OF CELL ADHESION MOLECULES IN DORSAL FOREBRAIN MIDLINE INVAGINATION.

Ojorshy Basak, Mentor: Prof. Jonaki Sen

In the vertebrate embryo the forebrain anlagen develops from the anterior-most region of the neural tube which is the precursor of the central nervous system (CNS). The roof plate located at the dorsal midline region of the forebrain anlagen, acts as a source of several secreted molecules involved in patterning and morphogenesis of the forebrain. One such key morphogenetic event is the invagination of the forebrain roof plate which results in separation of the single forebrain vesicle into two cerebral hemispheres. When this invagination has been blocked it results in the formation of an undivided cerebrum which is similar to that observed in a human developmental disorder known as holoprosencephaly. It has been implicated that Retinoic Acid (RA) and Bone Morphogenetic Protein (BMP) play a significant role in this process. My aim was to find whether cell adhesion molecules (CAMs) especially Cadherins and Integrins have any involvement in dorsal forebrain midline invagination.

CONTROL OF WINGTIP VORTICES BY USING DIFFERENT WINGTIP CONFIGURATIONS

Palak Pandya, Mentor: Prof. Kamal Poddar

One of the primary obstacles limiting the performance of aircraft is the drag that the aircraft produces. This drag stems from the vortices shed by an aircraft's wings, which deviates the local relative wind downwards (an effect known as downwash) and generates a component of the local lift force in the direction of the free stream.
This aim of this experimental project is to control wing tip vortices which generates induced drag and to get a better understanding of the effects produced by the winglets. A rectangular wing model and seven different configuration of winglets are fabricated and would be tested at various wind speeds and angles of attack in the wind tunnel. The performance of the winglets and induced drag is investigated by using a six- component force measuring device balance.

DESIGN AND ANALYSIS OF AN ULTRALIGHT AIRCRAFT
Palak Singh, Mentor: Prof. C S Upadhyay

The idea was to design an ultralight aircraft that could carry a payload of 30-40kg and should not exceed the limit of 280kgs with a desirable range and endurance. The conceptual design is inspired by a model named ison airbike. Its historical data and performance characteristics were reviewed. Schrenk method was used to calculate the lift distribution and thus the wing loading along with the bending, shear and torsion forces. Schrenk method proposed that the lift distribution per unit span length is the mean value of actual wing chord distribution and an elliptical wing chord distribution that has the same area and the same span. The shear forces, bending moments, torsion and general load distribution was analysed over the wing. The optimal wing loading was calculated to be around 115oz/ft^2.

THF HYDRATE FORMATION AND ITS APPLICATION
Pankaj Kumar, Mentor: Prof. P K Panigrahi

The principle of hydrate desalination is shown in Figure 1.6. The hydrate cavities are very selective. Only certain molecules with appropriate diameters such as methane, ethane and cyclopentane can enter the cavities, leaving the ionic compounds such as sodium chloride in the bulk phase. In other words, no salt exists in hydrate structures. Fresh water can be obtained through melting the separated hydrates from the bulk liquid phase.
Nucleation: to form hydrates rapidly. The objective is to promote hydrates hydrate seeds and nucleation agents produce hydrates in a shorter time and thus decrease.
Hydrate growth: to form more hydrates. The purpose of hydrate desalination is to transfer more water from the saline solution into hydrate structures. hydrate produces fresh water. With more hydrates formed, more fresh water produced.

MATERIALS AND ENERGY BALANCE IN ELECTRIC ARC FURN
Pankaj Kumar, Mentor: Prof. Amarendra Kumar Singh

The aim of this work is to create a representative mathematical model of heat and material balance in EAF to analyze the process of steelmaking for the quantities of raw materials and energy consumption optimal for producing a ton of steel of the any specific composition. In the electric arc furnace (EAF) steel production processes, scrap steel or with mixes of scrap and DRI is principally used as a raw material instead of iron ore. For production of high quality steel, unwanted tramps like Cu, Cr, Ni, etc. are to be removed using highly pure substituting materials, DRI (Directly Reduced Iron) which is produced by direct reduction of iron using H2 and CO.
Heat and mass balance calculations of the blast furnace process at steady state aim at two objectives. Firstly, they aim at characterizing the operational efficiency of a given EAF based on measured results. Secondly, they intend to predict future results of the same EAF under different operating conditions.
The first calculations are based on all measured data. Briefly, this includes mainly the quantity, temperature and chemical analysis of all the materials entering (DRI, scrap oxygen, etc.) or exiting (liquid metal, slag, top gas, dust) the electric arc furnace.

MATERIALS AND ENERGY BALANCE IN ELECTRIC ARC FURN

Payal Jain, Mentor: Prof. Amarendra Kumar Singh

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HRTF PHASE SYNTHESIS AND ITD CALCULATION USING GROUP DELAY COMPENSATION FILTER FOR PERSONALIZATION

Prabhsimrandeep Singh, Mentor: Prof. Rajesh Hegde

Head-related transfer function represents the acoustic transfer function from the sound source position to the entrance of the blocked ear canal of a human subject under anechoic conditions. In binaural synthesis, virtual source sounds are implemented by convolving anechoic signals with measured HRTF for a specific spatial angles. There are many potential applications of HRTFs such as 3D audio for games, live streaming of events, music performance, virtual reality, training and entertainment.

