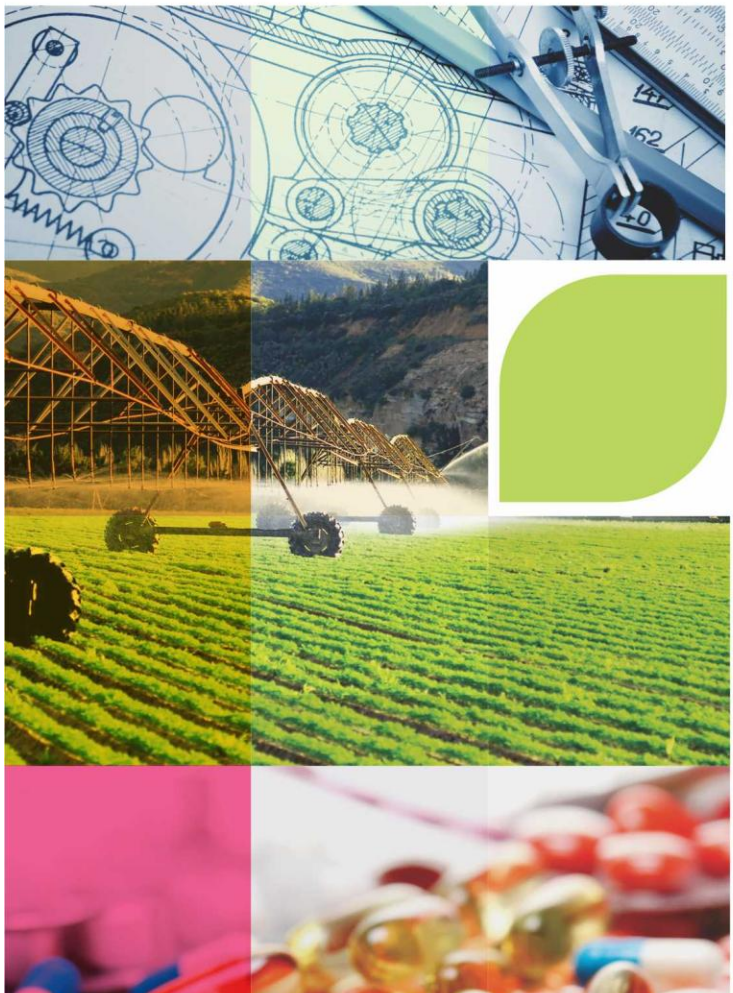
Confederation of Indian Industry

PRIME MINISTER'S FELLOWSHIP SCHEME FOR DOCTORAL RESEARCH

A PPP Initiative of Science & Engineering Research Board (SERB), Department of Science & Technology, Government of India and Confederation of Indian Industry (CII)



Projects 2016-17

..

Contents

..

..

..

Genesis of the Scheme

Public-Private-Partnership (PPP) for human resource capacity building for industrial R&D has been recognized as one of the main deliverables by a Sub-Committee of Prime Minister's Council on Trade & Industry. One of the recommendations that emerged from the Private Sector is to design, develop and implement a Doctoral Research Scheme under PPP for enhancing trust level in academia, research outfits and industry.

The Hon'ble Prime Minister, in his speech as General President of the Indian Science Congress Association, announced a special scheme for 100 Doctoral Research Fellowships every year during the Inception Ceremony in June, 2012 in Kolkata. Vide Prime Minister's Office ID No–3646245/2012-ES-II dated 2nd November 2012, the Prime Minister's Office approved the proposal of naming the SERB-CII Doctoral Fellowship Scheme as "**Prime Minister's Fellowship Scheme for Doctoral Research**".

On 8th November 2012, the "Prime Minister's Fellowship Scheme for Doctoral Research", being implemented jointly by Science & Engineering Research Board (SERB) and Confederation of Indian Industry (CII) was formally launched. The scheme was launched under PPP mode, at AICTE-CII University-Industry Congress & 4th Global Higher Education Summit held at Hotel Lalit in New Delhi

PM Fellows receive a maximum fellowship amount of upto Rs 8.7 lakh per annum per candidate. Fifty per cent of this amount comes from SERB [being equivalent to the prevailing Government norms for JRF/ SRF (inclusive of HRA)] and will be revised as per the JRF/ SRF norms from time to time. Rest 50 per cent comes from a partner company, on behalf of CII.

