IIT KANPUR

SURGE 2018

(STUDENTS-UNDERGRADUATE RESEARCH GRADUATE EXCELLENCE)

ANNUAL REPORT

Message from Dean, Research & Development

Dear SURGE Friends,

Congratulations to all the 2018 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 1300 applications were received from different colleges and 123 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 2018), one SAARC student (from Nepal) was selected under SURGE program

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 43 students received full support (stipend of Rs 12,500 for the eight-week summer program) while 3 students received partial support and one student from Nepal received full support from the funds raised from external sources.

Project Funded

This year 24 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 52 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 2018 from IITK

S. N.	Name of the Participant	Mentor Name	Project Title
1	Abhinav Arora	Dr. Rajdip Mukherjee	Phase Field Modeling of fine alpha/beta microstructure in beta-Ti alloys
2	Abhishek Datta	Dr. K. S. Venkatesh	Facial Gesture Recognition
3	Abhishek Karmakar	Dr. Sameer Khandekar	Thin Liquid film thickness profile using optical grid deflectometry
4	Aditya Garg	Dr. Ketan Rajawat	Simultaneous Localization and Mapping
5	Aditya Prakash Singh	Dr. Sudhanshu Shekhar	Algebraic Number Theory
6	Aditya Singh	Dr. Ishan Sharma	Structural model for optical fibre
7	Amartya Kumar Prusty	Dr. Vishal Agarwal	A DFT study to model Aldol Condensation of Furfural with Acetone in Sn-BEA zeolite
8	Anamay Ashwin Samant	Dr. Amitabha Bandyopadhyay	Elucidating the Contribution of Chondrogenic Lineage To Developing Bone in Mice
9	Anant Chopra	Dr. Abhishek Gupta	Use of Local Information for Traffic Assignment
10	Ankit Kumar	Dr. Bhaskar Dasgupta	Quantum Query Complexity
11	Ankita Anjali	Dr. Anandh Subramaniam	Semicoherent to Semi-Semi Coherent transition in precipitates
12	Anshul Yadav	Dr. Tarun Gupta	Global Burden of Diseases: An Insight through Air Pollution
13	Aryaman Jha	Dr. Amitabha Bandyopadhyay	Investigating the role of ECM adhesion gradient in proximo-distal patterning of embryonic limb
14	Astha Gaur	Dr. Suparno Mukhopadhyay	Railway bridge health monitoring using train load induced vibrations
15	Avijit Kalra	Dr. Sri Sivakumar	Development of non-aqueous electrolytes for supercapacitors
16	Ayush Rai	Dr. Anindya Chatterjee	Study of Visual Feedback Systems for Speech Therapy and Hearing Impaired

17	Bhumika Ojha	Dr. Saumyen Guha	Modeling of tidal circulation and sediment transport in the Gulf of Khambhat using analytical and numerical approach
18	Bnvs Shravan Kumar	Dr. Nalinaksh S. Vyas	Contact Stress Analysis and Rolling Contact Fatigue Life Estimation in Rail-Wheel.
19	D S Abhishek	Dr. Rajesh Hegde	Small World Wireless Sensor Network Development using Collaborative Beamforming(CB)
20	Dhananjay Singh	Dr. Vimal Kumar	Analysis of Good versus Bad Behaviour using Evolutionary Game Theory
21	Dhruv Mittal	Dr. Kantesh Balani	Finite element modeling of thermally processed LAT971 novel alloy
22	Dipankar Dutta	Dr. Alakesh Mandal	Linear Stability Analysis and Transient Growth Analysis of Measured Velocity Profile
23	Harshit Nyati	Dr. Rajesh Hegde	Buffer Aware Intelligent Mobile Sink Scheduling in Asynchronous Wireless Sensor Networks
24	Jaidev Ashok Narayan Swami	Dr. K. Poddar	Further Studies of the Sweeping Jet Oscillator
25	Jatin Jindal	Dr. Swaprava Nath	Truthful Peer Grading With Partial Observation
26	Krishan Singhal	Dr. Anindya Chatterjee	Closed loop Feedback control in discontinous friction model
27	Kshitiz Shukla	Dr. Yogesh M Joshi	Unstable flow of thixotropic fluids in low shear rate regime
28	Kshitiz Tyagi	Dr. Amit Kumar Verma	VO2 based relaxation oscillators
29	Kushlam Srivastava	Dr. Sudhanshu Shekhar	Galois Theory
30	Maharshi Kumar	Dr. Sanjay Mittal	Effect of a trip on the flow past a 3D circular cylinder in the regime of drag crisis
31	Mayank Shrivastava	Dr. Aditya K. Jagannatham	mmWave Model for Wireless Sensor Networks
32	Mohammed Asad Karim	Dr. Vinay Namboodiri	Visual Dialog using Reinforcement Learning and Topic Modeling
33	Nilay Tiwari	Dr. Sharmishtha Mitra	Problem of Multicollinearity and Violation of Weak Exogeneity Principle, Some

			Corrective measures and Application in a Recent Study
34	Nivedita	Dr. Monica Katiyar	Continuous nanowire matrix from Silver-Adenine based one dimensional polymer for electronic devices
35	Omkar Kumar	Dr. Abhishek Gupta	Millimeter Waves in Communication Networks for the Indian Cities
36	Prajual Maheshwari	Dr. Debayan Pakrashi	Impact of Technology Adoption in Rural Bangladesh
37	Pranshu Tripathi	Dr. Raghvendra Singh	Probing the role of divalent cation in ATP Hydrolysis.
38	Rhythm Pathak	Dr. Sachin Y. Shinde	Design a novel hovering device using flexible appendages
39	Rishav Kumar	Dr. P. Venkitanarayanan	Study of composite material under direct impact loading
40	Rochak Ranjan Parida	Dr. Malay K. Das	Effective thermal conductivity of reconstructed porous geometries using Lattice Boltzmann Method
41	Sagar Chaudhary	Dr. P. K. Panigrahi	Evaporation of Sessile Ferrofluid Droplet Under Static Magnetic Field
42	Saurabh Shukla	Dr. Deepak Dhingra	Systematic Characterization of Enceladus Plume
43	Shashank Shekhar	Dr. Abhas Singh	Removal of fluoride from drinking water
44	Shayamal Singh	Dr. Anandh Subramaniam	Computational investigations of internal pressure's affect on strain in nano pressure vessels
45	Shivali Agrawal	Dr. Vishal Agarwal	Modelling methane dissociation in a molten Te system
46	Shreya Agrawal	Dr. Sanjay Mittal	Vortex Induced Vibrations of a bridge section
47	Shruti Jain	Dr. Jonaki Sen	Expression Profiling of Metabolism Related Genes (MRGs) in vertebrate brain development.
48	Shubhanshi Singh	Dr. Anubha Goel	Impact of cooking practices on human health
49	Siddhanta Mhambrey	Dr. Nitin Gupta	Mosquito olfaction

50	Sudhanshu Pandey	Dr. Deepak Dhingra	Developing optimized exploration strategy for Planetary Missions
51	Sukhjeevan Bansal	Dr. Ishan Sharma	Spinning Ellipsoid Dynamics
52	Swapnil Srivastava	Dr. Ishan Sharma	Strucrural Model for the cross section of optical cables.
53	Tanmay Singhal	Dr. Arun K Saha	Flow past a Square Cylinder
54	Vipul Bajaj	Dr. Vinay Namboodiri	Multimodal Alignment
55	Vishal Keswani	Dr. Nisheeth	DRAWING DISTINCTION BETWEEN HEDONIC AND UTILITARIAN PREFERENCES
56	Yogesh Kumar	Dr. Amit Kumar Verma	Automation of four probe method using image processing techniques.

Participants of SURGE 2018 at IITK from Other Universities

S. N.	Name of the Participant	Institute Name	Mentor Name	Project Title
1	Aastha Chawla	National Institute Of Technology, Kurukshetra	Dr. Arvind Kumar	Design, analysis and ME modeling of ultra light SS316L lattice structures manufactured by Selective Laser Melting
2	Abdul Khalad	Jawaharlal Nehru Technological University Hyderabad	Dr. J Ramkumar	Performance analysis of multiple electrodes in ECM using COMSOL
3	Abhay Raj	National Institute Of Technology,Hamirpur,Himachal Pradesh	Dr. Y N Singh	Brihaspati android app
4	Abhishek Sharma	UPES Dehradun	Dr. Sathesh Mariappan	Study of thermoacoustic interactions and combustion instabilities in a flame due to changes in the density gradient through Schlieren Experiment
5	Aditya Sharma	Malaviya National Institute Of Technology, Jaipur	Dr. Abhas Singh	Removal of Chromium from groundwater using Electrocoagulation
6	Akanksha Sahu	Motilal Nehru National Institute Of Technology, Allahabad	Dr. Nitin Gupta	Computerized cognitive training for Autistic children
7	Akash A	National Institute Of Technology,Tiruchirappalli	Dr. Nitin Gupta	Development of cognitive training game for treatment of mental disorders
8	Akshat Pathak	Harcourt Butler Technical University	Dr. Anoop Singh	Creating tool for compiling and classifying inconsistent data using Machine Learning for Centre for Energy Regulation
9	Aman Kumar	IIT,Patna	Dr. J. N. Moorthy	Synthesis of Donor-Acceptor Helical Coumarins for the Investigation of Various Chiroptical Properties
10	Anirudha Jain	University of Petroleum and Energy Studies	Dr. Mohite	Effective properties of Carbon nanotube-Epoxy composite by

				Concentric Cylinder Assemblage Model and Standard Mechanics Approach
11	Ankit Kumar Singh	Harcourt Butler Technical University, Kanpur	Dr. Rajat Mittal	Planning Optimal Path for Redundant Manipulator in Constrained Environment
12	Ankita Sharma	Siddaganga Institute Of Technology	Dr. Raju Kumar Gupta	SYNTHESIS OF WET SPUN MULTI-APPLICATION GRAPHENE OXIDE FIBERS
13	Anshuman Sharma	University of Petroleum and Energy Studies Dehradun	Dr. V. Shankar	Friction factor Vs Reynolds number plot for shear thinning fluids for laminar flow in pipe
14	Arashjit Singh	IIT Kharagpur	Dr. Sathesh Mariappan	Lower order Modeling of a Pulse jet engine
15	Archy Tripathi	Sardar Vallabhbhai National Institute Of Technology	Dr. Amalendu Chandra	Combined Electronic Structure/Molecular Dynamics Study for IR and Raman Spectroscopy of Aqueous NaF Solution
16	Arijit Pradhan	IIT(ISM), Dhanbad	Dr. Mohite	Development of ABAQUS plug-in to estimate effective properties of a RVE with randomly oriented fibres
17	Arijit Saha	Dr. SPM IIIT Naya Raipur	Dr. Arnab Bhattacharya	Implementing Skyline Queries in Distributed Database
18	Ashutosh	Chhatrapati Sahu Ji Maharaj University Kanpur	Dr. Utpal Das	Study Of Monolithic-ally Integrated Passive Photonic Devices And Simulation
19	Ashwin Joseph Mathews	National Institute Of Technology Calicut	Dr. Tapan K Sengupta	ELLIPTIC GRID GENERATION USING MULTIGRID METHOD
20	Avik Ghosh	Indian Institute of Engineering Science and Technology, Shibpur	Dr. Jishnu Bhattacharya	A solar regenerated liquid desiccant assisted evaporative cooling system for hot and humid climates
21	Balasubramanyam Evani	Manipal University Jaipur	Dr. Ketan Rajawat	Multi-robot Multi-sensor Dataset Repository for Research on Short

				and Long Term SLAM(Simultaneous Localization and Mapping)
22	Bhavya Rakheja	Motilal Nehru National Institute Of Technology	Dr. anshu Gaur	Low temperature solution processed high-k gate dielectric for flexible electronics
23	Biswaranjan Pati	NATIONAL INSTITUTE OF TECHNOLOGY, DURGAPUR	Dr. Vaibhav Arghode	Transient analysis of air flow through louvers
24	Deepta Chattapadhyay	INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH, KOLKATA	Dr. J. N. Moorthy	Effect of Homoconjugation in Stabilizing o-quinonoid Intermediate of Chromene Fused on Triptycene Scaffold
25	Divyansh Sachan	Ashoka University	Dr. Munmun Jha	Dimensions of K-pop
26	Divyanshu Khandelwal	IIT PATNA	Dr. Amalendu Chandra	Conformations of TAT peptide in water medium
27	Diwanji Srinivas Prakash	Indian Institute Of Technology BHU Varanasi	Dr. Santanu De	Development of 1D Meanline Solver for Axial-Flow Turbines with physics based detailed Loss Models.
28	G Venkata Subramanian	Siddaganga Institute Of Technology	Dr. Raju Kumar Gupta	Dielectric study of polymer nanocomposites-based capacitors using barium titanate (BaTiO3) as nanofillers and polyvinyledene fluoride (PVDF) as polymer
29	Gaurav Verma	Malaviya National Institute Of Technology, MNIT Jaipur	Dr. Krishanu Biswas	Making of free standing nano powder of (Ti Ta Nb Mo V) high entropy alloy and study its thermoelectric behaviour on bismuth addition.
30	Harsh Mohan Agarwal	Jaypee Institute Of Information Technology	Dr. Manindra Agrawal	Treadwill- A depression detection platform
31	Jai Kumar Drave	National Institute Of Technology,Tiruchirapalli,Tamil Nadu	Dr. Sameer Khandekar	3D Numerical Simulation of Forced convective Heat transfer by Ferrofluids in external Magnetic fields