SIMULATION OF MAGNETORHEOLOGICAL ABRASIVE FLOW FINISHING PROCESS

Pragati Satish Rao, Mentor: Prof. J Ramkumar

Magnetorheological Abrasive Flow Finishing process is one of the evident advancements in the world of precision engineering. Effective control over rheological properties of abrasive laden magnetorheological finishing medium yields freeform structures with good surface finish. Magnetorheological polishing fluid (MRP) is composed of silicon carbide abrasives and carbonyl iron powder dispersed in the viscoplastic base of grease and paraffin oil. The rheological behavior of fluid changes in vicinity of external magnetic field. Surface finish relies on the finishing forces which can be controlled harnessing the smart behavior of MRP fluid.
In current study, an attempt is made to simulate the in-house developed MRAFF process. The model comprises of eight permanent magnets arranged around a work piece fixture bearing an acrylic replica and the asymmetric work piece. The MRP fluid generates a spatially varying magnetic field at different points on the work piece surface in vicinity of magnets. The magnetic field leads to formation of magnetic brush owing to its magnetorheological behavior. A brief study on rheology of the MRP fluid is carried out to interpret viscosity model for the flow of Non-Newtonian shear thinning fluid.

SHUTTLECOCK ANALYSIS

Prajapati Soham Jagadishchandra, Mentor: Prof. Sanjay Mittal

In order to understand the aerodynamics of shuttlecock used in the sport of badminton, computational study of shuttlecock is carried out. To study the effect of gaps and crinkles in the skirt of synthetic shuttlecock, computations are carried out for three different models of shuttlecock: synthetic shuttlecock (Mavis 350), synthetic shuttlecock without gaps and synthetic shuttlecock without crinkles. The flow over crinkle-less model will be compared with that of normal model in order to study the effect of crinkles and the flow over gapless model will be compared with that of normal model to study the effect of gaps in the skirt. The computations are carried out in a frame of reference attached to the shuttlecock.

BRIHASPATI-3

Prajwal Gaurav Sah, Mentor: Prof. Y. N. Singh

Brihaspati-3 is an open source java servlets based content delivery system. Administrator(admin) is the main authority of Brihaspati. The software is free of cost. We can enter in to Brihaspati as a student, instructor & admin mode. Guest can enter direct to Brihaspati but the instructor & student account is created by the admin. Brihaspati provides the features of glossary, calculator The login & password of guest is guest. Every instructor is independent to register student in their specified course. Instructor & student have their unique password of login. Brihaspati gave full freedom both to the instructor & Student to come in contact with each other through Mail, chat, etc.

CONTROL OF FLOW IN BACKWARD FACING STEP USING SYNTHETIC JET

Pranav Santosh Kulkarni, Mentor: Prof. Ashoke De

The effect of backward step on a channel flow in a 2D, unsteady, incompressible flow have been studied. The step height (h) used is almost half of the channel height (H) while its length was equal to its height. Direct Numerical Simulations (DNS) were performed for the above configuration for Reynolds numbers (Re) 20 and 50. Our results do not match with the existing results but the error is correctible and the work on that is in progress.

The flow around a backward facing step has been studied in the past. Biswas, Breuer and Durst have studied the separation region for a backward step flow for an expansion ratio (H/h) of about 2 and Reynolds numbers varying from 10-4 to 800. They reported that the reattachment length increases with increasing Reynolds number.

In another study by Armali, Durst, Pereira and Schonung the results obtained were similar for Reynolds numbers ranging from 70 to 8000.

Thus, the existing papers have data regarding the flow characteristics past a backward step but not many papers exist which have used synthetic jet as a means to reduce the separation region.

END TO END LEARNING FOR TEXT TO VIDEO GENERATION
Prannay Khosla, Mentor: Prof. Vinay Namboodiri

With the increase in use for GANs for building Generative Models for all kinds of data, one of the standard questions is that can we build videos on demand. The aim of this project is to build an end to end learning model that learns in an unsupervised manner to build videos from text.

The model consists of 3 major sub-models.
The first is an attention based model which gives us an embedding for every frame of the video. Further, there is a generative model which builds frames given the embedding for said frame. The third part is a LSTM which uses the input as the previous frame to come up with an embedding which when combined with a text level embedding gives the input embedding for the next frame which is used by the Generative Model to generate the next frame.

Every adversarial model requires a Discriminator model which tries to discriminate between real and computer generated input which therefore motivates the generative model to learn better and hence generate nearly real output. The discriminator network again is more than a simple Neural network, but instead is a tree based model. It tries to differentiate between every said frame to train the generator and it tries to differentiate between pairs of frames, in order to train the LSTM.

STUDY OF REDUCTION CHARACTERISTICS OF ALUMINA-SUPPORTED NICKEL OXIDE
Prantar Dutta, Mentor: Prof. Goutam Deo

Nickel has emerged as the leading transition metal for synthesizing catalysts due to its high activity and selectivity towards certain reactions and low cost compared to its noble metal counterparts. Supported nickel catalysts are widely used in industrially important reactions like steam reforming of methane, methanation of CO/CO2 and hydrogenation of various organic compounds.
During synthesis of nickel catalysts, nickel oxide is initially formed which requires subsequent reduction. Literature review suggests that nickel oxide is never completely reduced. This study is aimed at understanding the reduction kinetics of alumina supported nickel catalysts and suggesting methods to improve the reduction of the supported nickel oxide phase.