..

Executive Summary

Ongoing Fellowships

S.No.	Name of the PM Fellow	Partner Company	Institute	Research Topic
BATCH 2013				
1.	Andugulpati Sai Balaji	Strand Life Sciences	Manipal University	To Study the Role of ABCC Family of Drug Transporters in Breast Cancer Chemoresistance
2.	Boyapati Subrahmanyam	Intel Corporation, USA	IIT Bombay	Low-Noise Nano Scale Signal Conditioning Integrated Circuits for Portable Electro-Medical and Electro-Sensor Applications
3.	Darshak Bhatt	Intel Corporation, USA	IIT Bombay	Study and Design of Integrated Mixer and Local Oscillator Topologies for WiFi and WiMAX Systems
4.	Deepika Pandey	Tata Chemicals Ltd.	Manipal University	Study on Production of Gamma-Polyglutamic Acid by Bacillus Sp.
5.	Govardhan Rao Talluri	Maxim Integrated, California	IIT Bombay	High Speed I/Os for Chip to Chip Interconnects
6.	Hiren Kumar Mansukhbhai	Solar Agrotech Pvt. Ltd.	Saurashtra University	Isolation and Evaluation of Anti-Pathogenic Bacteria from Cotton Rhizosphere
7.	Jailakshmi Menon	Autosys Engineering (P) Ltd.	Anna University	Development of Control Algorithm for Canal Automation
8.	Jaydeep Bipin Deshpande	NanoXpert Technologies	NCL Pune	Process Design for the synthesis of Nanomaterials and Scale-up
9.	Madhava Krishna C	Morphing Machines Pvt. Ltd.	IISc Bangalore	Architecture and Compiler Support for Concurrent Program Execution on Application Specific Massively Parallel Processors

..

10.	Monika Gupta	Infosys Ltd.	IIIT Delhi	Mining Peer Code Review Process
11.	Narendra Akiti	P&G , Beijing	IIT Bombay	Granule Breakage in a Controlled Shear Field - Modelling and Experiments
12.	Neha Bhardwaj	Petrotech Society	IIT Delhi	Oil-slick Control and Development of an Intelligent Oil-recovery System
13.	Nidhina M Bhaskaran	Jai Bharath Gum & Chemical Ltd.	CSIR-CFTRI, Mysore	Biotechnological Approaches for Value Addition of Industrial Guar Meal
14.	Poonam Mishra	Tata Chemicals Ltd.	Manipal University	Isolation, Purification, characterization and optimization of fermentation conditions of γ-Polyglutamic acid producing Microbes
15.	Shamayeeta Rey	Piramal Healthcare Ltd.	IIT Bombay	Structural Characterization of Regulatory Proteins Useful in Developing Biosensors for Water Purification System
16.	Soujit Sengupta	Thermax Ltd.	IIT Bombay	Graphene-Based Composite for Capacitive Deionization and Water Purification
17.	Subhadeep Das	Piramal Enterprises Ltd.	IIT Bombay	Engineering Amyloids for Nanotechnology and Neuronal Cell Regeneration
18.	Sushrut Sandeep Bhanushali	Thermax Ltd.	IIT Bombay	Investigation of Thermo-Physical Properties of Nanofluids
BATCH 2014				
19.	Ajay Krishnan	Godrej & Boyce Mfg. Co. Ltd.	IIT Bombay	Influence of Temper Conditions on the Environmentally Assisted Cracking of AA 7085 Alloy
20.	Akula Durga Vara Prasad	Tata Steel Ltd.	IIT Bombay	Microstructural Engineering in Wire Rod: Possibilities?

..