32	Karthika Santhosh	SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMKUR	Dr. Anurag Tripathi	2-D Chute flow of granular particles on an inclined plane
33	Kulkarni Anish Niranjan	National Institute Of Technology, Tiruchirappalli	Dr. Kaustubh Kulkarni	Interdiffusion Studies in Binary Nb-Al System
34	Nasir Ahmad	Jamia Millia Islamia	Dr. J Ramkumar	Advancing EDM through Electric field distribution using different dielectric systems in COMSOL Multiphysics software and co-relating breakdown voltage and gap with electric field.
35	Nimish Khandelwal	Malaviya National Institute Of Technology	Dr. N. P. Gurao	Effect of strain reversal during cyclic forward/reverse torsion and monotonic high pressure torsion of CoCuFeMnNi high entropy alloy
36	Nimisha Panigrahi	National Institute Of Technology Rourkela	Dr. anshu Gaur	Study of conductivity behaviour of different concentrations of carbon nanotubes on glass substrates.
37	Prakhar Bajpai	University of Petroleum And Energy Studies	Dr. Rahul Mangal	Synthesis of porous adhesive films using micro emulsion method.
38	Rahul Joshi	National Institute Of Technology Patna	Dr. Anoop Singh	Study and Analysis of T&D losses of India
39	Rishav Deval	Indian Institute Of Technology Bombay	Dr. Dibakar Ghosal	DEVELOPMENT OF AN ALGORITHM FOR ONE-DIMENSIONAL MODELING OF WAVE EQUATION USING FINITE ELEMENT METHOD
40	Rohit Chaturvedi	National Institute Of Technology, Rourkela	Dr. Tanmoy Maiti	Thermoelectric materials
41	Rucha Pramod Mendhe	Government College Of Engineering Amravati	Dr. Mohite	Analysis Of Effective Properties Of Composite Material
42	Samarpan Chakraborty	Jadavpur University	Dr. P. Chakraborty	A numerical investigation on the relationship between anisotropy

				and deformation behavior from Berkovich indenter
43	Samynaathan V	Sri Sivasubramaniya Nadar College Of Engineering	Dr. D P Mishra	Numerical study of premixed CH4/air catalytic combustion in a rectangular micro channel
44	Sanjana Dubey	CHRIST UNIVERSITY	Dr. Somesh K Mathur	Trade in services between India and BIMSTEC countries : Analysis using Gravity Model
45	Saswat Choudhury	National Institute Of Technology Rourkela	Dr. Vivek Verma	Development of agar based hydrogels for wound healing applications
46	Shaelja Mishra	Gargi College, Delhi University	Dr. Debabrata Goswami	Optical Tweezers
47	Shibi.K	College Of Engineering Guindy	Dr. Shobit Omar	Synthesis of Solid State Sodium-ion Battery
48	Shivam Kumar	Indian Institute Of Technology (BHU) Varanasi	Dr. Arvind Kumar	Performance analysis of a waste heat recovery system employing spherically packed bed of phase change material in the temperature range of 800 -1000 K.
49	Shreya Rengarajan	National Institute Of Technology Tiruchirappalli	Dr. Ashish Garg	Comparative study of perovskite thin film formation using MAI vapours through hotplate and microwave oven routes.
50	Shubham Kumar	NIT JAMSHEDPUR	Dr. A. K. Singh	DYNAMIC MODELLING OF ELECTRIC ARC FURNACE AND ITS CORRELATION WITH DYNAMIC FOAMING INDEX
51	Sombuddha Bagchi	Jadavpur University	Dr. Ashoke De	Detailed Investigation of Flow Past a Bluff Body Stabilized Combustor
52	Soumya Sambit Rath	NIT Rourkela	Dr. Soumya Ranjan Sahoo	Control algorithms for tilt rotor quadcopter during rotor failure
53	Srilekha Kadali	JNTUH College Of Engineering Hyderabad	Dr. Biswabanda n Panda	SIDE-CHANNEL ATTACKS AT THE SHARED LAST-LEVEL CACHE

54	Subhajoy Datta	Indian Institute Of Engineering Science & Technology,Shibpur	Dr. Chinmoy Kolay	MATLAB Based Software for Dynamic Analysis of Single-Degree-of-Freedom Systems
55	Sudhanshu Gupta	NIIT University	Dr. Biswabandan Panda	Cache Hierarchy Bottlenecks for Machine Learning Applications
56	Sumit Kumar	NATIONAL INSTITUTE OF TECHNOLOGY JAMSHEDPUR	Dr. A. K. Singh	Dynamic Modelling of EAF and its correlation with Dynamic Foaming Index
57	Sushree Ananya Tanaya	NIT DURGAPUR	Dr. Krishanu Biswas	Selective decoration of high entropy alloys nano particles on mono layer of MoS2
58	Sushrutha P B	Siddaganga Institute Of Technology	Dr. Raju Kumar Gupta	STUDY OF WATER EVAPORATION USING B-TiO2 UNDER VISIBLE LIGHT ILLUMINATION
59	Suyash Tripathi	National Institute Of Technology, Raipur	Dr. Sarang Ingole	Electrodeposition of Selenium for Photovoltaic Applications
60	Swapnil Majumder	Indian Institute Of Technology, Kharagpur	Dr. Ashoke De	Development of an Hybrid RANS-LES method for predicting transitional flows.
61	Swimi Sampda Swami	Rajasthan Technical University	Dr. D P Mishra	Numerical simulation of impingement jet cooling over a circular plate
62	Touqeer Anwar Kashif	JNTUH College Of Engineering Hyderabad	Dr. Santanu De	Development of network based preliminary design methodology for a Micro gas turbine Combustor.
63	Ushasi Ghosh	National Institute Of Technology, Durgapur	Dr. Abhishek Gupta	Simulator for fifth generation (5G) system level simulations
64	Vaibhav Bajpai	Ajay Kumar Garg Engineering College	Dr. TV Prabhakar	Web App Developement
65	Vijit Kanjilal	Indian Institute of Engineering Science and Technology, Shibpur	Dr. Ashoke De	NUMERICAL INVESTIGATION OF DRAG EXPERIENCED BY AN AXISYMMETRIC PROJECTILE AT DIFFERENT CAVITATION

				NUMBERS IN PARTIALLY SUPERCAVITATIN G FLOWS
66	Vishal Kumar Yadav	IISER Thiruvananthapuram	Dr. Somnath Jha	Introduction to Elliptic Curves and Modular Forms
67	Vishesh Goel	National Institute Of Technology Karnataka	Dr. Tanmoy Maiti	Thermoelectric Oxides

Abstracts: SURGE 2018 Research Projects done at IIT Kanpur

DESIGN, ANALYSIS AND ME MODELING OF ULTRA LIGHT SS316L LATTICE STRUCTURES MANUFACTURED BY SELECTIVE LASER MELTING

Aastha Chawla, Mentor: Prof. Arvind Kumar

Our objective focuses on fabrication of ultra-light lattice structures by SLM process which is well suited for making lattice structures which are extremely impossible to manufacture by conventional manufacturing methods. Lattices are light-weighting self-supporting structures with high strength to weight ratio, good energy absorption and thermal insulation capabilities making them suitable for aerospace, automotive and biomedical parts. In the present work, five different lattices were designed in the Netfabb software and then printed using a SS316L material on a Concept Laser MlabR equipment. Bulk cube and tensile specimens were fabricated using the optimum process parameters to compare the mechanical strength of the lattices with respect to bulk specimen.

PERFORMANCE ANALYSIS OF MULTIPLE ELECTRODES IN ECM USING COMSOL

Abdul Khalad, Mentor: Prof. J Ramkumar

Electrochemical machining (ECM) is an advanced machining process (AMP) for electrically conducting materials. It has many advantages over other AMPs such as higher material removal rate (MRR), no recast layer, and no thermal residual stresses. ECM process works on the principle of anodic (workpiece) dissolution, and its machining performance is independent of workpiece hardness. The machining accuracy and precision can be controlled by various process parameters such as voltage, feed rate, inter-electrode gap (IEG), and type and concentration of electrolyte.

BRIHASPATI ANDROID APP

Abhay Raj, Mentor: Prof. Y. N Singh

Modern hand held devices such as smart phones and tablets have become increasingly powerful in recent years. Dramatic breakthroughs in processing power along with the number of extra features included in these devices have opened the doors to a wide range of commercial possibilities. The prime objective is to create a full-fledged Android application named “Brihaspati ” which would provide the IITK students the opportunity to view their courses and course content.

PHASE FIELD MODELING OF FINE ALPHA/BETA MICROSTRUCTURE IN BETA-TI ALLOYS

Abhinav Arora, Mentor: Prof. Rajdip Mukherjee

Phase field modelling is a powerful computational technique to predict the mesoscale microstructure evolution. Phase field variables define both temporal and spatial evolution of phases. The variables are of two types:• Conserved Variable - Composition of each element in all phases, • Non-conserved Variable - Structural order parameter, η. The evolution of both these variables is studied by non-linear

diffusion equations known as Cahn-Hilliard (i) and Allen-Cahn (ii) equations respectively.

FACIAL GESTURE RECOGNITION

Abhishek Datta, Mentor: Prof. K. S. Venkatesh

The basic facial gestures that we are going to interpret, will include a combination of facial expressions, eye movements and head gestures. Facial expressions and head movements will be mapped to a vocabulary of selected commands that will be performed by the device. Basic eye tracking will be used to ensure that the expressions are meant for the device only and not any general expression of the person, besides adding additional gesture combinations possible.

THIN LIQUID FILM THICKNESS PROFILE USING OPTICAL GRID DEFLECTOMETRY

Abhishek Karmakar, Mentor: Prof. Sameer Khandekar

The wavy dynamics of a liquid film flowing down an inclined plate is a day-to-day observable phenomenon, readily seen on windows or on windscreen of cars, etc., in the midst of rainfall. From the scientific point of view, such flows are part of the general class of free-boundary problems, which holds a prominent position both in pure and applied sciences. The precise prediction of internal or external liquid film flow plays an important role in the design of heat exchangers. Such film heat exchangers are commonly used as condensers of cooling agents in cryogenic technology. Therefore, a comprehensive understanding of liquid film flow, especially the film thickness profile on vertical surfaces from is of relevance to both industries as well as in academics. Mapping the liquid film profile on a surface is challenging as the method needs to be non-intrusive and here the use of optical techniques come into play.

STUDY OF THERMOACOUSTIC INTERACTIONS AND COMBUSTION INSTABILITIES IN A FLAME DUE TO CHANGES IN THE DENSITY GRADIENT THROUGH SCHLIEREN EXPERIMENT

Abhishek Sharma, Mentor: Prof. Sathesh Mariappan

The aim of the research is to study the THERMO – acoustic interactions and combustion instabilities of a flame by carrying out a flow visualization technique called ‘SCHLIEREN Experiment’. Through the SCHLIEREN experiment the changes in the density gradient due to changes in the refractive index will be studied. This technique is used for visualizing only compressible flows due to the presence of large density gradients.

SIMULTANEOUS LOCALIZATION AND MAPPING

Aditya Garg, Mentor: Prof. Ketan Rajawat

I have been working on collecting data to build a reliable multi-sensor multi-robot dataset repository with verified ground trothing done, which can then be subsequently used for research in the field of Simultaneous Localization and Mapping (SLAM). We plan to use modern sensors like LIDAR, an omnicam with 360o field-of-view, a Kinect camera which outputs RGB as well as depth information and an Inertial Measurement Unit (IMU) with 9 degrees of freedom, mounted on a Kobuki robot. To maintain the

integrity of the data collected, all of these sensors need to be calibrated with each other. I have been working on the sub-problem of the intrinsic calibration of the vision cameras and the IMU unit, along with the extrinsic calibration of these with respect to each other. The ROS software system is being used as a middleware for interacting with the sensors as well as for collection of data. For the intrinsic calibration of the IMU, the gyroscope, accelerometer and the magnetometer were calibrated separately. For the extrinsic calibration of the cameras and IMU, the Kalibr toolbox was used with collected raw data which captured an AprilTag board at different orientations. We plan to establish ground truth to within an accuracy of 2-3 cm using a Vicon camera system, Ultra-wideband Sensors as well as using floor plans, and test different SLAM algorithm implementations against the data collected by the other sensors in the robot to verify robustness.

ALGEBRAIC NUMBER THEORY
Aditya Prakash Singh, Mentor: Prof. Sudhanshu Shekhar
Modern hand held devices such as smart phones and tablets have become increasingly powerful in recent years.

REMOVAL OF CHROMIUM FROM GROUNDWATER USING ELECTROCOAGULATION
Aditya Sharma, Mentor: Prof. Abhas Singh
Hexavalent Chromium has been found to be hemotoxic, genotoxic and carcinogenic while trivalent Chromium is an essential trace mineral in the human diet. The objective of this work is to develop a method for chemically reducing Cr(VI) ion to Cr(III) ion and simultaneously bring the total Chromium under the drinking water limit (i.e., 50 parts per billion) as mentioned in IS 10500 (2012). The proposed method of electrocoagulation using iron electrodes has been widely studied for this purpose. We aim to verify the results using tap water and perform batch studies by varying current and then develop a sand filter as a final treatment unit to produce Chromium-free drinkable water. The batch study at three different current intensities (5mA, 10mA, and 20Ma) is completed while the filter is currently being prepared for the column study. Analysis of the concentration of Chromium and Iron is being done using UV-Visible Spectrophotometer and Inductively Coupled Plasma Mass Spectroscopy.