PVDF-TrFE SENSOR
Prashant Kumar, Mentor: Prof. Deepak Gupta

MIM sensor can be made by making use of either ITO coated glass slabs or polyamide films. In case of ITO, Silver has been used as the topmost metal with ITO itself serving as the base metal layer. However, in case of flexible sensor (polyamide), Aluminum serves as both the top and bottom layer metal. PVDF-TrFE film serves as the intermediate layer in both the models.

REINFORCEMENT LEARNING FOR ADAPTIVE MOBILE SINK SCHEDULING IN CLUSTERED AND ASYNCHRONOUS WSN

Pratyush Garg, Mentor: Prof. Rajesh Hegde

Wireless Sensor Networks (WSNs) are a collection of a large number of nodes that can sense their environment and communicate with each other. However, these sensor nodes possess limited processing power and batteries. WSNs are generally randomly deployed and the possibility of recharging the sensors is minimal if not zero. Due to this, energy efficiency is a vital area of research in WSNs.

Several surveys (cite) reveal the different ways that may be used to optimize the performance of the network, and mobile sinks form a huge part of them. They reduce the distance of communication between nodes and the sink and hence save energy. Unfortunately, the usage of a mobile sink ushers in problems of data latency and buffer overflow which are difficult to deal with in a random network, i.e. where the behavior of the sensor nodes is not known in advance.

INVESTIGATING THE ROLE OF METABOLISM RELATED GENES IN DEVELOPMENT OF VERTEBRATE NERVOUS SYSTEM

Prince Kumar, Mentor: Prof. Jonaki Sen

A Genome-Wide Screen of Metabolism Related Genes (MRGs) in the chick embryo was carried out by Dr. Priti Roy in Dr. Amitabha Bandyopadhyay's lab at IIT Kanpur to investigate if this was true. She shortlisted 1620 genes encoding metabolic enzymes and transporters/carriers from Gene Ontology Database and performed whole mount RNA in-situ hybridization for all shortlisted genes across 4 developmental stages (HH18, HH22, HH26, HH28) of chicken embryo. 410 genes were expressed in a tissue-restricted manner while 32 genes were expressed in ubiquitous manner in the developing embryo. Moreover, she also performed a time course of the expression of MRGs in chicken in different organs across 4 developmental stages. For example, in case of the gut, the number of MRGs expressed at early stages (HH18, HH22) was very low in comparison to later stages (HH26, HH28). Conversely, in neuronal structures, the number of MRGs expressed at the early stages was very high and decreased gradually at the later stages.

ROBUST FEATURE EXTRACTION USING DEEP STACKED AUTO-ENCODER

Radhit Dedania, Mentor: Prof. Nishchal Verma

The main objective of this research project is to find suitable representations of input data in the form of uncorrelated, distinct and well-informative features which could provide far better classification, when fed to a classification algorithm, in comparison to the case when the input data is directly fed into the classifier. The algorithm will be implemented on data sets like Lung Cancer dataset, Prostate Tumor dataset etc. The performance of the proposed method is checked on the basis of AUC(area under ROC curve) values.

LINEAR STABILITY ANALYSIS OF FLOW PAST A RECTANGULAR CYLINDER PLACED IN A CHANNEL

Raghav Gupta, Mentor: Prof. Arun K Saha

The formation of vortices past a bluff body has always been an interesting phenomenon. The vortex shedding becomes periodic after a certain Reynolds number known as the critical Reynolds number. Blockage ratio (β), which is the ratio of obstacle size to channel height, affects the critical Reynolds number. An attempt is made to study the effect of blockage ratio on various parameters like Critical Reynolds Number, Strouhal Number etc. A linear stability analysis on a square cylinder is performed to find these parameters. Results will be compared with that obtained from DNS.

ADHESION ENHANCEMENT OF CONDUCTIVE INKS ON NON-POROUS SUBSTRATES FOR PRINTING APPLICATION

Raghav Mittal, Mentor: Prof. Anshu Gaur & Prof. Ashish Gupta

We explored the idea to enhance adhesion between the hydrophobic, inert surfaces of nonporous substrates and the deposited electrically conducting inks via an intermediate adhesive layer. The substrates considered included both glass and flexible counterparts like Polyethylene Terephthalate(PET) and Polyimide(PI). To pack more transistors and circuit elements within a given area requires a reduction in the line width of the interconnects. This, however, has a setback. The wettability of the ink formulation affects the limit to which we can reduce the line width. And if we tamper with the wettability the adhesion strength stands compromised. Hence our motivation was to optimize between high adhesion and low wettability such that the line width of the interconnects can be further reduced.

A TWO-DIMENSIONAL DIFFERENCE ALGORITHM

Riya Jindal, Mentor: Prof. Satyadev Nandakumar

The program diff reports differences between two files, expressed as a minimal list of line changes to bring either file into agreement with the other. Diff has been engineered to make efficient use of time and space on typical inputs that arise in vetting version-to-version changes in computer-maintained or computer-generated documents. Time and space usage are observed to vary about as the sum of the file lengths on real data, although they are known to vary as the product of the file lengths in the worst case. The central algorithm of diff solves the ‘longest common subsequence problem’ to find the lines that do not change between files. But Diff is line-oriented, and is not flexible enough to handle column-type comparisons. We factor this problem into the sub problem of finding longest common subsequence and the sub problem of finding shortest edit script in two dimensions. In this research, we aim to provide solution for the column-diff problem. Firstly, we enhance the breakthrough algorithm by Eugene W. Myers, which was the first algorithm to deliver a longest common subsequence using only linear space. Our enhancement allows the algorithm by Myers for positional alteration of the input field to facilitate comparisons respective to a particular column element. This algorithm is based on an intuitive edit graph formalism.