21.	Ankit Kumar Agarwal	Sahajanand Medical Technologies Pvt. Ltd.	ICT Mumbai	Development of Smart Drug Eluting Stents
22.	Anup Kundu	Forbes Marshall Pvt. Ltd.	IIT Bombay	Numerical and Experimental Investigation of Heat Transfer Enhancement in Heat Exchanger
23.	Avick Sinha	GE India Technology Center Pvt. Ltd.	IIT Bombay	Numerical and Experimental Study of Superheated Liquid Jet
24.	Babita Mukhija	Sampurn Agri Ventures Pvt. Ltd.	Punjab Agricultural University	Characterization of native *Bacillus thuringiensis* isolates against *Mylabris pustulata* Thunberg in Pigeonpea and optimization of Bioprocess parameters
25.	Chandresh Kumar Maurya	Robert Bosch Engineering and Business Solutions Ltd.	IIT Roorkee	Anomaly Detection in Big Data
26.	Chiranjeevi Yarra	Xerox India Ltd.	IISc Bangalore	Analysis of Temporal Contours of Spoken Language Learning
27.	Dinesh Bapurao Balgude	Nova-Surface Care Centre Pvt. Ltd.	ICT Mumbai	Modification of Renewable Resources for Coating Applications
28.	Gunjankumar Jagdishbhai Mehta	Skymax Research & Regulations	Saurashtra University	Isolation, Identification and Evaluation of Quorum Sensing Inhibitors (QSIs) From Medicinal Phytoextracts
29.	Karthikeyan Palaniswamy	Joegeetha Plastic Pipes	Tamil Nadu Agricultural University	Techno - Economic Prospects and Environmental Perspective of Recycling Agricultural Plastic Waste towards Sustainable Productivity
30.	Kavitha Manoharan	Sree Akzya Dyeing	Alagappa University	Nanoparticles Based Biodegradation & Power Generation by Waste Water Bacteria
31.	Manoj Kumar Puniya	Prathista Industries Ltd.	Indian Agricultural Research Institute	Anthocyanins as ingredients for food industry: Strategy for extraction, functional characterization and enhanced stability

..

32.	Murugan Ezhumalai	Arche Biologics	PSG College of Arts & Science	Designing and Prototyping of Computer Interfaced Embedded Design for Psychological Patients & Future Warrior Hand Wear System
33.	Padma Ishwarya Shankaran	General Mills India Pvt. Ltd.	Central Food Technological Research Institute, Mysore	A combined computational modeling and experimental approach to investigate the influence of non-wheat particulate ingredients on volume and structure development in baked food systems
34.	Porselvam Subramanian	Envian Engineers Pvt Ltd.	CSIR-Central Leather Research Institute, Chennai	Study on Influence of Pre-Treatment and Co-Digestion on Biogas Production from Slaughter House Solid Waste With Other Organic Waste
35.	Pratichi Singh	IBIDEN Co. Ltd.	Banaras Hindu University	Quaternary Catalyst for Control of Diesel Engine Exhausts Emissions
36.	Rahul Dubey	Robert Bosch Engineering and Business Solutions Ltd.	IIT Delhi	Adaptive and Intelligent Protection Scheme for Transmission Network Including Facts and Off-Shore Wind-Farms
37.	Rahul Jain	Intel Technology India Pvt. Ltd.	IIT Delhi	Runtime System Adaptation for Optimal Energy-Performance Trade-off
38.	Rohit Kumar	Petrotech Society	IIT Delhi	Catalytic Tri-reforming of Methane for Syn-gas Generation over Multi-functional Catalysts
39.	Sajal Saha	Tata Steel Ltd.	Bidhan Chandra Krishi Viswavidyalaya	From Wastes to Assets - Use of Iron Slime in Agriculture
40.	Sammit Ekanath Karekar	Suyog Infraspaces Pvt. Ltd.	ICT Mumbai	Development of Nanocontainers for Performance Applications
41.	Sankepally Samara Shekar Reddy	Varsha Bioscience and Technology	Amity University	Abiotic stress tolerance in Oryza sativa.L (paddy) mainly drought and salinity tolerance using genetic transformation techniques
42.	Shibin Krishnan Tc	Simco Global Technology &	National Physical Laboratory (CSIR-	Growth of $In_xGa(Al)_{1-x}N$ Based Heterostructures and

..