STRUCTURAL MODEL FOR OPTICAL FIBRE
Aditya Singh, Mentor: Prof. Ishan Sharma
This project includes the development of a model for the contact of multiple elastic, curved, inextensible beams using basic equilibrium and inextensibility conditions. A set of equations developed in the paper “On The Contact Problem of Thin Rings” by Chien-Heng Wu and Robert Plunkett will be used for predicting the shapes and contact forces between rings placed between anvils of different shapes. The final aim is to use these equations to develop a structural model for the cross section of an optical fiber.

COMPUTERIZED COGNITIVE TRAINING FOR AUTISTIC CHILDREN
Akanksha Sahu, Mentor: Prof. Nitin Gupta

The aim of this project is to develop cognitive training games to train working memory in autistic children. In these games, the participants will have to remember position of objects having same shape. To change the difficulty level of the game, the number of shapes can be increased or decreased. The overall goal of my games is aligned with the behavioral preferences of autistic children which will provide them the incentive to play the games. The games will also use appropriate sound and visual feedback to encourage the participant to progress in it. Also, autistic children have problems in fine motor skills which can restrict their ability of using a smartphone to very simple interactions with the screen. To overcome this challenge, my games will require minimal interaction with the mobile screen, which these kids are able to perform.

DEVELOPMENT OF COGNITIVE TRAINING GAME FOR TREATMENT OF MENTAL DISORDERS

Akash A, Mentor: Prof. Nitin Gupta

The goal of my project is to develop an engaging and challenging game based on this training paradigm. The game's design is similar to an endless running game with added features like obstacles and dropping platforms. The game will be part of version 2 of TreadWill, an online automated tool for helping individuals with depressive symptoms. In order to encourage the users actively use the tool, additional features like double jump, flying capability are also being provided, which can be unlocked by progressing in the main TreadWill program. Finally, I aim to record the user's performance in the training tasks for future analysis.

CREATING TOOL FOR COMPILING AND CLASSIFYING INCONSISTENT DATA USING MACHINE LEARNING FOR CENTRE FOR ENERGY REGULATION

Akshat Pathak, Mentor: Prof. Anoop Singh

The project aims at creating a tool for creating a comprehensive regulatory database which would collect regulatory data from all the Electricity Regulatory Commissions and archive them in standardized formats for easy access. Any update appearing on the website of any ERC is to be automatically captured, classified and systematically archived.

in which data regarding updates on the websites of central as well as state energy regulatory commissions can be stored. This stored data will be further used for its classification into various categories using machine learning techniques so that useful information can be extracted in minimum possible time.

SYNTHESIS OF DONOR-ACCEPTOR HELICAL COUMARINS FOR THE INVESTIGATION OF VARIOUS CHIROPTICAL PROPERTIES

Aman Kumar, Mentor: Prof. J. N. Moorthy

Helicenes are polycyclic aromatic compounds formed by ortho-fused benzene rings. These class of molecules are well explored because of its inherent chirality and unique nonplanar screw-shaped skeletons. The scaffold has been well explored as a design element in the development of recognition-based sensors molecular switches, display devices, NLO materials and thin films etc. Fusion of this helicity with fluorescent coumarin dyes can lead to remarkable change in its various chiroptical properties. Also because of the extended donor-π-acceptor type conjugation the targeted derivative is

capable of ICT (Intramolecular charge transfer) and is expected to show high solvatochromic shift which makes it appropriate to be used as NLO materials.

A DFT STUDY TO MODEL ALDOL CONDENSATION OF FURFURAL WITH ACETONE IN SN-BEA ZEOLITE

Amartya Kumar Prusty, Mentor: Prof. Vishal Agarwal

At a time when the worlds emphasis is on global warming, less use of fossil fuels, and developing renewable energy sources, biofuels have become one of the most highly needed sources of energy. Furfural is an organic compound formed from lignocellulosic biomass and it can be transformed into precursors for C8-C13 liquid hydrocarbons through aldol condensation with acetone.2 Zeolite is one of the catalysts that can be used for this purpose and here we have doped it Sn to use as a Lewis acid to study this reaction.3 A study of thermodynamics and kinetics of the reaction has been made here. We have also attempted to understand the role of water in this reaction.

ELUCIDATING THE CONTRIBUTION OF CHONDROGENIC LINEAGE TO DEVELOPING BONE IN MICE

Anamay Ashwin Samant, Mentor: Prof. Amitabha Bandyopadhyay

In vertebrates, endochondral ossification is the primary mode of limb skeleton formation by which all long bones are formed. It is a series of developmental events where a cartilage primordium gives rise to mature limb elements comprised primarily of bone. The cells responsible for making bone matrix are osteoblasts which differentiate into osteocytes i.e. the mature bone cells. The main aim of the experiment is to determine whether osteoblasts (bone cells) are derived from collagen II expressing chondrocytes (constituting the cartilage primordia) in mice using two techniques of lineage tracing. The mouse strain used is a TdT-Col2-Cre line, which expresses red fluorescent protein (RFP) all throughout the mouse with the help of a ubiquitously expressed promoter (Rosa26).

USE OF LOCAL INFORMATION FOR TRAFFIC ASSIGNMENT

Anant Chopra, Mentor: Prof. Abhishek K. Gupta

I aim to model traffic on any network link as a random variable. The random variable would be centered about a mean which would be calculated from the traditional processes of minimizing various objective functions considering constant average traffic flows for the network links. It is assumed that information regarding traffic on neighboring links would be readily available via the upcoming V2V communication technology.

EFFECTIVE PROPERTIES OF CARBON NANOTUBE-EPOXY COMPOSITE BY CONCENTRIC CYLINDER ASSEMBLAGE MODEL AND STANDARD MECHANICS APPROACH

Anirudha Jain, Mentor: Prof. P. M. Mohite

The aim is to calculate the effective properties of the single phase composites by concentric cylinder assemblage (CCA) model in which the properties of CNT (carbon nanotube) and matrix (Epoxy 862) are known. The properties are calculated by

assuming an equivalent homogenous cylinder of same radius as the outer radius of the CNT-matrix combination. To proceed with, the RVE (representative volume element) is constructed in the ABAQUS software and the CNT-matrix combination now called as fibre is inserted in the RVE. The effective properties obtained from the CCA model are used as an input for thematerial properties of the fibre and matrix material epoxy862 is known already. For the imposed boundary condition the analysis was done and the strain values for each element were obtained.

PLANNING OPTIMAL PATH FOR REDUNDANT MANIPULATOR IN CONSTRAINED ENVIRONMENT

Ankit Kumar, Mentor: Prof. Bhaskar Dasgupta

Path planning is a process of finding the optimum path between two nodes having obstacles in between. Manipulators are used in industries and we can optimize it to work in a regular household.For planning the path, I used several algorithms like Breadth First Search(BFS), Depth First Search(DFS), Dijkstra and Astar. I finally arrived at the conclusion that Astar algorithm was the most efficient. Problem faced was that each time while travelling from one node to another I had to use a function to check if the edge was intersecting with the polygon (obstacle). But using this function for large number of nodes proved repetitive and expensive. So, I further increased the number of nodes which ensured that when we travel from one node to another edge does not intersect with the obstacle.

QUANTUM QUERY COMPLEXITY

Ankit Kumar Singh, Mentor: Prof. Rajat Mittal

Quantum computation is the research area I am working on during the internship. Quantum computation involves query complexity and is efficient as compared to classical computation which involves time and space complexity due its features of superposition and entanglement. The research paper which I am studying and mainly focusing on is “The Polynomial Method Strikes Back: Tight Quantum Query Bounds via Dual Polynomials” which explores the polynomial method for improving quantum query complexity.

SEMICOHERENT TO SEMI-SEMI COHERENT TRANSITION IN PRECIPITATES

Ankita Anjali, Mentor: Prof. Anandh Subramaniam

Precipitation reactions fall under phase transformations in which temperature change causes transformations from single phase region of a binary phase diagram to a region where one or more phases are stable. This project attempts to carry the work that has been done already for infinite systems and employ the same ideas further for semi-infinite system. This investigation pertains to Finite Element simulations of the state of stress of a semi-coherent precipitate, its growth and its stability.

SYNTHESIS OF WET SPUN MULTI-APPLICATION GRAPHENE OXIDE FIBERS

Ankita Sharma, Mentor: Prof. Raju Kumar Gupta

Graphene oxide (GO) has recently become an attractive building block for fabricating graphenebased functional materials. Despite the excessive researches done, it is still considered that many exotic properties of graphene based materials are yet to be

discovered. One of the recent founding's is with regards to GOLC's (Graphene Oxide Liquid Crystals). Liquid crystals (LCs) are matter in a state which has properties between those of conventional liquids and those of solid crystals. The use of LC GO dispersions for fabrication enables formation of novel self-assembled 3D architectures. Therefore, an established protocol for a rational control over the formation of the same would greatly advance this self-assembly nanoscience. Yarn supercapacitors have great potential in future portable and wearable electronics because of their tiny volume, flexibility and weavability.

GLOBAL BURDEN OF DISEASES: AN INSIGHT THROUGH AIR POLLUTION
Anshul Yadav, Mentor: Prof. Tarun Gupta
This study incorporates satellite data from government archives for Air pollution in aforementioned locations. Then an Integrated Exposure-Response Function was trained through non-linear regression techniques to account for Relative Risks of various diseases. The data used for this purpose was taken from previously conducted cohort studies (Cohen et al.). For generating final results above processes will be incorporated with health data from GBD reports. This study is one of its kind as estimates in this field have been resolved up to state level (Dandona et al. 2017 Lancet) only whereas this goes up to city level.

FRICTION FACTOR VS REYNOLDS NUMBER PLOT FOR SHEAR THINNING FLUIDS FOR LAMINAR FLOW IN PIPE
Anshuman Sharma, Mentor: Prof. V Shankar
Fluids are broadly classified as Newtonian and Non-Newtonian fluids. Shear thinning fluids is the class of Non-Newtonian fluids whose viscosity decreases with increase in shear rate, also known as pseudoplastics, most of the polymeric fluids are shear thinning. This research work is concern with obtaining a relationship between the friction factor and Reynolds number for shear thinning fluids for laminar flow in pipe using Power law model and Carreau-Yasuda model. Power law model is a two parameter model and can be solved to get a relationship between friction factor and Reynolds number using analytical methods. CarreauYasuda model is a five parameter model and have to be solved using numerical methods to get a plot between friction factor and Reynolds number.

LOWER ORDER MODELING OF A PULSE JET ENGINE
Arashjit Singh, Mentor: Prof. Sathesh Mariappan
This project is aimed at developing a lower order mathematical model for a valve pulse jet engine. Pulse jet engine's operation is a result of the combustion instabilities. This model will take into account the interaction between the combustion and the acoustics that leads to instabilities, neglecting the other interactions of fluid dynamics. We will try to study the pressure and velocity fields that develop in the engine during its operation, that can give us an approximate for the thrust generated and also provide an insight into the physics involved.

COMBINED ELECTRONIC STRUCTURE/MOLECULAR DYNAMICS STUDY FOR IR AND RAMAN SPECTROSCOPY OF AQUEOUS NAF SOLUTION

Archy Tripathi, Mentor: Prof. Amalendu Chandra

We have used the combined ES/MD approach developed by Skinner et al[1] to study the solvation structure and dynamics of isotopically diluted aqueous NaF solution through vibrational spectroscopy. Since such vibrational frequencies are sensitive to local solvation environments, the study of OH stretching vibration can be effectively used to probe hydrogen bond dynamics of the system. The approach works by developing an empirical linear relationship between the transition frequencies (computed by ab-initio methods) and the electric field component along the bond of interest (OH/OD).

DEVELOPMENT OF ABAQUS PLUG-IN TO ESTIMATE EFFECTIVE PROPERTIES OF A RVE WITH RANDOMLY ORIENTED FIBRES

Arijit Pradhan, Mentor: Prof. P. M. Mohite

Modeling of random fibre distribution of a uni-directional fibre-reinforced composite is of great importance in the analysis of composite structures, which caters the need of developing Representative Volume Element(RVE). Different Micro-mechanical techniques are adopted for the study of Representative Volume Element(RVE) constituting randomly oriented uni-directional fibres. The traditional Random Sequential Adsorption(RSA) algorithm fails to generate RVE with more than 50% fibre volume fraction due to jamming of the processor. This report presents a unique way to generate RVE, even with more than 60% fibre volume fraction.

IMPLEMENTING SKYLINE QUERIES IN DISTRIBUTED DATABASE

Arijit Saha, Mentor: Prof. Arnab Bhattacharya

The skyline operator has attracted considerable attention recently due to its broad applications in the field of product recommendations, review evaluations with user ratings, querying wireless sensor networks and graph analysis. Skyline queries are a popular way to obtain preferred answers from the database by providing only the orderings of attribute values. The result of a skyline query consists of those input tuples for which there is no input tuple having better or equal values in all the attributes and a better value in at least one attribute. The skyline operator is important for several applications involving multi-criteria decision making.

INVESTIGATING THE ROLE OF ECM ADHESION GRADIENT IN PROXIMO-DISTAL PATTERNING OF EMBRYONIC LIMB

Aryaman Jha, Mentor: Prof. Amitabha Bandyopadhyay

Modern hand held devices such as smart phones and tab lets have become increasingly powerful in recent years.