DEVELOPMENT OF COMPUTATIONAL TOOLS FOR FREE ENERGY CALCULATIONS OF CHEMICAL REACTIONS

Rohit Goswami, Mentor: Prof. Nisanth N. Nair

Free energy simulations have been providing an increased understanding of the driving forces involved in a wide range of interesting phenomena in chemistry and biophysics. Te metadynamics or hills method is a relatively new molecular dynamics technique aimed to enhance the sampling of separated regions in phase space and map out the underlying free energy landscape as a function of a small number of order parameters or collective variables. We propose to parallelize an already efcient serial code used in the popular molecular simulation program CPMD for reconstructing and visualization (Vreco). Also we plan to implement metadynamics toolkit for integration into a wavelet based DFT program, BigDFT. Currently no such implementation exists, limiting its utility for simulating chemical reactions

MUSIC SIMILARITY USING RABINDRASANGEET

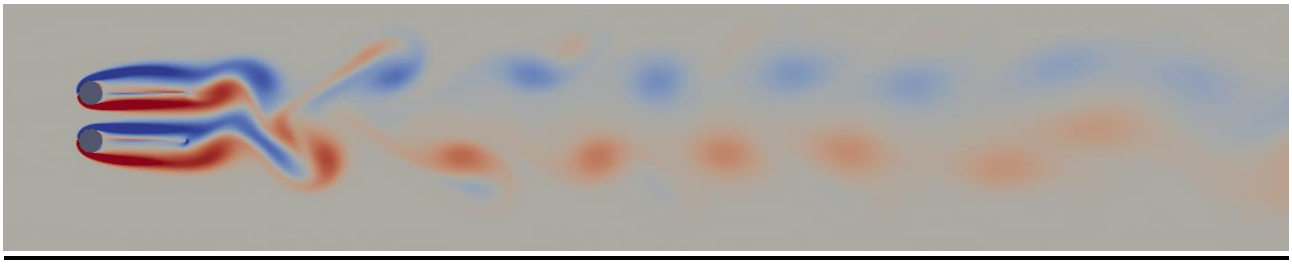
Rohit Kumar Bose, Mentor: Prof. Arnab Bhattacharya

To compare songs, we shall be using the chroma features that are derived from a piece of audio. It is a well-known phenomenon that human perception of pitch is periodic in the sense that two pitches are perceived as similar in \color" if they differ by an octave. Chroma features are an interesting and powerful representation for music audio in which the entire intensity spectrum is projected onto 12 bins representing the 12 distinct notes (or chroma) of the musical octave. This is a many-to-one mapping, as all members of the same pitch class are mapped to the same bin. Essentially, chroma feature gives us a rough idea of the musical notes being played in a time-window. This serves our purpose, since we also want to check if artists hit the correct note, corresponding to the swaralipi.

COMPUTATIONAL FLUID-STRUCTURE INTERACTIONS

Saakar Bhatnagar, Mentor: Prof. Sanjay Mittal

To simulate Re=150 flow over two side-to-side cylinders in 2D with flexible splitter plates, and to obtain the variation of forced oscillation frequency, maximum amplitude of displacement etc. by varying first mode frequency of the plates.
Approach: The fluid and structure meshes are prepared separately, with an in-house flow solver being used to simulate the flow, and the open-source software Calculix being used to simulate the stresses and displacements of the beam. The study first required mesh convergence of both the fluid and structure meshes.



Flow at Re=150. Vortex Shedding is observed in the developed flow.

UIMA - AN ARCHITECTURAL APPROACH TO CONVERT UNSTRUCTURED INTO STRUCTURED INFORMATION

Sandhaya Kumari, Mentor: Prof. T. V. Prabhakar

UIMA is an architecture in which basic building blocks called Analysis Engines (AEs) are composed in order to analyze a document. At the heart of AEs are the analysis algorithms that do all the work to analyze documents and record analysis results (for example, detecting person names, place etc.). These algorithms are packaged within components that are called Annotators. AEs are the stackable containers for annotators and other analysis engines.
How Annotators represent and share their results is an important part of the UIMA architecture. To enable composition and reuse, UIMA defines a Common Analysis Structure (CAS) precisely for these purposes. The CAS is an object-based container that manages and stores typed objects having properties and values. Annotators are given a CAS having the subject of analysis (the document), in addition to any previously created objects (from annotators earlier in the pipeline), and they add their own objects to the CAS. The CAS serves as a common data object, shared among the annotators that are assembled for an application.

TRADE-OFF BETWEEN DISTORTION AND LIFETIME FOR WIRELESS NETWORKS

Sarthak Jain, Mentor: Prof. Ketan Rajawat

The Internet of Things paradigm envisages the presence of many battery-powered sensors and this entails the design of energy-aware protocols. Source coding techniques allow to save some energy by compressing the packets sent over the network, but at the cost of a poorer accuracy in the representation of the data. This project addresses the problem of designing efficient policies to jointly perform processing and transmission tasks.
In wireless networks, there are many batteries powered sensors (called nodes) which transmit information to a central base station. Each node is assigned a certain battery level. In this project, these nodes are considered to send data in a TDMA fashion. The time is divided into frames. In each frame, we require to transmit a certain length of data (depending on the compression ratio) with a certain power for a certain time duration. The power, time duration and compression ratio decide the amount of energy that has been used in that particular frame.