		Systems Ltd.	NPL)	Characterization for High-Efficiency Nitride Solar Cell
43.	Subhrakanti Nanda	G.E. Motors Pvt. Ltd.	IIEST	Investigations on Permanent Magnet Synchronous Generator (PMSG) for Different Renewable Energy Sources
44.	Veera Asha Kumari Aketi	National Mineral Development Corporation (NMDC) Ltd.	IIT Hyderabad	Improving the Efficiency of Dense Medium Cyclone Treating High NGM Coal Using CFD and PEPT Methods
45.	Venkatesh Vinayakarao	Microsoft Research	IIIT Delhi	Semantic Analysis & Synthesis of Source Code
BATCH 2015				
46.	Abhijnan Chakraborty	Google India Pvt Ltd.	IIT Kharagpur	Designing Information Retrieval Systems Optimized to Users' Sampling Strategies
47.	Adinarayana Ganjigunta	Nuziveedu Seeds Ltd.	Acharya Nagarjuna University	Improvement of Tropical Maize By Introgression Superior Alleles Responsible For Increase Of Lysine, Tryptophan & B - Carotene
48.	Darsheen Jitendrabhai Kotak	Zim Laboratories Ltd.	ICT Mumbai	Design and Development of Non-Invasive Drug Delivery Systems For Large Molecules
49.	Dhivyaraja Kumaran	Eaton Corporation	IIT Madras	Advanced Micro Spray Cooling Technologies For High Power Density Hydraulics
50.	Indu Elizabeth	EON Electric Ltd.	Academy of Scientific and Innovative Research (AcSIR)	Novel Electrode Materials For Lithium Ion Batteries
51.	Jagreeti Gupta	Beauscape Farms	Punjab Agricultural University	Morphological And Physiological Parameters of Subtropical Ornamental Trees Under Salt Stress
52.	Piyali Dhar	Thermax India Ltd.	IIT Madras	Pre-Treatment of Lignin By Non-Conventional Methods and Catalytic Conversion to Useful

..

				Compounds
53.	Sameena Naaz Malik	Ozone Research and Application India Pvt Ltd.	IIT Bombay	Development, Optimization, Modelling and Scale-Up of a High Performance Pre-Treatment System For Complex Industrial Wastewaters For Biodegradability Enhancement, Colour and Toxicity Reduction Along With Concomitant Biofuel Production
54.	Srinivasa Sudharsan Govindan	Vaata Infra Ltd.	Thiagarajar College of Engineering	Advanced Controllers For Optimizing Wind Energy
BATCH 2016				
April				
55.	Akash Dilipkumar Patel	Abellon Clean Energy Ltd.	Hemchandracharya North Gujarat University	Economic and Environmental Potential of Industrially Useful Microalgae cultivation
56.	Archana Rajendran	Hoganas AB	CSIR-Central Electrochemical Research Institute, Karaikudi	Fabrication of porous Ti and Ti alloys with multi element substituted nano-structured titania layer having bioactivity, antibacterial activity and bone cell responses for biomedical application
57.	Bhaskar Bethi	K-Pack Systems Private Ltd.	NIT Warangal	Development of pilot scale cavitation assisted catalytic membrane reactor for wastewater treatment
58.	Deepak C Akiwate	Eaton Technologies Pvt. Ltd.	IIT Hyderabad	Acoustic Analysis of Periodic Structures
59.	Harshal Agarwal	Thermax Ltd.	AcSIR Chennai	Thermal Management of High Temperature Proton Exchange Membrane Fuel Cell (HT-PEMFC) Integrated with Fuel Reformer and Vapor Absorption Machine
60.	Inayathullah Ghori	Kamineni Hospital Ltd.	IIT Hyderabad	Development of a low-cost screening system devised to identify cardiac diseases in a rural health care setup.

..

61.	Jyoti Shankar Jha	Bharat Forge Ltd.	IIT Bombay	Microstructure based fatigue modeling of Titanium Alloy (Ti-6Al-4V)
62.	Karanveer Singh Aneja	Talga Resources Ltd.	IIT Bombay	Graphene based anticorrosive coatings
63.	Rajpreet Kaur Goraya	The Punjab State Cooperative Milk Producers Fed Ltd. (Milkfed Punjab)	Punjab Agricultural University	Development of Low Sugar/Sugar Free Ice Cream and Whey Beverages with Improved Physico-Chemical And Sensory Attributes
64.	Sandeep Kumar	Cymk Inks LLP	Kurukshetra University	Synthesis & Characterization of Graphene Based Conductive Ink for Flexible & Printable Electronics
May				
65.	Ashok Babadev Jagtap	Maxim Crop Sciences Pvt Ltd.	Punjab Agricultural University	Identification And Characterization Of High Temperature Stress Responsive Genes In Maize (Zea Mays L.)
66.	Barnali Banerjee	Shell India Markets Private Ltd.	NIT Rourkela	Fundamental Investigations of Cationic Surfactants with Bitumen Product Components
67.	Ejaz Ahmad	Hindustan Petroleum Corporation Ltd.	IIT Delhi	Catalytic Conversion of Biomass Derived Residual Lignin into Aromatics and Value Added Chemicals
68.	Gundappa Saha	Cadila Pharmaceuticals Ltd.	IIT Guwahati	Immunosuppression during Leishmania infection and immuno-therapeutics against the parasite.
69.	Gunjan Gurunath Naik	Persistent Systems Ltd.	Savitribai Phule Pune University	Adaptive kernel framework for Active mechanism for effective segmentation strategies
70.	Hament Thakur	Verdenta Hybrid Seeds Pvt Ltd.	Punjab Agricultural University	Genetics and Molecular Mapping Of Leaf Curl Virus Disease Resistance Gene(S) in Chilli Pepper (Capsicum Annuum L.)
71.	Kaushal Rameshchandra	Hindustan Petroleum	IIT Delhi	Catalytic decomposition of methane in fluidized bed reactor.