STUDY OF MONOLITHIC-ALLY INTEGRATED PASSIVE PHOTONIC DEVICES AND SIMULATION

Ashutosh, Mentor: Prof. Utpal Das

Photonics generally studies the energy of ~meV-eV of electromagnetic wave packets of light properties and interaction with matter. Human life has significantly been influenced by photonics in the areas of communication, sensing/imaging, information technology, signal processing, power generation, consumer electronics,

instrumentation, and manufacturing process. Semiconductor photonics, in particular leverages the infrastructure available in computers and communications to develop new implementations of lasers, detectors and other optical components which are versatile, smaller, faster and power efficient, and hence can be integrated into a chip. One specific application of photonic devices in the form of photonic integrated circuit (PIC) is optical communication.

ELLIPTIC GRID GENERATION USING MULTIGRID METHOD
Ashwin Joseph Mathews, Mentor: Prof. Tapan K Sengupta
The aim of the project is to generate elliptic grid points between two turbine blades. Elliptic grids are used here due to the fact that all boundary points are specified in this problem. The problem was approached in a step by step manner, starting with elliptic grid generation over a cylinder and then over NACA 0012 airfoil by discretizing an elliptic partial differential equation.

RAILWAY BRIDGE HEALTH MONITORING USING TRAIN LOAD INDUCED VIBRATIONS,
Astha Gaur, Mentor: Prof. Suparno Mukhopadhyay
The project would present a methodology for quantification of structural damage which would be helpful in predicting the expected life of structure with greater accuracy. The methodology is expected to be achieved by formulating the dependence of signal energy on mass, velocity of train and on stiffness of elements independently, thus estimating the energy signal function. Required data to formulate the function is to be collected through an experimental setup of a bridge with the train load as moving distributed mass modelled as Euler Bernoulli beam elements resulting in a finite element model.

DEVELOPMENT OF NON-AQUEOUS ELECTROLYTES FOR SUPERCAPACITORS
Avijit Kalra, Mentor: Prof. Sri Sivakumar
Supercapacitors are devices which deliver much higher specific energy than electrolytic capacitors. This is because instead of a conventional dielectric, they use electrolytes in between the electrodes. Efforts are being made to further increase the specific energy while maintaining the high specific power of such supercapacitors. The most prudent way to do so is by increasing the voltage gap across the supercapacitor. Aqueous elec- trolytes are limited by the reduction potential of water (1V). Therefore, we must find an alternative to narrow potential window aqueous electrolytes.

A SOLAR REGENERATED LIQUID DESICCANT ASSISTED EVAPORATIVE COOLING SYSTEM FOR HOT AND HUMID CLIMATES
Avik Ghosh, Mentor: Prof. Jishnu Bhattacharya
In this study, a novel scheme of a solar regenerated liquid desiccant assisted evaporative cooling system has been proposed. The objective of the system is to provide suitable comfort conditions inside large commercial buildings situated in the hot and humid tropical/subtropical areas of the world. The various components of the cooling system are counter-flow packed bed dehumidifier, dew-point indirect

evaporative cooler, cooling tower, forced parallel-flow solar regenerator, desiccant-desiccant heat exchanger, desiccant-water heat exchanger and air-water heat exchanger.

STUDY OF VISUAL FEEDBACK SYSTEMS FOR SPEECH THERAPY AND HEARING IMPAIRED

Ayush Rai, Mentor: Prof. Anindya Chatterjee

Our aim is to develop visual feedback for speech training of hearing impaired people. Such people can produce sounds, but the auditory feedback loop is missing or weak and so it is hard for them to refine their pronunciation. The aim is to focus on some vowels only: A (as in cane), AA (as in far), EE (as in keep), O (as in fore), OO (as in hoot) and so on. The aim is to record these vowels from several hearing people. The pitch and waveform differs. The aim is to seek commonalities between these signals. Because of periodicity, Fourier series will be used.

MULTI-ROBOT MULTI-SENSOR DATASET REPOSITORY FOR RESEARCH ON SHORT AND LONG TERM SLAM(SIMULTANEOUS LOCALIZATION AND MAPPING)

Balasubramanyam Evani, Mentor: Prof. Ketan Rajawat

Simultaneous Localization and Mapping is used for building/updating maps of unknown environments while simultaneously tracking the robots pose with respect to the environment. The project discussed aims to create a dataset repository using various perspective sensors in order to perform SLAM. The whole project is being developed on Robot Operating System (ROS). ROS provides a powerful framework of tools and libraries for development of various robotic applications.

LOW TEMPERATURE SOLUTION PROCESSED HIGH-K GATE DIELECTRIC FOR FLEXIBLE ELECTRONICS

Bhavya Rakheja, Mentor: Prof. Anshu Gaur

For flexible electronics, in the fabrication of thin film transistors, materials with higher dielectric constant (k) than the polymers with the value ranging between 2 and 4, are required, as they need low operation power. Also the materials that can be solution processed at low temperature are needed for flexible substrates. Inorganic materials such as zirconium oxide and zirconium titanium oxide, which have high dielectric constants and can be solution processed at low temperature, are being investigated for application in flexible electronics.

MODELING OF TIDAL CIRCULATION AND SEDIMENT TRANSPORT IN THE GULF OF KHAMBHAT USING ANALYTICAL AND NUMERICAL APPROACH

Bhumika Ojha, Mentor: Prof. Saumyen Guha

The objective of this work is to formulate a model of the flow patterns of sediments in the Gulf of Khambhat and the effect of external factors on the transportation of these sediments. Gulf of Khambhat receives the industrial wastage of many Industrial plants like IPCL, GSFC, and Gujarat refinery, and transportation of these sediments in the gulf is important to marine environment and coastal engineering.

TRANSIENT ANALYSIS OF AIR FLOW THROUGH LOUVERS

Biswaranjan Pati, Mentor: Prof. Vaibhav Arghode

Louvers are indispensable machine components having ubiquitous applications in the areas of air conditioning systems; architecture; infrastructure and transportation in which they are primarily serving the purpose of directional airflow delivery. The effectiveness of systems employing louvers can be increased by analyzing the air flow through louvers and contemplating its physical implications. The present study explores the avenue of transient analysis of air flow through louvers which provides a more accurate delineation of their operation in terms of pragmatic inferences. A detailed computational fluid dynamics (CFD) analysis can be done by resolving all the geometrical features of the louvers; however, this involves high computational effort, especially, in the case of physical movement of the louvers for time-varying directional delivery of the air.

CONTACT STRESS ANALYSIS AND ROLLING CONTACT FATIGUE LIFE ESTIMATION IN RAIL-WHEEL

BNVS Shravan Kumar, Mentor: Prof. Nalinaksh S. Vyas

Safety and economy of railway traffic is enormously influenced by the contact stress variation caused by wheel rail contact profile changes. A change in designed surface topology may result from wear that brings in a wide change in contact geometry and stresses. To study the influence of interacting wheel and rail profile topology of standard rail UIC60, the standard wheel profile as per Indian Railway standards are considered .Geometrical modeling was carried out in a CAD environment.

SMALL WORLD WIRELESS SENSOR NETWORK DEVELOPMENT USING COLLABORATIVE BEAMFORMING(CB)

D S Abhishek, Mentor: Prof. Rajesh Hegde

Small world characteristics (SWC) have been observed and studied in social networks in the context of Information dissemination in important applications like disease spread among communities. However, the significance of SWC in wireless sensor network (WSN) applications has hitherto not been investigated. SWC introduction reduces the average path length of the network drastically while maintains a high average clustering coefficient. Introduction of SWC utilizes various techniques such as wired shortcuts, mobile nodes, beamforming, and multi radio mounted sensor nodes. Wired shortcuts are not feasible in applications like flood monitoring and battlefield surveillance.

EFFECT OF HOMOCONJUGATION IN STABILIZING O-QUINONOID INTERMEDIATE OF CHROMENE FUSED ON TRIPTYCENE SCAFFOLD

Deepta Chattapadhyay, Mentor: Prof. J. N. Moorthy

Photochromism is defined as the reversible transformation between two forms of a chemical species, induced by electromagnetic radiation having distinct absorption spectra. Photochromic phenomena can be shown by different classes of organic and inorganic compounds such as spiropyrans, spirooxazines, benzopyran (Chromene), napthopyran, silver chloride etc which have been rewarded by many important

applications such as photochromic glasses, optical data storage devices, design materials, etc.

ANALYSIS OF GOOD VERSUS BAD BEHAVIOUR USING EVOLUTIONARY GAME THEORY

Dhananjay Singh, Mentor: Prof. Vimal Kumar

My main idea is to probe into this seemingly irrational behavior using Evolutionary Game Theory as a tool. In a hypothetical setting consisting of population consisting of all ‘good behavior ’ members, how does a small mutant population of ‘ bad behavior’ fair ? And How about a mutant population of ‘good behavior ‘ in a population of ‘bad behavior’? Instead of assuming rational and voluntary action/choices we assume the choices and decisions taken as having been genetically encoded in us . Every action taken is considered an impulsive response to the then at hand situation. The urge to respond to a phone call even when driving on a highway could be a vivid example. It is not that one cares more about the call than about someone else's or even their own life. It’s just that impulsive response to the stimuli is to take that call, which is by no means a rational decision.

FINITE ELEMENT MODELING OF THERMALLY PROCESSED LAT971 NOVEL ALLOY

Dhruv Mittal, Mentor: Prof. Kantesh Balani

The focus of this work is to understand the effect of this changed microstructure (upon various thermal treatments) on stress evolution during loading using finite element technique, by modeling the microstructure and observing the role of precipitates in affecting the overall modulus and stress distribution of the alloy. Simulations at different strain values will enable visualizing stresses at the interface of the matrix and the precipitates. Since the thermal treatment affects the size and distribution of precipitates, these simulations can be suggestive of a strategy for processing the alloy for optimal mechanical properties as compared to its as-cast form.

LINEAR STABILITY ANALYSIS AND TRANSIENT GROWTH ANALYSIS OF MEASURED VELOCITY PROFILE

Dipankar Dutta, Mentor: Prof. Alakesh Chandra Mandal

Stability of a laminar flow is often investigated based on linear disturbance equation about a basic flow. This analysis indicates whether a particular flow is stable or unstable at a particular Reynolds number, or it provides a critical Reynolds number above which the flow can be unstable. There are some flows which become transitional even at subcritical Reynolds number. In these cases, transient growth of disturbance can shed some light. That is, a flow can be linearly stable, but can have enough transient growth within short downstream distance or short time interval, which can be viable for triggering transition. Therefore, stability analysis is important to investigate the nature of transition which may prevail in a flow.

DIMENSIONS OF K-POP

Divyansh Sachan, Mentor: Prof.Munmun Jha

My project explores the different ways Korean pop(K-pop) music industry has had an impact on economy, politics, culture etc. and then further connects them together to show how it is being used as a soft power by the nation-state of South Korea. It looks at how the history of the nation had an impact on how the industry turned out to be and then further the economic and political benefits that the nation-state has gained by treating K-pop as a cultural commodity. The method for my research has been based on papers, articles and published news written on similar themes.

CONFORMATIONS OF TAT PEPTIDE IN WATER MEDIUM
Divyanshu Khandelwal, Mentor: Prof. Amalendu Chandra
In the past two decades, researchers are trying relentlessly to figure out the mechanism of HIV virus replication in human bodies. Years of hard work lead them to TAT (Trans activator of Transcription) proteins , which is believed to drastically enhance the efficiency of viral transcription (one of the initial step for protein synthesis) in the host body. It was found that TAT binds to an RNA stem loop structure, known as TAR (Transactivating response) element and the resulting structure leads to the transcription enhancitivity. The mechanism of how it enhances the transcription is still unclear although it is believed that this phenomenon can be unfolded by focusing on the conformational change of TAT upon binding to TAR RNA.

DEVELOPMENT OF 1D MEANLINE SOLVER FOR AXIAL-FLOW TURBINES WITH PHYSICS BASED DETAILED LOSS MODELS
Diwanji Srinivas Prakash, Mentor: Prof. Santanu De
he purpose of the present work is to develop suitable loss models for an axial-flow turbine, after performing pitch-line design and validation of the loss models from 3-D CFD simulations. The basic design of gas turbine blades consists of pitch-line design, 2-D flow analysis, and 3-D CFD analysis. An open-source CFD based turbomachinery solver, Multall, is used for the pitch-line design, which takes efficiency as an input; however, it does not consider the losses occurring in a turbomachine. When used with CFD, the pitch-line design may yield erroneous results. A loss model incorporated in the pitch-line solver is expected to provide us better results from CFD simulation.

MAKING OF FREE STANDING NANO POWDER OF (TI TA NB MO V) HIGH ENTROPY ALLOY AND STUDY ITS THERMOELECTRIC BEHAVIOUR ON BISMUTH ADDITION
Gaurav Verma, Mentor: Prof. Krishanu Biswas
Thermoelectric (TE) materials have the capability of converting heat into electricity and are based on seeback effect , which can improve fuel efficiency, as well as providing robust alternative energy supply in multiple applications by collecting wasted heat, and therefore, assisting in finding new energy solutions. Thermoelectric efficiency is measured by figure of merit (ZT value). In our study we have designed the (Ti Ta Nb Mo V) single BCC phase high entropy alloy (HEA) and investigate its thermoelectric properties.