OPTICAL PROPERTIES OF DISSOLVED ORGANIC MATTER

Sarthak Mehta, Mentor: Prof. Anubha Goel

Optical properties such as absorbance and florescence are used to assess the dissolved organic matter (DOM) composition and infer sources and processing. Absorbance is defined as a measure of the capacity of a substance to absorb light of a specified wavelength whereas florescence is defined as the property of absorbing light of short wavelength and emitting light of longer wavelength. Over the two months of study we will be measuring changes in commonly used optical properties and will see whether they link to original DOM source.

MATHEMATICAL MODELLING OF VISCOELASTIC MATERIALS

Sarthak Rastogi, Mentor: Prof. Bishakh Bhattacharya

This is the part of ISRO project which involves dynamic analysis of Inflated Torus Structures. Material which is generally used in space antenna is Kaptaan which is one kind of viscoelastic material. So identifying suitable mathematical model is primary task before going into its Finite Element Modelling. This project is aimed at developing mechanical models of viscoelastic materials on the basis of vibration transmissibility status. Materials that are used in space applications doesn't obey Hooke's law. For such materials stress is neither directly proportional to strain neither it is directly proportional to strain rate. They are related to strain and strain rate in complicated way. These deviations are called "Stress Anomalies". So for such materials modified Hooke's law holds good. Thus it is required to fit a mathematical model by some appropriate arrangement of spring-damper combination which can be fitted in Finite Element Analysis of such materials using softwares such as Ansys or Abaqus.

UNDERSTANDING THE DEFORMATION BEHAVIOR OF COCUFEMNNI HIGH ENTROPY ALLOY BY INVESTIGATING MECHANICAL PROPERTIES OF BINARY, TERNARY AND QUARTERNARY ALLOY SUBSETS.

Saumya Ranjan Jha, Mentor: Prof. N. P. Gurao

High entropy alloys are multiprincipal multi-component alloys comprising of five or more elements in equal or near equal proportions (5 to 35 atomic percentage), that have attracted attention of researchers over the last decade, due to their promising properties. High entropy alloys (HEAs) derive their name from the high configurational entropy of mixing associated with elements in equal or near equal proportions, which has been debated in the recent past. Most of the investigations on HEAs have focused on mixture of high entropy phases and till recently Cantor’s alloy (CoCrFeMnNi) was the only single phase quinary HEA to be investigated in details. Recently, Tazuddin et al. developed a unique procedure to decipher single phase HEAs using CALPHAD approach and investigated single phase face center cubic CoCuFeMnNi alloy to understand the micro-mechanisms of deformation at a large strain, using crystallographic texture and mechanical testing.

OPTICAL TRAPS AS INFORMATIVE NANOSCALE PROBES

Shaivya Anand, Mentor: Prof. Debabrata Goswami

Over the course of this summer project, an insight into the working of and uses of optical tweezers is to be garnered. An emphasis is put on the rheological and temperature effects of the optical tweezers and the implications for trapped objects. The uses and data assimilation of such experiments is also to be understood. This midterm report contains the basic background and direction of the project.

MOSFET CHARACTERIZATION AND MODELLING

Shivangi Shukla, Mentor: Prof. Y. S. Chauhan

The aim is to understand the importance of compact modelling, study the equations involved in BSIM3 and BSIM4 model, fit the characteristic curve of designed MOS in IC-CAP. Analytical or compact models are based on device physics. Fitting parameters are introduced to improve the accuracy of the model. Models used in compact modeling are BSIM3 and BSIM4. BSIM4, as the extension of BSIM3 model, addresses the MOSFET physical effects into sub-100nm regime. It is a physics-based, accurate, scalable, robustic and predictive MOSFET SPICE model for circuit simulation and CMOS technology development. After the selection of model, the next step is the simulation of the model. Simulation is the process of generating device and circuit output characteristics based on an available model. The accuracy of a model determines how well simulated characteristics agree with the real physical behavior of devices and circuits. Simulator hpeesofsim (Advanced Design System simulator (ADS)) is used to simulate the model.

INFLATION AS A MONETARY PHENOMENON IN THE INDIAN CONTEXT: AN EMPIRICAL APPROACH

Shreya Shree, Mentor: Prof. Surajit Sinha

Inflation is one of the most commonly known yet the most misunderstood of economic phenomena. There is already a vast body of research that attempts to assess its nature and propose remedies. Milton Friedman, the Nobel laureate economist, has averred, “Inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output.” The objective of this research project is to examine this statement in the Indian context.

For purpose of this research, three alternative variables have been considered – reserve money (M0), narrow money (M1) and broad money (M3) for the monetary component. The rationale behind considering M0 as a factor is that reserve money affects narrow and broad money through their respective multipliers.