..

	Parmar	Corporation Ltd.		
72.	Mahesh Maroti Dhakate	United Phosphorus Ltd.	IIT Bombay	Optimum Design and Scale-up of Air Jet Mills: Experimental and Computation
73.	Neeraj C Hanumante	Tata Chemicals Ltd.	IIT Bombay - Monash University Research Academy	Agent based modeling for sustainability assessment
74.	Ravi Bhandari	Microsoft Research India	IIT Bombay	Improving Road Safety using Smart Sensing
75.	Snehkumar Narendrakumar Shahani	Persistent Systems Ltd.	Savitribai Phule Pune University	Techniques of Privacy Preserving Data Aggregation in an Untrusted Distributed Environment
76.	Vaishakhi Trivedi	Natco Pharma Ltd.	Tata Memorial Hospital, Mumbai	Characterization of therapeutically relevant alterations in human cancer
October				
77.	Antara Dasgupta	Skymet Weather Services Pvt Ltd	IIT Bombay - Monash University Research Academy	Improved Flood Forecasting Using Data Assimilation
78.	Nitya Sharma	MSD Wellcome Trust Hilleman Laboratories Pvt Ltd	Amity Institute of Virology and Immunology	Development of Immunodiagnostic Assays of Meningococcal Antigens For Vaccine Development
79.	Raj Dorai Arjunan	Merkel Haptic Systems Pvt Ltd	Indian Institute of Technology Madras	Design And Development of Affordable Haptic Interface For Virtual Reality/Augmented Reality-Based Medical Simulations
80.	Reshma Ayswaraia	Garment Wash Effectzs	Bharathiar University	Optimization of Endophytic Actinomycetes Bioactive Extracts For Textile Industry
81.	Rutesh Vallabhbhai Savalia	Paragon Industries	Institute of Chemical Technology	Development and Application Of Nanomaterial Based Sensors For Sensitive Determination Of Drugs In Biological Fluids