TREADWILL- A DEPRESSION DETECTION PLATFORM

Harsh Mohan Agarwal, Mentor: Prof. Sandeep K. Shukla

My goal is to add-on features in the ongoing project named TreadWill to reduce the gap between students and the counsellor. The online portal has the PHQ-9 and GAD-7 test to determine the depression and anxiety in students. Students can share their test result with the counsellor of their choice. The institute's counsellor can see the test result only after accepting the request of a student and can suggest treatment accordingly. This portal can act as a bridge between counsellor and students and help institutes deal with the increasing mental health issues.

BUFFER AWARE INTELLIGENT MOBILE SINK SCHEDULING IN ASYNCHRONOUS WIRELESS SENSOR NETWORKS

Harshit Nyati, Mentor: Prof. Rajesh Hegde

Energy-efficient data aggregation is a challenging problem in wireless sensor networks (WSNs). The deployment of mobile sink for collecting sensory data is a common way to address this issue. However, the scheduling of mobile sink is also very challenging which becomes more important in asynchronous behavioured wireless sensor networks.The asynchronous behaviour of sensor nodes is generally due to adaptive duty cycling of sensing rate. It results in uncertain buffer overflow in sensors which leads to information loss as mobile sink may not be available at the required time. To overcome these issues, an intelligent mobile sink scheduling scheme is being proposed which learns about the halt-times in different clusters based on the network behavior.

3D NUMERICAL SIMULATION OF FORCED CONVECTIVE HEAT TRANSFER BY FERROFLUIDS IN EXTERNAL MAGNETIC FIELDS

Jai Kumar Drave, Mentor: Prof. Sameer Khandekar

High thermal flux management is one of the key areas of research in thermal engineering due to increasing miniaturization of electronic components. To tackle this ever increasing demand, forced convection heat transfer by nanofluids has been constantly explored as a viable option due to their superior thermo-physical properties over pure fluids. Magnetic nanofluids or ferrofluids are one such type of nanofluids possessing magnetic properties as well. This additional advantage of having magnetic properties can be used to controlled and manipulated the flow of ferrofluids by the application of external magnetic field.

FURTHER STUDIES OF THE SWEEPING JET OSCILLATOR

Jaidev Ashok Narayan Swami, Mentor: Prof. Kamal Poddar

In view of the ever-consistent goal of increasing lift-to-drag ratio in aerodynamic devices, or in situations where early mixing of discrete flow jets is desirable, a fluidic oscillator serves the purpose with a simple, scalable design without any moving parts. In particular, the research problem involves a sweeping jet oscillator (SWJ). This is done in two phases. The first phase involves studying the frequency response of the jet with changes in the divergence angle of the SWJ in a quiescent environment.

TRUTHFUL PEER GRADING WITH PARTIAL OBSERVATION

Jatin Jindal, Mentor: Prof. Swaprava Nath

Massive Online Open Courses have the potential to revolutionize higher education with their broad outreach and accessibility, but evaluating such a large class requires considerable time and effort for the professor in the traditional evaluation system. Peer grading – having students assess each other – is a widely used, scalable approach to solve this task of extensive evaluation. However, students are not trained in grading, which means that they cannot be expected to have the same level of grading skills as the teaching staff.

2-D CHUTE FLOW OF GRANULAR PARTICLES ON AN INCLINED PLANE

Karthika Santhosh, Mentor: Prof. Anurag Tripathi

We study the gravity flow of monodisperse and polydisperse particles through an inclined plane at an inclination angle θ from horizontal for a wide range of inclination angles on bumpy surface. We found that with the increasing inclination angle, both the inertial number and effective friction coefficient increase while the packing fraction decrease. We study the change in the different properties with different θ and coefficient of restitution values. We also study the behaviour of single particle over and inclined plane with very low coefficient of restitution values.

CLOSED LOOP FEEDBACK CONTROL IN DISCONTINOUS FRICTION MODEL

Krishan Singhal, Mentor: Prof. Anindya Chatterjee

Friction is encountered in almost every machine. Discontinuous friction has to be compensated when using closed loop feedback in controls. We aim do a careful numerical study of spring mass system with coulomb friction and bring down the displacement to zero in time limits using PID control or some variation of PID control. We have noticed for single DOF system that the time to settle within some small displacement, i.e., something like 1e-3 when all parameters are O (1), can be quite short or quite long depending on initial conditions. This problem may get worse with 2 DOF and one feedback actuator. Aim is to quantify this performance with direct simulations.

UNSTABLE FLOW OF THIXOTROPIC FLUIDS IN LOW SHEAR RATE REGIME

Kshitiz Shukla, Mentor: Prof. Y.M.Joshi

The capillary flow of thixotropic fluids at low shear rates is studied in detail. A lot of research has already been done by different people on thixotropic fluids suggesting that these fluids show a peculiar behavior when subjected to low shear rates but there is still no experimental proof to it. So we have tried to build a horizontal capillary rheometer which can analyze the unstable behaviour shown by these thixotropic fluids in low shear rate region. We started our work with a Newtonian fluid, Glycerine, so as to check if our device was calibrated properly and was giving accurate results. For this we actually calculated the flow curve of glycerine for different ratios of length and diameter of the capillary.

VO2 BASED RELAXATION OSCILLATORS

Kshitiz Tyagi, Mentor: Prof. Amit K Verma

VO2 is correlated system which exhibits various technologically useful qualities like MIT(metal-insulator transition),half-metallicity among others. Our aim is to harness the

MIT properties of VO2 devices to harness compact,scalable and low power nano-oscillators which find applications in hardware based solutions for solving computationally hard problems like image recognition,template matching and graph coloring etc based on associative storage architectures.The transition results in about 5 orders of change in conductivity of the material.

INTERDIFFUSION STUDIES IN BINARY NB-AL SYSTEM
Kulkarni Anish Niranjan, Mentor: Prof. Kaustubh Kulkarni
Vacuum arc melting is used to prepare alloys of Nb and Al at varying compositions ranging from 4-9 at%. SEM analysis shows that Aluminium dissolves up to 6 at% inside Niobium in as-cast condition. Homogenisation is carried out to remove micro-segregation and make the composition homogeneous. The homogenised alloys will be diffusion coupled with pure Nb and interdiffusion fluxes will be determined by fitting experimental concentration profile into MultiDiFlux Software. The concentration and flux profiles will further be analysed for binary interdiffusion coefficients as functions of compositions.

GALOIS THEORY
Kushlam Srivastava, Mentor: Prof. Sudhanshu Shekhar
The roots of unity and the cyclotomic extensions generated by them over the field of rational numbers,$\mathbb{Q}$.We will then study cyclic extensions and their generalisation in Abelian Kummer Theory.We will then study infinite Galois extensions,and the generalisation of the Fundamental Theorem to infinite extensions using the Krull topology.We also plan to look at some unsolved problems,the most notable of which is the inverse Galois problem, which concerns whether or not every finite group appears as the Galois group of some Galois extension of the rational numbers.

EFFECT OF A TRIP ON THE FLOW PAST A 3D CIRCULAR CYLINDER IN THE REGIME OF DRAG CRISIS
Maharshi Kumar, Mentor: Prof. Sanjay Mittal
Flows past bluff bodies are of significant scientific and engineering importance. As the Reynolds number(Re) is increased, various instabilities associated with the flow unfold. In the critical regime, the separated boundary layer undergoes transition to turbulence and reattaches to the surface of the cylinder. Hence, the eventual separation takes place at a further downstream location of the cylinder, narrowing the near wake . As a result, the base pressure increases and the drag decreases causing the drag-crisis. In the supercritical state the boundary layer achieves a turbulent state on the body itself, prior to separation. In this state, compared to the critical state, the separation points move upstream on the cylinder surface. Therefore, the wake is relatively wider and the time-averaged CD rises slightly.

MMWAVE MODEL FOR WIRELESS SENSOR NETWORKS
Mayank Shrivastava, Mentor: Prof. Aditya Jagannatham
Wireless Sensor Networks (WSNs) have attracted a significant interest due to their wide-spread applicability in defense, civilian and environment monitoring scenarios. A typical WSN consists of a dense network of sensor nodes interconnected by wireless

links that are used to measure several physical phenomena such as temperature, pressure, humidity etc. This correlated nature of WSN measurements can be successfully employed to derive optimal estimation schemes for efficient utilization of the physical resources such as bandwidth, power etc. This paradigm of cooperative estimation of the parameter at the fusion center from the collective measurements of the constituent sensor nodes is termed as Distributed Estimation.

VISUAL DIALOG USING REINFORCEMENT LEARNING AND TOPIC MODELING
Mohammed Asad Karim, Mentor: Prof. Vinay P. Namboodiri
We observed that to succeed the person asks questions on topics based on the captions and previous dialog history.So from this experiment we inferred that to generate good questions the model must learn to understand the key topics from the model and dialog history.So we propose a model which will generate questions based on the topics and we will ask question based on all sorts of diverse topics to capture all the visual concepts present in the image.

ADVANCING EDM THROUGH ELECTRIC FIELD DISTRIBUTION USING DIFFERENT DIELECTRIC SYSTEMS IN COMSOL MULTIPHYSICS SOFTWARE AND CO-RELATING BREAKDOWN VOLTAGE AND GAP WITH ELECTRIC FIELD.
Nasir Ahmad, Mentor: Prof. J Ramkumar
The Objective of the research is to get maximum electric field between tool and workpiece in Electric Discharge Machining (EDM) process using different dielectric systems and co-relate with breakdown voltage, time required and gap between the tool and workpiece. EDM process is a thermoelectric, non-conventional which involves multiphysics at multi time scales. The single discharge phenomena in EDM consist of solid, liquid, gas and plasma states confined within a micrometers region and occurs at a time scales of micro-nano seconds. When the electrode and workpiece are separated by a small gap filled with dielectric oil, deionized water or gas; the application of high voltage between these two electrodes (tool, workpiece) results in ionization of the dielectric fluid.

PROBLEM OF MULTICOLLINEARITY AND VIOLATION OF WEAK EXOGENEITY PRINCIPLE, SOME CORRECTIVE MEASURES AND APPLICATION IN A RECENT STUDY
Nilay Tiwari, Mentor: Prof. Sharmistha Mitra
In this Research Work, we propose to represent GDP change as GDP growth rate, a better way than the one used in the paper. We also propose that the Fertility Rate is a factor which depends upon the fact weather the country is a Developed or a Developing Economy. We plan on dropping the Correlated variables by the method of Variance Inflation Factor and then constructing the subsequent Subset Regression Models for all countries. A Panel Data Regression for the Models of 11 countries in the 15 year range 2002-2016 will also be constructed.
The Results from the work will give us a better understanding on the variation of the dependence between GDP growth with Fertility Rate and Unemployment Rate with the change in the Economy from a developing to developed one.

EFFECT OF STRAIN REVERSAL DURING CYCLIC FORWARD/REVERSE TORSION AND MONOTONIC HIGH PRESSURE TORSION OF COCUFEMNNI HIGH ENTROPY ALLOY

Nimish Khandelwal, Mentor: Prof. N.P. Gurao

The microstructural evolution was observed using electron backscatter diffraction (EBSD) technique. Nano-indentation was carried out to determine stain rate sensitivity and activation volume which defines the rate controlling mechanisms. The different conditions of HPT was simulated using finite element modeling (FEM), which matches with the experimental results.

STUDY OF CONDUCTIVITY BEHAVIOUR OF DIFFERENT CONCENTRATIONS OF CARBON NANOTUBES ON GLASS SUBSTRATES.

Nimisha Panigrahi, Mentor: Prof. Anshu Gaur

Single walled Carbon nanotube (SWCNT) is an allotrope of carbon with rolled sheets of Graphene. Electronic band structure of SWCNTs along with their low dimension and high aspect ratio are responsible for their unique electrical, mechanical and thermal properties. The main objective of the this project is to study the network behavior of dispersed carbon nanotubes (CNT) solutions and to study the conductivity in different CNT concentrations for different sizes of source drain pattern and to fabricate a working thin film transistors with CNT channel.

CONTINUOUS NANOWIRE MATRIX FROM SILVER-ADENINE BASED ONE DIMENSIONAL POLYMER FOR ELECTRONIC DEVICES

Nivedita, Mentor: Prof. MONIKA KATIYAR

Various techniques are considered including self-assembly, dielectrophoresis, assembly by electrostatic interactions between the substrate and molecule (inherent polarizability), assembly driven by shear force (the wetting/de-wetting of surfaces or the mechanical movement of two surfaces in opposite directions for alignment), etc. Applicability of the aforementioned techniques require a deeper understanding of the chemical nature of the molecule which is being looked into for moving ahead.

MILLIMETER WAVES IN COMMUNICATION NETWORKS FOR THE INDIAN CITIES

Omkar Kumar, Mentor: Prof. Abhishek Kumar Gupta

Millimeter wave(mmWave) is the band of spectrum between 30 GHz and 300 GHz. It has short wavelength that ranges from 1 millimeter to 10 millimeters. In recent time wireless data traffic has been increasing at a very fast rate. To address this demand, the wireless industry is moving to its fifth generation (5G) of cellular technology which are being tested on mmWave frequencies to offer high rate of data transfer in the order of multi-Gigabit-persecond (Gbps) to a mobile device. 5G promises great flexibility to support a large number of devices simultaneously along with dense coverage areas. Despite these improvements in rate of data transfer, difficulties arise when we use them in congested places such as Indian Metro cities. mmWaves travel by the line of sight so their high frequency wavelengths can be blocked by physical objects like buildings and trees.