DEVELOPMENT OF DENSITY FUNCTIONAL THEORY METHODS FOR MOLECULAR COMPUTATIONS

Soumyadeep Datta, Mentor: Prof. Nisanth N. Nair

Density functional theory (DFT) is a computational quantum mechanical modelling method to investigate electronic structure of many-body systems, particularly atoms, molecules and condensed phases. It derives its name from its usage of functional of spatially dependent electron density to predict properties of many-electron systems. DFT is among the most popular and versatile methods used in condensed matter physics, computational physics and computational chemistry. DFT has been popularly used in solid-state physics calculations since 1970. The calculated results were quite satisfactorily close to experimental data and computational costs were significantly less compared to traditional approaches based on multi-electron wave functions, such as the Hartree-Fock theory and its descendants. However, it was not regarded to be accurate enough for quantum chemistry calculations until around 1990.

DYNAMIC ASYMMETRIC NUMERAL SYSTEMS
Subin Pulari, Mentor: Prof. Satyadev NandaKumar

To consider the possibility of Adaptive/Dynamic variants of Asymmetric Numeral Systems (Encoding/Decoding by learning the probability distribution of the source 'on the fly'). If found, these variants have to be formalized.
To give rigorous proofs for the optimality of Asymmetric Numeral Systems and its main variants (unlike the intuitive arguments found in most literature concerning ANS).
To characterize the distributing functions used in ANS on their ability to produce encoding with low average code word length.

INTERACTION OF A STRAIGHT EDGE DISLOCATION WITH A VOID DEFECT USING FINITE ELEMENT METHOD (FEM)
Sufia, Mentor: Prof. Anandh Subramaniam

Microstructure of crystalline materials plays very significant role on mechanical and physical properties which are basically governed by presence of different defects. For example, dislocation in the materials plays vital role in plastic deformation. However, role of dislocation is not only limited to plasticity phenomenon. Study of dislocation stress fields in a domain will give insight of diverse phenomenon in the material.
Considerable theoretical work had been carried out on behavior of dislocations in infinite crystals. In 1951, Eshelby determined the stress fields and strain energy of an edge dislocation in an infinite plate. The effect of finite domain size on the edge dislocation has also been studied, wherein the configurational forces experienced by the dislocation due to proximity of free surfaces have been determined. Some interesting phenomena have been discovered in Eshelby plates (thin domain with an edge dislocation) like "stability of an edge dislocation", "materials analogue of zero stiffness structures", using finite element simulations.

PIPE HEALTH MONITORING ROBOT
Suryansh Agarwal, Mentor: Prof. Bishakh Bhattacharya

Almost all the energy related utilities like fuel, gas or oil supply lines and power generation sources require an extensive network of pipelines for various transportation purposes. These pipelines, however, have limited life cycles due to various types of static and dynamic loads originated from both inside and outside the pipe; as well as, due to natural processes of degradation such as oxidation and corrosion of the pipe surface, and joint failures due to abrasion. In order to inspect such defects, a pipe health monitoring robot is developed which passively crawls inside the compressed air pipeline.

EFFECT OF COUPLING OF TWO STRINGS IN A MUSICAL INSTRUMENT
Swati Sharma, Mentor: Prof. Anurag Gupta

A string instrument is a musical instrument having several strings that makes sound by vibrating the strings on it, which are plucked to produce sounds. Each string has a different frequency, which can be obtained by adjusting the tension in the string. In nearly all stringed instruments, the sound of the vibrating string is amplified by the use of a resonating chamber or soundboard. A bridge is a device that supports the strings on a stringed musical instrument and transmits the vibration of those strings to some other structural component of the instrument such as a soundboard, for example violin, guitar etc. transfer the sound to the surrounding air. The current work tries to understand the effect of coupling of two strings coupled together. The strings are of same length with one end fixed and another end is coupled with the help of a combination of spring and a dashpot.

CONTROL OF FLOW SEPARATION OVER A FORWARD FACING STEP
Ujjwal Pradeep Khandelwal, Mentor: Prof. Ashoke De

Flow separation is a phenomenon that appears under variety of flow conditions and encountered in many engineering applications. The effect of forward step on a channel flow in a 2D, unsteady, in-compressible flow have been studied. The step height (h) and length (L) used is almost half the channel height (H). Direct numerical simulation (DNS) of flow over such a Forward Facing Step at low Reynolds number (150) has been carried out. Our results do not match with the existing results but the error can be rectified and work is still in progress.

DESIGNING LINE TRAPS FOR POWER LINE COMMUNICATION TO FACILITATE SMART MICRO-GRID SYSTEM
Vikas Kumar Rathor, Mentor: Prof. P. Sensarma

Communications play a key role in distributed generation based smart micro-grid system. New functionalities such as smart metering, demand side management (DSM), and grid protection that make the grids ‘smart’ require the communication network to function properly. One solution applied to implement the communication medium in power distribution grids is power line communication (PLC). There are power cables in the distribution grids, and hence, they may be applied as a communication channel for the distribution-level data.

DESIGN AND IMPLEMENTATION OF A WIRELESS SYSTEM: MACHINE TYPE COMMUNICATION ON LTE (RECEIVER SIDE)
Vishad Viplav, Mentor: Prof. Rohit Budhiraja

This project involves design, implementation and then demonstration of a LTE system capable of Machine Type Communication. The system would be based on version 13 LTE standards by 3GPP and built on an existing framework of version 8 LTE. Implementation and demonstration would be done on a Software Defined Ratio from National Instruments. I am working on the receiver part of the system.