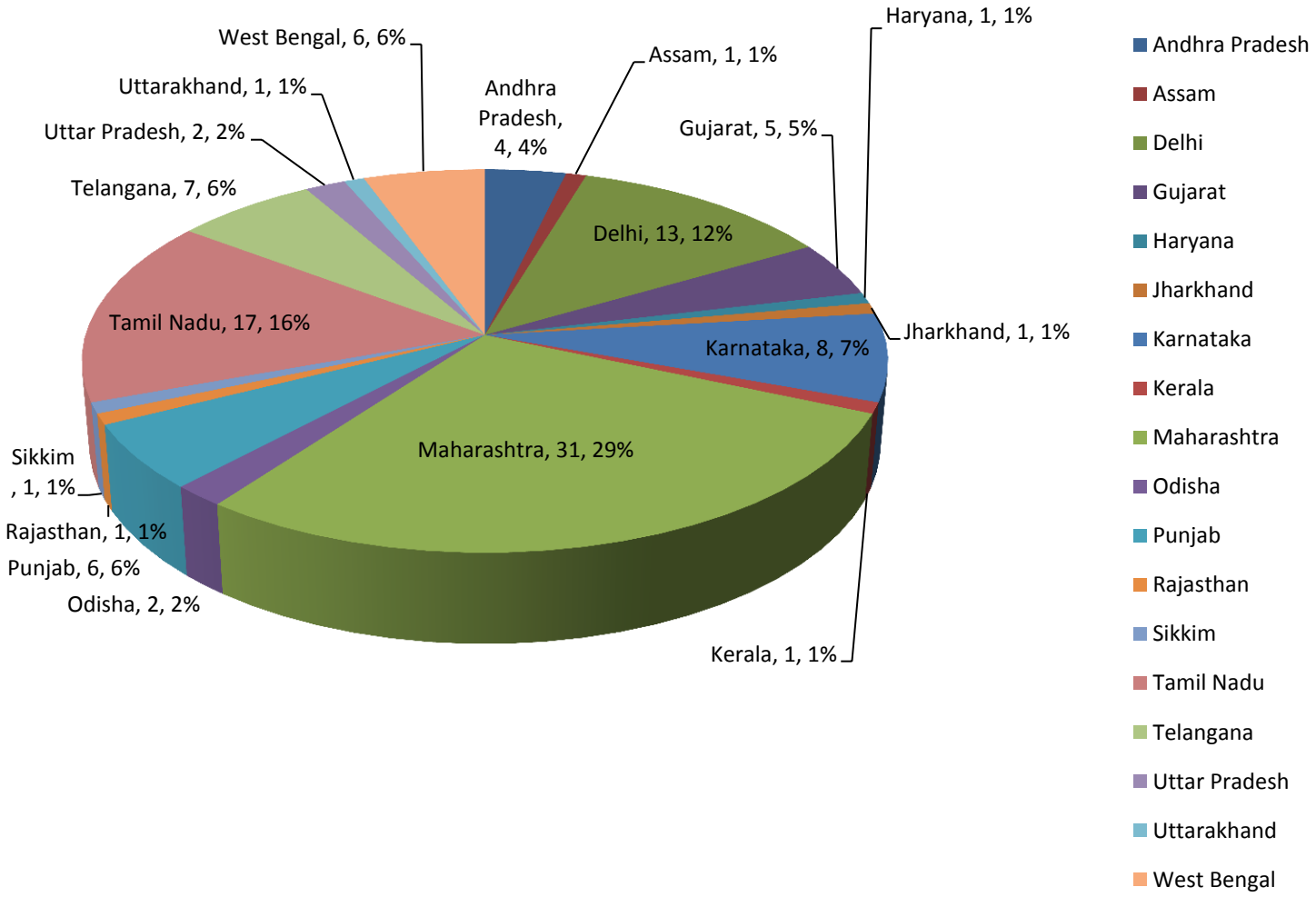
..

Key Statistics

108 Awarded Fellowships

..