IMPACT OF TECHNOLOGY ADOPTION IN RURAL BANGLADESH
Prajual Maheshwari, Mentor: Prof. Debayan Pakrashi
This is the first study in the literature that uses a large scale Randomized Controlled Trial (RCT) to do an impact evaluation of adoption of a new rice technology: System of Rice Intensification. Out of total 180 villages surveyed, 120 villages were randomly assigned to the treatment group while 60 villages were assigned to the control. Villages in the treatment group were further sub-divided into 3 categories based on the treatment they got. While technology adoption was found to significantly improve production and profitability of the household, it deteriorated food insecurity and wellbeing.

SYNTHESIS OF POROUS ADHESIVE FILMS USING MICRO EMULSION METHOD.
Prakhar Bajpai, Mentor: Prof. Rahul Mangal
We are working on synthesizing porous adhesive films with a potential application in medicinal patches. To the best of our knowledge there have been no reports about it. Here, we are using micro-emulsion method in order to synthesize porous films, where we create water in PDMS emulsion followed by removal of water at 120°C, which makes the film porous. We are working on charactering the adhesive strength via peel test and the mechanical properties via rheology measurements, in comparison to the control smooth films.

PROBING THE ROLE OF DIVALENT CATION IN ATP HYDROLYSIS.
Pranshu Tripathi, Mentor: Prof. Raghvendra Singh
Adenosine 5‘-triphosphate (ATP) is the universal energy carrier in the living cell therefore known in biochemistry as the ”molecular currency” of intracellular energy transfer[1].Energy is released upon hydrolysis of γ -phosphate group of ATP molecule [see Fig.1]. The catalysis of this unique reaction by various enzymes leads to a myriad of different functions such as muscle contraction, replication of genetic material, and signal transmission.[2] The rate of hydrolysis crucially depends upon the environments of reaction.[3,4] Though there have been several attempts to elucidate the mechanism underlying and effect of solvent but none have examined the effect of divalent cation .In this project we aim to shed light on the catalytic effect of divalent cation Mg^{2+} and Be^{2+}.

STUDY AND ANALYSIS OF T&D LOSSES OF INDIA
Rahul Joshi, Mentor: Prof. Anoop Singh
With aggressive capacity addition in power generation in India, annual power deficit has reduced from 8.5% in FY 2011-12 to 0.7% in FY 2016-17. Despite this, India has one of the highest Transmission and distribution (T&D) losses in the world. AT&C loss is the difference between energy input and the energy for which revenue is actually realized from the consumer while the T&D loss is the difference between the energy input and the energy billed to the consumer. Some technical loss is inevitable, but with the use of better technology and stringent vigilance activities, T&D loss can be economically reduced to 6-8%. As per Central Electricity Authority (CEA), T&D losses in the country for the year 2012-13 stood at 23.04%. Higher levels of T&D loss imply

higher power purchase requirement which in turn translates to higher tariff to be paid by the consumers.

DESIGN A NOVEL HOVERING DEVICE USING FLEXIBLE APPENDAGES
Rhythm Pathak, Mentor: Prof. Sachin Shinde

DEVELOPMENT OF AN ALGORITHM FOR ONE-DIMENSIONAL MODELING OF WAVE EQUATION USING FINITE ELEMENT METHOD
Rishav Deval, Mentor: Prof. Dibankar Ghosal
The wave equation is an important linear partial differential equation for the description of waves-as they generally occur in classical physics-such as mechanical waves (e.g. water waves, sound waves and seismic waves) or light waves. The current work basically serves as one of many foundations for an ongoing project “Seismic Wave Propagation in the Poroelastic Medium”. The main objective of the work is to develop a working C++ code for one- dimensional model of wave equations using the Finite Element Methods (FEM). The code (currently under development) basically takes the parameters (Nodes, Elements, Property, Displacements, Force, Boundary Conditions, Mesh, e.tc.) required for further calculations in order to obtain the coefficients and evaluate the global vector of nodal displacements.

STUDY OF COMPOSITE MATERIAL UNDER DIRECT IMPACT LOADING
Rishav Kumar, Mentor: Prof. P. Venkitanarayanan
In this project, Composite specimens will be made and given high velocity impact using Hopkinson Bar. This test is known as Hopkinson test. It is done to test dynamic stress-strain behaviour of materials. High-speed imaging will be used to track the real time deformation. The load and displacement history will be measured in real time. The finite element simulation of this experiment will be done in ABAQUS software. The data of strain, velocity, displacement and damage pattern from Hopkinson test and ABAQUS will be compared and studied.

EFFECTIVE THERMAL CONDUCTIVITY OF RECONSTRUCTED POROUS GEOMETRIES USING LATTICE BOLTZMANN METHOD
Rochak Ranjan Parida, Mentor: Prof. Malay K. Das
Thermal transport in porous media is a phenomenon, common in numerous practical applications including functional material design, fuel cell optimization, biomedical engineering etc. Macro scale modeling of thermal transport in porous media requires a parameter named effective thermal conductivity and is being investigated extensively both experimentally and numerically. The present work conducts pore scale simulations in realistic pore microstructures for the numerical estimation of effective thermal conductivity in porous media.

THERMOELECTRIC MATERIALS
Rohit Chaturvedi, Mentor: Prof. Tanmoy Maiti
The hunger for achieving sustainable and promising material properties for a plethora of real applications, that demand the delivery of efficiency and excellence, has turned spotlights on perovskites. The diverse physical properties of oxides having a

perovskite(ABO3) structure in different application areas like cathode of solid oxide fuel cells, proton conductors, photo catalysts, dielectrics, ferroelectric and multiferroic materials makes them an ambitious batch for the applications. This research deals with development of a high-entropy perovskite by solidsolution synthesis and prying into their mechanical, physical, dielectric and conductive properties. The experimentation has involved calculation of the Goldschmidt's tolerance factor that influences the formation and temperature-stability of single cubic perovskite solid solutions.

ANALYSIS OF EFFECTIVE PROPERTIES OF COMPOSITE MATERIAL
Rucha Pramod Mendhe, Mentor: Prof. P . M. Mohite
Unidirectional fibre pre-pregs are extensively used in aerospace industry due their excellent properties. Therefore, these pre-pregs are very costly. Utmost care is taken to utilize these materials with lowest possible or no wastage. However, in general, 3 to 5% of wastage is seen at the end of their use which cannot be used further. Furthermore, these materials are hazardous environmentally therefore, cannot be disposed by land filling. In the current work carried out in this group an attempt has been made to utilize this waste or leftover material for fabrication of structural components.

EVAPORATION OF SESSILE FERROFLUID DROPLET UNDER STATIC MAGNETIC FIELD
Sagar Chaudhary, Mentor: Prof. P.K. Panigrahi
Ferrofluids are colloidal liquids made of nanoscale ferromagnetic particles suspended usually in an organic solvent or water which get strongly magnetized in the presence of a magnetic field. When a droplet of particle-laden liquid (such as a colloidal solution) is allowed to evaporate, it leaves a characteristic ring like stain around the edge of the drop. This phenomenon is called the Coffee Ring Effect. The coffee ring effect is undesirable for several applications like ink-jet printing, painting, thin film deposition, biological labelling, and the like where uniform deposition of solute particles is required. Hence, understanding the mechanisms of evaporation in drying drops is both scientifically interesting and technologically useful.

A NUMERICAL INVESTIGATION ON THE RELATIONSHIP BETWEEN ANISOTROPY AND DEFORMATION BEHAVIOR FROM BERKOVICH INDENTER
Samarpan Chakraborty, Mentor: Prof. Pritam Chakraborty
Nanoindentation experiments have been widely used over the past few decades for measurement of mechanical properties at the material surface, most commonly for measurement of hardness. Progress has been continuously made to measure a number of other parameters including surface hardening exponents and creep parameters. In this work, the process of inverse finite element method (IFEM) has been used to determine the stress-strain and the load-depth relationships of single crystals with reference to nanoindentation experiments with a Berkovich indenter. Three-dimensional and axisymmetric numerical simulations of Berkovich indentation tests were carried out to compare the differences in the load-indentation depth curves that arose due to differences in the tip geometry.

NUMERICAL STUDY OF PREMIXED CH4/AIR CATALYTIC COMBUSTION IN A RECTANGULAR MICRO CHANNEL

Samynaathan V, Mentor: Prof. D. P. Mishra

The demand for small power sources will continue to rise due to the rapid growth of portable devices such as mobile phones and laptops. In recent years, Micro electro mechanical systems are gaining popularity due to small size, light-weight, low cost and high energy density. Micro-combustor is a major component in which the chemical energy of fuel is converted to thermal energy via combustion. Even though, hydrocarbons are difficult to burn on a microchannel than hydrogen, they are preferred because the production and storage of hydrogen is difficult. The major challenge in micro combustion of hydrocarbons is maintaining stable combustion. Thus, catalytic combustion has been proposed to overcome the stability issues.

TRADE IN SERVICES BETWEEN INDIA AND BIMSTEC COUNTRIES : ANALYSIS USING GRAVITY MODEL

Sanjana Dubey, Mentor: Prof. Somesh K Mathur

Trade theories have paid more attention towards trade in goods as compared to services (as they were non tradable) thus literature on trade in services is quite limited. The objective of the research is to analyze bilateral trade flows in services between India and BIMSTEC countries using the gravity model. The novelty of the research is that, it studies the impact of determinants such as FDI flows, technological progress, non tariff barriers, free trade agreements, service trade restrictiveness index and digital trade restrictiveness index of each country on bilateral trade in services between India and BIMSTEC countries using an augmented version of the gravity model.

DEVELOPMENT OF AGAR BASED HYDROGELS FOR WOUND HEALING APPLICATIONS

Saswat Choudhury, Mentor: Prof. Vivek Verma

Wound is defined as a loss or damage of tissue of outer epidermal layer of skin. Wound healing is observed to be faster in the presence of a protective covering or dressing material than an open wound. Agar based hydrogels have been previously explored as potential low cost biodegradable dressing materials for acute wounds. However, in case of chronic and infected wounds, agar based dressings fall short due to lack of key attributes like acidic pH i.e. required for decreasing the matrix metalloproteases (MMP) activity and antibacterial effect for control of infection causing bacteria.

SYSTEMATIC CHARACTERIZATION OF ENCELADUS PLUME

Saurabh Shukla, Mentor: Prof. Deepak Dhingra

Our aim is to characterize and classify the reflectance spectra of ice-particles within the geysers on Saturns' moon Enceladus using data collected by VIMS (Visual and Infrared Mapping Spectrometer) used in Cassini orbiter mission by NASA-ESA [1]. Enceladus is believed to be made up of icy outer surface, a subsurface ocean and rocky core [2]. Enceladus possesses all three ingredients believed to be necessary for the origin of life (energy, liquid water and organic material) and is therefore the target for future planetary missions [3]. We will use Enceladus infrared observations from the

Cassini mission to study physical and compositional properties of water ice in its plume.

OPTICAL TWEEZERS

Shaelja Mishra, Mentor: Prof. Debabrata Goswami

First demonstrated over 30 years ago in the 1980s by Dr.Ashkin, optical tweezers have been used to trap dielectric spheres, viruses, bacteria, living cells, sub-cellular organelles, small metal particles, and even strands of DNA due to their unique non-contact and non-invasion characteristics. As their name suggests, optical tweezers use beams of light to hold and manipulate microscopically small objects such as biological molecules or even living cells. The basic optical tweezer scheme uses a single beam of light focused down to a very small spot. If you take some small (mostly) transparent object and place it in the beam, it will feel a force pulling it right to the center of the focus. Over the past two decades, single-molecule techniques have evolved into robust tools to study many fundamental biological processes and for applications such as cell sorting and micromanipulation.

REMOVAL OF FLUORIDE FROM DRINKING WATER

Shashank Shekhar, Mentor: Prof. Abhas Singh

Removal of fluoride from drinking water is the main aim of the study as greater than 1.5mg/L of fluoride is harmful for human health. First, all the basic principles of physico-chemical processes like pH, titration, solubility, complexation, kinetics etc. was learnt. Then, literatures on different methods of fluoride removal by sorption which are, by activated alumina, and hydroxyapatite were reviewed. After that an experiment was carried out in the lab on determining the fluoride content in a water sample by TISHAB reagent using fluoride ISE probe. Theories and skills of operations of Spectrophotometer and pH meter were learnt, with the help of PhD seniors and working principles of XRD, IC, ICP-MS, Zeta-analyzer were learnt. The main aim is removal of fluoride by sorption on calcium phosphate solids.

COMPUTATIONAL INVESTIGATIONS OF INTERNAL PRESSURE'S AFFECT ON STRAIN IN NANO PRESSURE VESSELS

Shayamal Singh, Mentor: Prof. Anandh Subramaniam

Nano pressure vessels are considered, incorporating Ar at high pressure inside palladium hollow nanospheres (PdHS). These PdHS samples are filled with Ar with various pressures. It has been observed that the strain in the PdHS has a higher value than the yield stress of Pd and a nonlinear function of the internal pressure. The strain comes out to be an order of magnitude higher than that computed through elasticity theory of pressure vessels. The present work is an attempt to understand the effect of internal pressure on the strain and to see how it’s affected as adsorption takes place inside the hollow spheres, subjected to different initial pressures of Ar using molecular dynamics (MD) simulations. These simulations at various initial pressures can help further our understanding of the novel effects involved and also hint at the state of Ar inside the spheres.