Abstracts: SURGE 2017 Research projects done in Overseas University

DETERMINATION OF RELEASE RATE OF UREA FROM NOVEL ENCAPSULATED FERTILIZERS

Ayush Gupta, Mentor: Prof. Kathryn Mumford

Novel encapsulated fertilizer products were manufactured via solvent vapor treatment of liquid marbles stabilized with various functional monomers, creating a polymer film, which are subsequently dehydrated. This type of material has many advantages over currently available products primarily due to the almost limitless tenability of the surface chemistry of the film formed and ease of manufacture.
Specifically, for fertilizer products, these benefits include control over water permeation rates into the capsule via manipulation of the pore size of the polymer film coating and disintegration of film triggered by external stimulus like pH, UV and temperature. The combination of these design features provides an added capability for fertilizer products for specific applications and requirements thereby improving nitrogen efficiencies. A simple methodology was used to gauge the release rate of the nutrients from the liquid marbles via salicylate method.

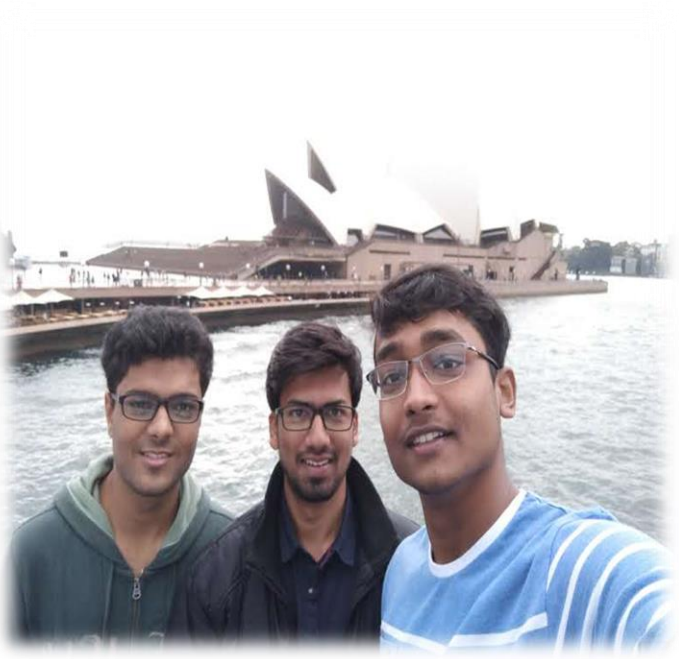
DNS STUDY OF FLOW IN A 2D CHANNEL WITH SMOOTH WALLS

Naman Jain, Mentor: Prof. Daniel Chung

The project aims at understanding the compressibility effects on the flow in a 2D smooth channel by comparing it for two different Mach numbers, 0.1 and 0.5. A compressible flow solver with periodic boundary conditions is used in both the cases and the mean velocity profile and the mean density profiles are compared to conclude that at Mach number of 0.5 the compressibility effect is significant whereas at Mach number of 0.1 the flow can be effectively classified as an incompressible flow.

This report presents the results obtained by simulating a case of a 2D channel flow with smooth walls. The aim of the report is to compare the cases of compressible and incompressible flow using a compressible flow solver in HIPSTAR. Two simulations were run for the cases of Mach number 0.5 and 0.1. To compare the two cases, the rest of the parameters were kept identical. The bulk Reynolds number was estimated to 6793 and the pressure gradient was then set to -5.89×10-4. As a steady state was desired, periodic boundary conditions were applied to the stream-wise component of velocity and to temperature and the pressure gradient was set to a constant value. The walls were set to isothermal condition and no slip boundary condition was imposed on the velocity field.


LIONS



SURGE 2017 Popular Lectures

Prof. Akashsdeep Bansal is pursuing PhD with Prof. M. Balakrishnan at School of Information Technology, IIT Delhi. Here, he is working with the ASSISTECH group, worldwide known for its first product SmartCane. He earlier completed Master of Technology in Optoelectronics and Optical Communication from IIT Delhi in 2016 and Bachelor of Technology in Electronics and Communication Engineering from Uttar Pradesh Technical University, Lucknow in 2014.

Title: "Tools and Techniques for accessing STEM content and challenges in Reading Accessibility for Visually Impaired"

Abstract: We always thought that Science and Engineering are not for visually impaired due to its high involvement with Mathematics, Graphics and Laboratory. This talk will help you in changing your perception and will aware you with the various tools and techniques for accessing STEM (Science, Technology, Engineering and Mathematics) content with the help of the screen readers (Text to Speech software). We will start with discussion over various commercially available tools and techniques for accessing Mathematical content, making printed text accessible, accessible IDEs for various programming languages and accessing molecular diagrams, etc. We will conclude with the discussion over various challenges needs to be address towards reading accessibility for visually impaired.

Prof. Praveen Kulshreshtha is currently the Professor in the Department of Economic Sciences at Indian Institute of Technology, Kanpur. His area of interest is Microeconomics, Industrial Organization, Econometrics, Economics of Corruption (Governance), Business Ethics.

Title: "Ethical Leadership in Organizations"

Abstract: Contemporary organizations must strive to be ethical to succeed, given the complex ethical concerns that they face in today's global environment. This talk focuses on the principles of ethical leadership and illustrates their relevance to present-day enterprises, by using examples and cases drawn from the enterprises in higher education and development enterprises. The ethics of personal leadership (in particular, Aristotle's ethics of prudence and self-development, and "personality based" leadership versus "character-based" leadership) and the ethics of interpersonal leadership (specifically, Confucian ethics of interdependence and Covey's win/win paradigm of human interaction) are elucidated and their usefulness in developing contemporary organizational ethics is examined.