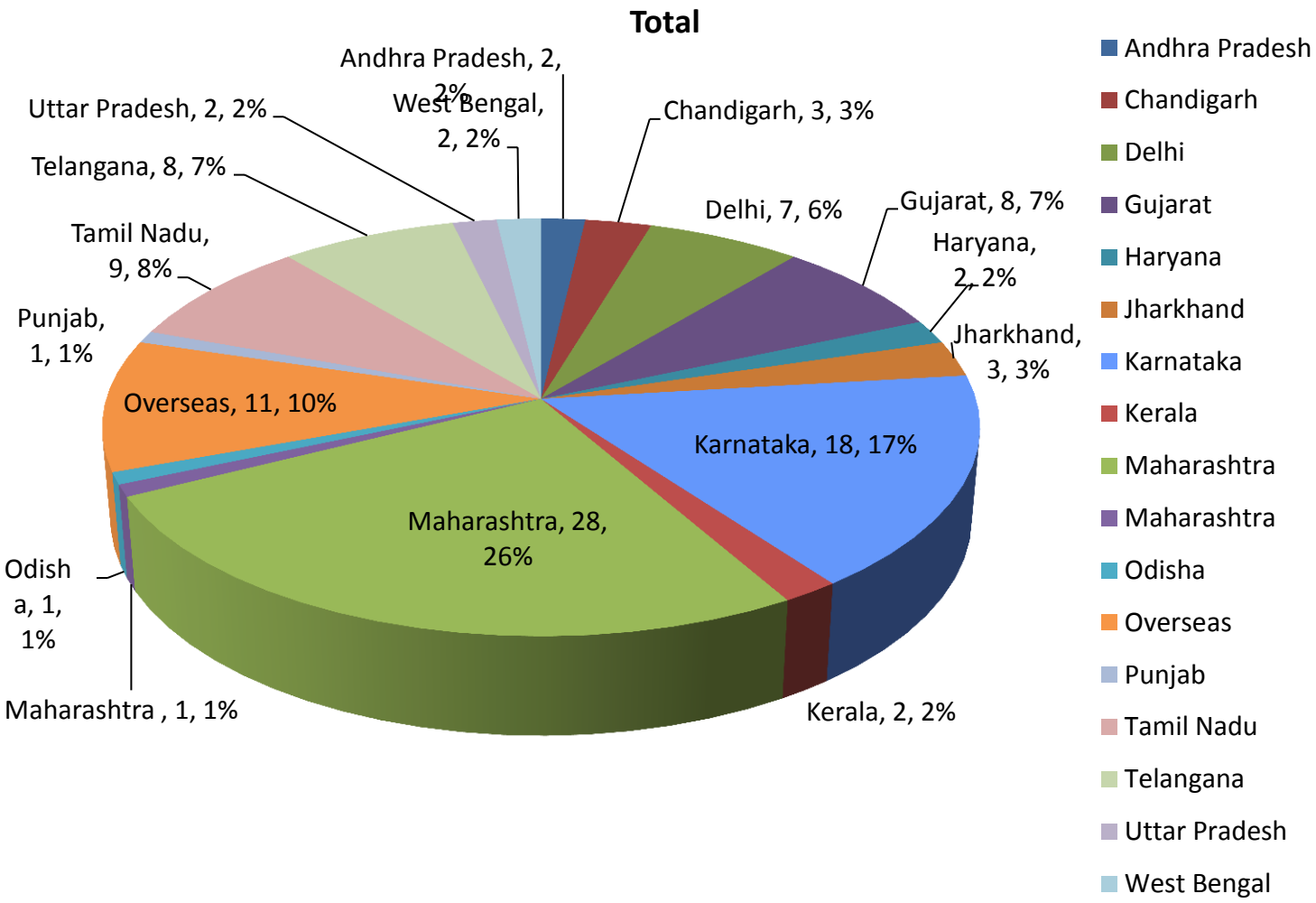
Geographical Spread of Institutes



The 108 candidates awarded the Prime Minister's Fellowship are spread over 50 institutes across 18 states. Maximum number of institutes with PM Fellows are in Maharashtra and Tamil Nadu.

..

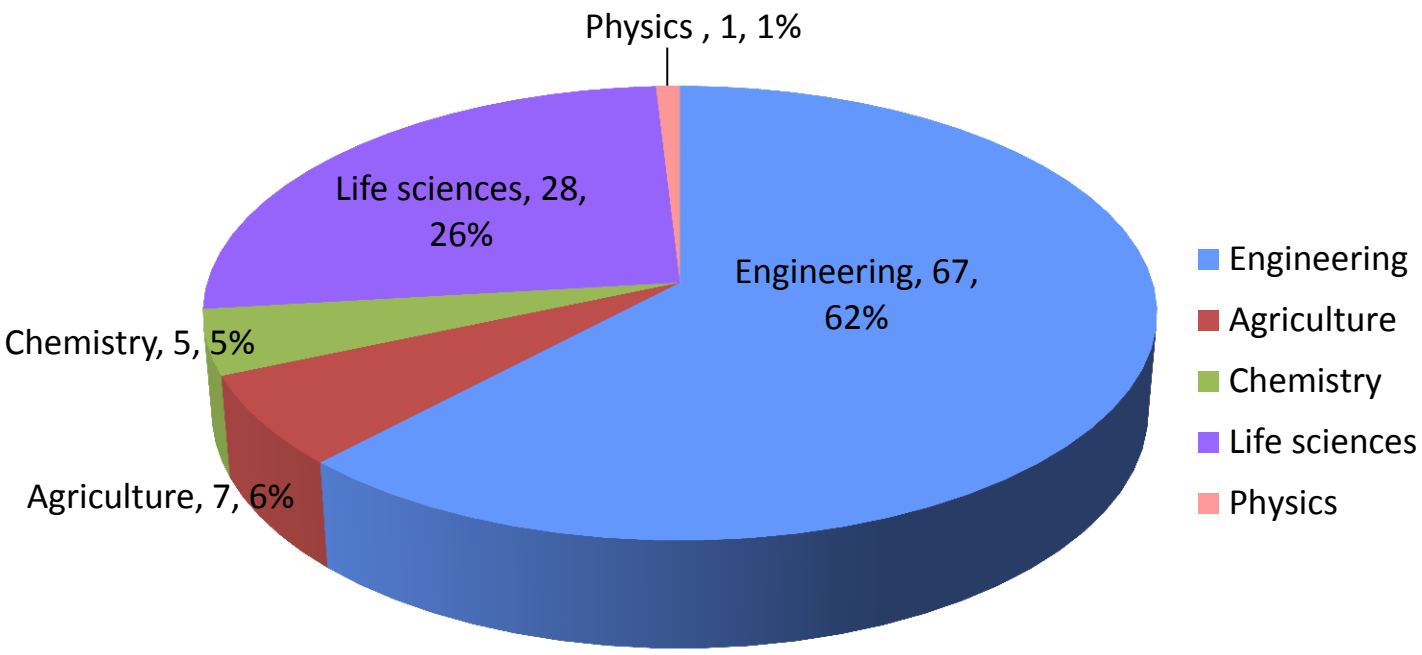
Geographical Spread of Industry Partners