SYNTHESIS OF SOLID STATE SODIUM-ION BATTERY

Shibi.K, Mentor: Prof. Shobit Omar

Battery is an energy storage device that transforms chemical energy to electrical energy. A typical battery is made up of cathode, electrolyte and anode. In the present work, we are looking for the development of sodium-ion battery using solid-state electrolyte. Electrolyte play a crucial role in transferring the ions from the cathode to anode and vice-versa during charge-discharge cycles. Sodium-ion superconductor (NASICON) has been chosen as solid electrolyte for the sodium-ion battery with the basic composition of Na3+xZr2-xMx(SiO4)2(PO4) were (M = Sc3+-Scandium, Gd3+-Gadolinium, Al3+-Aluminium, Yb3+-Ytterbium or Y3+-Yttrium).

To increase the conductivity of solid electrolyte, we will perform the doping of trivalent cations at Zr4+ (Zirconium) site in NASICON structure. It is widely known that the ionic radius of dopant cation significantly influences the conduction of sodium-ions.

MODELLING METHANE DISSOCIATION IN A MOLTEN TE SYSTEM

Shivali Agrawal, Mentor: Prof. Vishal Agarwal

Hydrogen is an important fuel for the future because of environmental considerations of using fossil fuels as energy sources. Therefore, it is necessary to develop environment friendly hydrogen production techniques for mitigating the greenhouse gas emission problem [1]. Commercially, hydrogen is produced by the well developed Steam Methane Reforming (SMR) process followed by water gas shift reaction which produces greenhouse gases like CO2 and CO [2]. To reduce the carbon footprint of the process, it is required that the produced CO2 be sequestered; but the sequestration process consumes a lot of energy that is produced in the process[3]. Another viable process for hydrogen production is the Thermal Cracking of Methane (TDM), also called pyrolysis which requires high temperature and gives solid C and pure hydrogen as products.

PERFORMANCE ANALYSIS OF A WASTE HEAT RECOVERY SYSTEM EMPLOYING SPHERICALLY PACKED BED OF PHASE CHANGE MATERIAL IN THE TEMPERATURE RANGE OF 800 -1000 K.

Shivam Kumar, Mentor: Prof. Arvind Kumar

In this work, an attempt has been made to numerically model and simulate in Ansys FLUENT (Commercially available CFD software) the spherically packed bed LHTES system in the temperature range of 400-600 oC. The eutectic metal alloy AlSi12 (88 mass% Al and 12 mass% Si) has been chosen as the PCM owing to its high latent heat of fusion (560 kJ/kg). After the literature review Nickel has been selected as the spherical shell material for the encapsulation of the PCM due to its high thermal conductivity and corrosion resistance. For the study Air has been selected as the heat transfer fluid for charging and discharging process of the LHTES.

VORTEX INDUCED VIBRATIONS OF A BRIDGE SECTION

Shreya Agrawal, Mentor: Prof. Sanjay Mittal

When flow is separated from a bluff body, a regular pattern of vortices develop in the downstream region that exerts periodic pressure on the body. The frequency (fs) of vortex shedding may approach one of the natural frequencies (fn) of the structure at

some critical wind speed. If the ratio fs/fn becomes close to unity, the structure and the wake begin to oscillate at a common frequency close to the natural frequency of the structure over a certain band of wind speeds. This type of vibration can generate moderately large amplitude response of the structure. The overall phenomenon described above is called “locked-in” vibration and the region within which it occurs is often called the “lock-in” region.

COMPARATIVE STUDY OF PEROVSKITE THIN FILM FORMATION USING MAI VAPOURS THROUGH HOTPLATE AND MICROWAVE OVEN ROUTES.

Shreya Rengarajan, Mentor: Prof. Ashish Garg

In this project, we aim to study the structural, morphological, optical, & electronic properties of CH3NH3PbI3 (perovskite) films formed by a two-step sequential deposition method using MAI vapours, carried out via two differences routes: namely, on a hotplate and in a microwave oven. In order to carry out the sequential deposition, a layer of PbI2 is spin coated onto a previously deposited TiO2 scaffold on FTO substrate. Methyl ammonium iodide (MAI) vapours are then allowed to deposit on the PbI2 layer, which spontaneously forms CH3NH3PbI3 film.

EXPRESSION PROFILING OF METABOLISM RELATED GENES (MRGS) IN VERTEBRATE BRAIN DEVELOPMENT.

Shruti Jain, Mentor: Prof. Jonaki Sen

Differentiation is a process in which cells become specialized from a common pool of non-specialized cells. A previous study from our lab, demonstrated that a number of genes encoding for metabolic enzymes and transporter proteins belonging to a special class of genes known as Metabolism Related Genes (MRGs) are expressed in tissue restricted manner in the developing chick embryo. Also, the maximum number of MRGs are expressed in the time window wherein key aspects of differentiation and patterning occur in the developing embryo. Taking cues from this, we hypothesized that Metabolism Related Genes(MRGs) may play a role in the development of the vertebrate brain apart from their known metabolic activity.

To test this hypothesis, we first wanted to determine the expression pattern of five MRGs: DIO1,PHACTR1,NUAK1, HMGCS1 and CNKSR2 in the developing forebrain of HH22 chicken embryos via Whole Mount In situ Hybridization (WMISH). WMISH is a technique, wherein labelled antisense probes, help detect the mRNAs of the above genes in the cells in which they are expressed.

DYNAMIC MODELLING OF ELECTRIC ARC FURNACE AND ITS CORRELATION WITH DYNAMIC FOAMING INDEX

Shubham Kumar, Mentor: Prof. Amarendra kumar Singh

Electric arc furnace process of steel making has grown significantly in the past several decades. Slag engineering is becoming an essential issue in many companies due to increasing need felt by the end users to cut cost and produce high quality steel. Slag foaming has been mainly used in EAF in order to protect refractory material from high energy intensity radiation generated by electrodes, decrease in noise level, increasing productivity and the energy efficiency of the equipments. Literature review of the existing research papers was done which explained that to sustain a foam in steel

making process two basic requirements should be fulfilled i.e. appropriate physical properties of the slag and the generation of sufficient reaction gas.

IMPACT OF COOKING PRACTICES ON HUMAN HEALTH

Shubhanshi Singh, Mentor: Prof. Anubha Goel

Most of the rural households burn biomass for cooking and heating purposes. This category of fuel not only has low efficiency but it also releases harmful chemicals due to the incomplete combustion of the biomass. The smoke thus emitted is made up of chemicals in gaseous phase and bound to particles. This smoke has a direct impact on the health of the residents. Moreover, the poor ventilation conditions add on to the health burden.

MOSQUITO OLFACTION

Siddhanta Mhambrey, Mentor: Prof. Nitin Gupta

My project involves creating a website to hold data that has been collected (partly by me) which contains information regarding the response of various species of mosquitos to various odours. This information was obtained by going through many research papers and obtaining values either from tables or either from graphs provided in the papers. The website contains different search parameters for different sets of data and also allows the user to download the data satisfying particular search entries. The information include the species name of the mosquito, odour name, concentration of the odour, details about the mosquito (age, gender, blood fed status etc) and the response that was obtained after doing the experiment.

DETAILED INVESTIGATION OF FLOW PAST A BLUFF BODY STABILIZED COMBUSTOR

Sombuddha Bagchi, Mentor: Prof. Ashoke De

A detailed numerical investigation of laminar, two-dimensional transient flow past a cylindrical bluff body has been performed. The simulations were carried out using a laminar finite rate model. A thorough study of the fluid mechanics has been completed. The current investigation illustrates the qualitative and quantitative aspects of the vortex shedding phenomena. Fast Fourier Transform analysis of the temporally fluctuating lift coefficient is performed in the present study. Proper orthogonal decomposition of the vorticity field was implemented to identify the dominant nodes and their respective enstrophy content. Dynamic mode decomposition was also carried out on the vorticity magnitude field to analyze the temporal variations. Von Karman vortex street is observed. A 90º phase shift is observed between the different modes and vortex tearing is detected from the POD data. The flow field is successfully reconstructed using the proper orthogonal decomposition data.

CONTROL ALGORITHMS FOR TILT ROTOR QUADCOPTER DURING ROTOR FAILURE

Soumya Sambit Rath, Mentor: Prof. Soumya Ranjan Sahoo

With the increasing use of quadrotors in military, surveillance and air delivery applications, it becomes essential to make flight operations secured and develop fail-safe mechanisms for the vehicles. A lot of research work is going on in improving the

manoeuvrability and autopilot features of the quadrotors. However, it is equally important to develop algorithms that would help the vehicle recover stability and suffer minimum damage in case of any eventuality like accidents, crashes and engine failure. Tilt rotor quadrotors are a special class of quadrotors that have additional servo motors to tilt the rotors. Since the number of user inputs (eight) is more than the degrees of freedom (six), the vehicle is over-actuated. It enables the vehicles to pitch forward at higher speeds, take sharper turns, brake aggressively and perform difficult manoeuvers.

SIDE-CHANNEL ATTACKS AT THE SHARED LAST-LEVEL CACHE

Srilekha Kadali, Mentor: Prof. Biswabandan Panda

On a multi-core system, the cache attacks enable the spy process to infer the private information of the victim by observing the programs cache behaviour. The spy process evicts an address from the shared cache, which results in the eviction of the address from the private cache of the victim, creating an Inclusion Victim. The cache attacks are mainly side channel attacks, where private information is obtained by observing its behaviour, rather than by directly gaining access to private information. The objective is to prevent a spy process from replacing shared cache lines from the victim process that would create inclusion victims in private cache of the victim process's core. This is done by altering the shared cache's replacement algorithm to minimize the number of inclusion victims that a process induces on other processes.

MATLAB BASED SOFTWARE FOR DYNAMIC ANALYSIS OF SINGLE-DEGREE-OF-FREEDOM SYSTEMS

Subhajoy Datta, Mentor: Prof. Chinmoy Kolay

A MATLAB-based software for simulation of single-degree-of-freedom (SDF) systems is very useful for research and teaching works. This software is designed to solve SDF systems in a MATLAB-based Graphical User Interface (GUI). This will give the user many options for choosing the force-deformation behaviours of the system, excitation types and direct integration algorithms. The force-deformation behaviours currently available are 'Linear Elastic', 'Bilinear Elastic', 'Elastic Perfectly Plastic', 'Bilinear Plastic', 'Self Centering' and 'Duffing Oscillator'. A user can define the required system parameters like natural frequency, damping ratio, and yield force using the GUI. There are four excitation options currently available: 'Free Vibration', 'Seismic Excitation', 'Harmonic Excitation' and 'Arbitrary Excitation'. The user can also choose initial conditions according to his/her requirements and browse file for seismic data.

CACHE HIERARCHY BOTTLENECKS FOR MACHINE LEARNING APPLICATIONS

Sudhanshu Gupta, Mentor: Prof. Biswabandan Panda

AI applications have taken the world by a storm and AI powered devices are the norm today. Their ubiquitousness, however, has come at a cost. Deep learning, the machine learning method that powers present day AI, requires great computational power. Significant research work to accelerate such computations using hardware accelerators has already been done by both academia and industry, resulting in processors like Google TPU [1]. Not much, however, has been done to evaluate the impact of such applications on the memory subsystems.

DEVELOPING OPTIMIZED EXPLORATION STRATEGY FOR PLANETARY MISSIONS

Sudhanshu Pandey, Mentor: Prof. Deepak Dhingra

In this project, we will develop strategies to study pre-selected scientific locations on the Moon in the most optimized way such that maximum scientific analysis can be performed in the minimum amount of time by travelling the shortest distance using a rover. We will utilize imaging, topography and compositional data from lunar missions. This work would help prepare for future missions to various planetary bodies. In the project we will be developing exploration strategy involving maximum distance coverage in minimum amount of time least risk to the mission (e.g. avoid steep slopes or boulders) and optimal utilization of the available scientific instruments, by using lroc quickmap and using remote sensing softwares tools such as ArcGIS and ENVI. This project would enable us to generate the most efficient traverse maps for studying a set of scientific locations at a landing site.

SPINNING ELLIPSOID DYNAMICS

Sukhjeevan Bansal, Mentor: Prof. Ishan Sharma

Spinning objects have historically been interesting subjects to study. There are many toys or objects which show weird movement on spinning that contradicts our common sense. One of such objects is an ellipsoid or an egg which is shaped like an ellipsoid. Its long axis rises from horizontal to nearly vertical when spun rapidly. Spinning eggs have been studied for more than 100 years. It is a strange phenomenon that physicists didn't solve until 2002. So, the main goal of my project is to study its motion and predict its orientation at any specific time.

DYNAMIC MODELLING OF EAF AND ITS CORRELATION WITH DYNAMIC FOAMING INDEX

Sumit Kumar, Mentor: Prof. Amarendra Kumar Singh

Electric arc furnace process of steel making has grown significantly in the past several decades. Slag engineering is becoming an essential issue in many companies due to increasing need felt by the end users to cut cost and produce high quality steel. Slag foaming has been mainly used in EAF in order to protect refractory material from high energy intensity radiation generated by electrodes, decrease in noise level, increasing productivity and the energy efficiency of the equipments. Literature review of the existing research papers was done which explained that to sustain a foam in steel making process two basic requirements should be fulfilled i.e. appropriate physical properties of the slag and the generation of sufficient reaction gas.