Prof. Mohit Law is currently the Professor in the Department of Mechanical Engineering at Indian Institute of Technology, Kanpur. His area of interest is Machining dynamics; Machine tool design and analysis; Dynamic substructuring; Vibration damping, isolation and control; Process-machine interactions; High performance machining; Model order reduction; Machining with robots.

Title: "Manufacturing: Why does it matter"

Abstract: This talk will explore the role of manufacturing in society, and address why it is important in the Indian context. I will motivate how manufacturing is a value multiplier, and discuss its central role in the process of industrializing nations and making them more prosperous. I will discuss the share and growth of employment in knowledge intensive manufacturing industries. I will offer some perspectives on the potential for manufacturing to play a transformative role for India to reap the benefits of a demographic dividend. The talk will conclude by addressing the role of higher education in addressing manufacturing specific challenges faced by the nation.

Prof. K. S. Venkatesh is currently the Professor in the Department of Electrical Engineering at Indian Institute of Technology, Kanpur. His area of interest is Signal processing, Image and Video processing, Computer vision with applications in Robotics, Signal and System Theory.

Title: "Vision Based Human Computer Interfaces: Some Examples"

Abstract: Human computer interfaces have become necessary because users Are faced with the severe limitations of the keyboard and mouse to communicate with a computing device. The main problem with these conventional devices is their speed of communication (bandwidth) and also the constrained modalities that they are capable of, which fail to exploit the much higher bandwidth signals that a human can produce. More recent interfaces include touch and speech.
Here, we will present a few examples of different kinds of gestures that will be visually recognized by the computing device to produce signals within the computer

SURGE 2017 Awards

"Dr. Elizabeth and Dr. Verkey Cherian Award" for Best Project and an "Outstanding Poster Award" for Best Poster who produce exceptional quality research during the SURGE program. Award of Rs. 5000 plus a commendation certificate will be given to SURGE students for best project and an Award of Rs. 5,000 plus a commendation certificate for Outstanding Poster will be given to SURGE students.

This year SURGE Evaluation committee has been shortlisted the following SURGE participants for SURGE 2017 Awards.

BEST PROJECT AWARD

S. N.	Name	Project Title	Mentor Name
1	Aditya Srivastava	Detection of Cyber Attacks in Industrial Process Control Systems using Neural Networks	Prof. Sandeep Shukla (Computer Science & Engineering)
2	Ashay Anurag	BaTiO3@MnO2 based polymer nanocomposites for high energy density applications	Prof. Raju Kumar Gupta (Chemical Engineering)

BEST POSTER AWARD

S. N.	Name	Project Title	Mentor Name
1	Ojoshy Basak	Investigating the role of cell adhesion molecules in dorsal forebrain midline invagination.	Prof. Jonaki Sen (Biological Sciences & Bioengineering)
2	Vishad Viplav	Design and implementation of a wireless system: machine type communication on LTE (receiver side)	Prof. Rohit Budhiraja (Electrical Engineering)

Acknowledgement

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1. The faculty mentors at IIT Kanpur and the students for their enthusiastic participation.

2. The generous donors who made contributions to support the program.

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

4. Prof Abbas Rajabifard, Associate Dean, International and Beth Hunter, Global Mobility Coordinator at University of Melbourne for developing cooperation.

5. Department faculty coordinator and the Project Evaluation Committee.

6. Mr. Abhishek Singh and Ms. Shobhi Srivastava of SURGE office for coordinating the SURGE program.

SURGE 2017 Batch

From Bottom to top

Row 1 (Left to Right): Saumya, Ayushi, Ayushree, Shreya, Kartikey, Kaushal, Mr. Abhishek Singh, Dr. Sudhir Kamle, Ms. Shobhi Srivastava, Deya, Abhimanyu, Abeetath, Prantar, Mehnoor, Swati, Palak Pandya, Aditi.

Row 2 (Left to Right): D. S. Ramaswamy, Karnika, Anya, Aditya Srivastava, Pankaj, Jasbir, Suryansh, Jatin, Prajwal, Sarthak Rastogi, Sarthak Jain, Sandhaya, Sufia, Riya, Shivangi, Aditya, Prannay, Aman.

Row 3 (Left to Right): Ajeet, Mansi, Abhinav, Aditya Srivastava, Ashay, Lovish, Alankrit, Gyanendra, Vikram, Prajapati Soham, Saakaar, Vishad, Harsh, Sarthak Mehta, Kawarpreet, Ojoshy, Prince, Arnab.

Row 4 (Left to Right): Anubhav, Rohit, Shaivya, Arpitrama, Ankriti, Harshita, Devang, Biswajeet, Manish, Ashutosh, Devansh, Akshay, Bhavy, Ishank, Rohit, Devang, Aranya, Palak.

Row 5 (Left to Right): Soumyadeep, Atul, Prabhsimrandeep, Agrim, Pratyush, Arjun, Avi, Ahir, Ajay, Raghav, Pranav, Ujjwal, Mohd. Abbas, Aditya Pratap Singh, Radhit, Nishkarsh, M.V.S. Saketh, Pankaj Kumar, Bhuvan, Nilesh, Prashant, Kritish.