SELECTIVE DECORATION OF HIGH ENTROPY ALLOYS NANO PARTICLES ON MONO LAYER OF MOS2

Sushree Ananya Tanaya, Mentor: Prof. Krishanu Biswas

The objective of our work is to form monolayer of MoS2 from number of layers through additive-free technique, such as solvent-assisted exfoliation via sonication, where DMF (Dimethylfermamide) is used as solvent. First the bulk MoS2 powder is cryomilled (at 123 K) for some hours to obtain nanocrystalline powder. Cryomilling helps in obtaining powder which are relatively contaminations free with narrow size

distribution. The samples were characterized by X-ray diffraction (XRD), optical microscopy, scanning electron microscopy (SEM),Transmission electron microscopy(TEM), UV-vis spectroscopy and Raman spectroscopy to reveal the nature. High entropy alloys nanoparticles(Cu0.2Ag0.2Au0.2Pt0.2Pd0.2) obtained by cryomilling are decorated on the MoS2 monolayer and the effect is studied.

STUDY OF WATER EVAPORATION USING B-TIO2 UNDER VISIBLE LIGHT ILLUMINATION

Sushrutha P B, Mentor: Prof. Gupta Raju K.

Solar energy to heat energy conversion is an essential metrology for water purification and desalination. Usage of black materials is a novel method to attain this goal. B-TiO2 is used as the absorber. The project deals with study of photo thermal properties B-TiO2 for desalination of water. B-TiO2 is synthesized using hydrothermal method. Chemical reduction method is employed to create defective in TiO2 using NaBH4 as reducing agent.

ELECTRODEPOSITION OF SELENIUM FOR PHOTOVOLTAIC APPLICATIONS

Suyash Tripathi, Mentor: Prof. Sarang Ingole

Copper Gallium Selenide(CGS) and Copper Indium Selenide (CIS) are semiconductor materials that have potential to be used as a photo electrodes however the two major problems of using these electrodes is that Indium and Gallium are two rare and very expensive elements and also, during the electrodeposition of CGS/CIS film, co-deposition of oxides takes place (primarily copper selenides).

DEVELOPMENT OF AN HYBRID RANS-LES METHOD FOR PREDICTING TRANSITIONAL FLOWS.

Swapnil Majumder, Mentor: Prof. Ashoke De

Predicting transition of a laminar boundary layer into turbulence is one of most important aspect in fluid flows especially in aerodynamic flows. Transition to turbulence can lead to increase in friction drag and also sudden decrease in lift (a phenomena called stall). Hybrid models have gained increase importance in the research community as it indulges the advantages of both RANS and LES models. RANS modelling computes the mean flow and accounts for the effect of the eddies as an additional stress tensor, whereas LES filters the large eddies and models the sub grid scale eddies as a stress component.

STRUCRURAL MODEL FOR THE CROSS SECTION OF OPTICAL CABLES.

Swapnil Srivastava, Mentor: Prof. Ishan Sharma

The aim of the project is to develop a structural model for the cross-section of optical cables, which are under constant in-plane stress. Optical fibres are laid out through optical cables. The cables consist of an outer sheath, an inner rigid core and loose tubes between them which carries gel and optical fibres. To tackle this problem, we have considered the case of inextensible ring(s) or beam(s) with small thickness, which are compressed by rigid anvils of given curvatures.

NUMERICAL SIMULATION OF IMPINGEMENT JET COOLING OVER A CIRCULAR PLATE

Swimi Sampda Swami, Mentor: Prof. D.P. Mishra

Convective heat transfer by jet impingement is a prominent method of cooling. The applications of this cooling method include cooling of gas turbine components, cooling of fusion reactors, cooling of power electronics, annealing and quenching of metals, drying of paper and fabric as well as tempering of glass. The objective of this study is to analyse the transient heat transfer characteristics over a circular flat plate made of steel by using numerical method.

FLOW PAST A SQUARE CYLINDER

Tanmay Singhal, Mentor: Prof. Arun K Saha

Flow past a circular and square cylinder has been a topic of interest in fluid mechanics because of its wide practical application. Simulation of flow of immiscible and incompressible fluids past a square cylinder will reveal different aspects of flow and can be helpful for further studies. The present work tries to recreate simulation of such a flow. First of all, a working code for a single fluid flow simulation. Marker and Cell (MAC) method by Harlow and Welch is helpful in finding solution of 2D flow for a single fluid.

DEVELOPMENT OF NETWORK BASED PRELIMINARY DESIGN METHODOLOGY FOR A MICRO GAS TURBINE COMBUSTOR.

Touqeer Anwar Kashif, Mentor: Prof. Santanu De

The design of combustor involves two stages. The first stage involves the preliminary design, where through an iterative process an extensive number of geometrical and operational conditions are evaluated and compared. During this phase, important design parameters are considered, such as the mass flow rate distribution through air admission holes, associated pressure losses, liner wall temperatures, etc. The process is iterative and this saves both time and resources by eliminating the need for running 3D CFD simulations of reactive flows. Flownex, a commercial 1D network solver, is used to build a network model of the combustor, and the results obtained are found to be satisfactory.

SIMULATOR FOR FIFTH GENERATION (5G) SYSTEM LEVEL SIMULATIONS

Ushasi Ghosh, Mentor: Prof. Abhishek Kumar Gupta

The objective of my work is to develop the channel realization for the fifth generation system and link level simulations which is based on the channel model established by the WINNER II Project Report [WINNER II Channel Models, 2007, also called WIM2 channel model]. The WINNER II MIMO radio channel is essentially a geometry based stochastic channel model, which allows the creation of an arbitrary double-directional model. The source code is being written in MATLAB.

WEB APP DEVELOPEMENT

Vaibhav Bajpai, Mentor: Prof. Revathy K T

In the project I am working on creating a website on which Teachers can post the tutorial videos in different languages and the students can search and view through the videos to find the one best suited for them in terms of language, content,etc. Not

only the students would get to see the video tutorials but also see their progress in the profile section. A detailed analytics interface will be available to instructors where they can see who viewed what.

DIELECTRIC STUDY OF POLYMER NANOCOMPOSITES-BASED CAPACITORS USING BARIUM TITANATE (BATIO3) AS NANOFILLERS AND POLYVINYLEDENE FLUORIDE (PVDF) AS POLYMER

Venkatasubramanian G, Mentor: Prof. Raju Kumar Gupta

Dielectric capacitors are widely used in electrical devices because of their fast discharge/charge capacity with high power density. Usually, polymers have high breakdown strength, but suffer from low dielectric constant. On the other hand, high-k ceramics have high dielectric constant but at the cost of much lower breakdown strength as compared to polymers. Hence, the use of high-k nanofillers and their incorporation in polymers with new design are attracting attention. Also, the literature suggests that using single layered polymer nanocomposites-based capacitors with high-k fillers lead to early breakdown due to formation of conducting channels across the film, which is not desirable.

NUMERICAL INVESTIGATION OF DRAG EXPERIENCED BY AN AXISYMMETRIC PROJECTILE AT DIFFERENT CAVITATION NUMBERS IN PARTIALLY SUPERCAVITATING FLOWS

Vijit Kanjilal, Mentor: Prof. Ashoke De

Supercavitation is a revolutionary phenomenon, currently under research, for improving the performance of underwater vehicles, enabling them to achieve high under-water speeds by virtue of sufficient drag reduction. Supercavitation is a hydrodynamic process in which an underwater body is almost entirely enveloped in a layer of gas initiated at a cavitator, mounted at the forward end. Because the density and viscosity of the gas engulfing the body, are dramatically lower than that of water, skin friction drag is reduced significantly. When the cavity covers the entire solid body, the phenomenon is called Supercavitation.

MULTIMODAL ALIGNMENT

Vipul Bajaj, Mentor: Prof. Vinay P. Namboodiri

Vision, language and speech cues have been well explored individually. An interesting aspect of research is to develop ideas for joint learning of language, speech, and vision. Deep generative models have recently received an increasing amount of attention, not only because they provide a means to learn deep feature representations in an unsupervised manner that can potentially leverage all the unlabeled images on the Internet for training, but also because they can be used to generate novel images necessary for various vision applications.

DRAWING DISTINCTION BETWEEN HEDONIC AND UTILITARIAN PREFERENCES

Vishal Keswani, Mentor: Prof. Nisheeth Srivastav

Hedonic preferences are characterised as quick and change-insensitive whereas utilitarian preferences are slow and sensitive to change. Cognitive Sampling Cost is

higher for utilitarian decisions and lower for hedonic decisions. In the paper, “Choosing fast and slow: explaining differences between hedonic and utilitarian choices” (Srivastava and Vul, 2015), the basic premise of the theory proposed is that hedonic decisions are made by sampling observations from an internal mental representation of value that has a small probabilistic sample space, while utilitarian decisions require sampling from distributions with large sample spaces. To test the premise, I am working on a web-interface(app).

INTRODUCTION TO ELLIPTIC CURVES AND MODULAR FORMS

Vishal Kumar Yadav, Mentor: Prof. Somnath Jha

I started my project with ‘Modular Forms’ by Jean-Pierre Serre’s ‘Course in Arithmatic’. Serre started with speacial linear group and its action on upper half plane then he defined modular group using quotients. After that I read about fundamental domains and an example of it. I then learned about ‘Modular Functions’ , and how to define Modular Forms using them. Then Serre defined Modular Functions on a lattice and associated a lattice function to a modular function. After this Serre gave an example of modular form namely Eisenstein Series. Next topic was ‘The space of modular forms’, in that I read some theorems.

THERMOELECTRIC OXIDES

Vishesh Goel, Mentor: Prof. Tanmoy Maiti

High entropy perovskites are a relatively new class of compounds, consisting of multiple cation solid solutions with high configurational entropies. Perovskites (AB in general are environment friendly and show minimal toxicity.)O 3 Perovskites are well known for their interesting properties viz. ferroelectric, piezoelectric, pyroelectric, thermo-electric, dielectric and optical. Perovskite structured oxides can accept considerable substitutions in one or both cationic sites (i.e. A and B sites) while retaining their original crystal structures, which helps in the chemical tailoring of the materials and hence modifying their structural, microstructural, electrical and magnetic properties.

AUTOMATION OF FOUR PROBE METHOD USING IMAGE PROCESSING TECHNIQUES.

Yogesh Kumar, Mentor: Prof. Amit Verma

Four probe apparatus is one of the standard and most widely used apparatus for the measurement of resistivity of semiconductors. This method is employed when the sample is in the form of a thin wafer, such as a thin semiconductor material deposited on a substrate.

Usually this process is carried out by manually taking the readings of the PID controlled oven and the voltmeter and ammeter. To make this process of measurement automatic we will take images of the readings of voltmeter, ammeter and the temperature reading.

SURGE 2018 Popular Lectures

Dr. C. S. Upadhyay

Dr. C. S. Upadhyay is currently Professor in the Department of Aerospace Engineering at Indian Institute of Technology, Kanpur. His research interests are Solid Mechanics, Adaptive Finite Element Methods, and Structural Optimization.

Title: "Academics as Career Option".

Presented by HAL Team
Moderated by Profs. C. S. Upadhyay, A. R. Harish and S. Kamle.

Title: "Solving Engineering Problems".

Dr. Nisheeth Srivastava

Dr. Nisheeth Srivastava is currently Professor in the Department of Computer Science and Engineering at Indian Institute of Technology, Kanpur.

Title: "A computational view of delayed gratification ".

Abstract: "Anthropologists and psychologists have combined to identity a central aspect of behavior that strongly predicts worldly success - the ability to delay gratification. In this talk, I will present to you some empirical studies that document the centrality of this trait in predicting future success. I will then show you how to mathematically model and measure this trait in behavior, and briefly review some computational models that try to explain how and why people are able to delay gratification in some cases, and not in others. Included in this set will be a model that I am currently working on that claims that individual differences in the ability to delay gratification stem primarily from observers' prior environmental experiences. I will finish by pointing out some interesting cultural and social implications of this hypothesis."

Dr. Saravanan Matheshwaran

Dr. Saravanan Matheshwaran is currently Professor in the Department of Biological Sciences and Bioengineering at Indian Institute of Technology, Kanpur.

Title: "Bacterial Language- New recipe Old spice! ".

Abstract: "Scientists believed that life has evolved from bacteria. Bacteria can do diverse activities from making curd to poison. These activities are performed based on the population density of the bacteria. Bacteria can maintain their population density and heterogeneity by communicating with each other through a common or unique language. Scientists have explored these properties and successfully applied them in agriculture, health, industrial and defence (Bio-warfare) sectors. Bacteria can evolve quicker than what we are prepared for. Even the most harmless bacteria, under certain conditions, can become the most formidable enemy. We will be discussing the extra-ordinary dynamics of the bacterial world, which continues to surprise us every day."

SURGE 2018 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 2018 Awards.

S. N.	Name of the Participant	Department	Award Name
1	Aditya Garg	Electrical Engineering	Best Project Award
2	Shreya Rengarajan	Material Science & Engineering	Best Project Award
3	Shruti Jain	Biological Sciences & Bioengineering	Best Project Award
4	Dhananjay Singh	Humanities Social Sciences	Best Poster Award
5	Shubhanshi Singh	Civil Engineering	Best Poster Award
6	Sudhanshu Gupta	Computer Science & Engineering	Best Poster Award

From Left to Right: Aditya Garg (IITK), Dr. Sudhir Kamle (SURGE, Incharge), Dr. B. V. Phani (DoRA), Dr. S. Ganesh (DoRD), Shubhanshi Singh, Dr. V. P. Singh (JR), Shruti Jain, Dhananjay Singh, Ms. Shobhi.

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4. Department faculty coordinator and the Project Evaluation Committee.

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

SURGE 2018 Batch

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