A total of 91 companies spread all across the world offered to be partners in the Prime Minister's Fellowship Scheme. These include 80 Indian companies and 11 international companies.

..

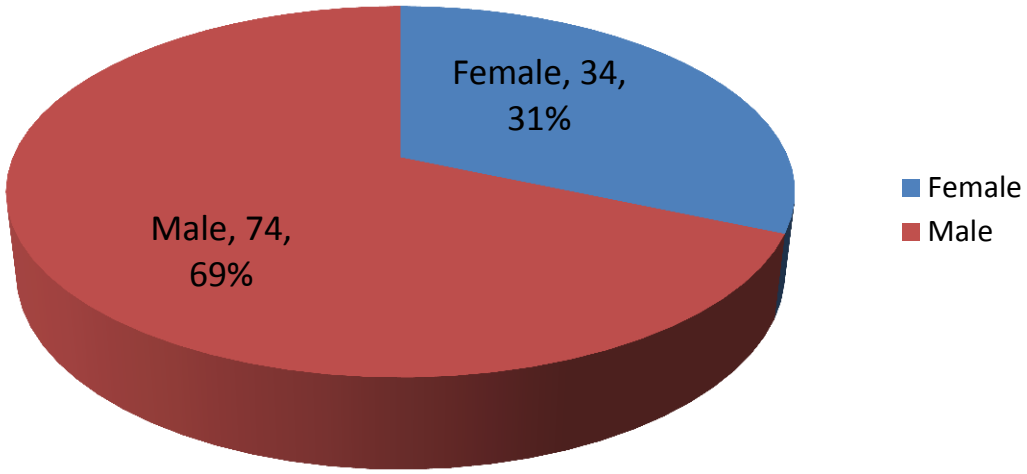
Stream-wise Spread of Research Subjects



Maximum candidates whose research projects were awarded fellowships are in Engineering domain

..

Gender Ratio of Research Candidates



While 34 females were awarded the fellowship, 74 male candidates were given PM Fellowship

Research Projects
Batch 1
April 2013

..

ANDUGULPATI SAI BALAJI

Manipal College of Pharmaceutical Sciences
Manipal University, Karnataka – 576104
saibalaji@mrdg.iisc.ernet.in

Research Area

To Study the Role of ABCC Family of Drug Transporters in Breast Cancer Chemoresistance

Cancer tissue is composed of heterogeneous population of cells containing both drug-sensitive and drug-resistant cells. Recent studies have revealed that while conventional chemotherapy can abolish drug-sensitive cells, it is ineffective against the small population of stem like cells (termed as cancer stem cells or CSCs) that are inherently drug-resistant cells. These CSCs are left behind unscathed, thus leading to cancer relapse, and further to multi-drug resistance and tumor aggressiveness.

Doxorubicin is an anticancer agent that has been widely used in breast cancer chemotherapy. It is known to show 35-50% therapeutic response in patients who have not previously received anticancer drugs. However, in parallel with its anticancer activity, doxorubicin also shows acute and chronic toxicity due to its relatively low therapeutic index. Further, drug resistance, an important property of cancer stem-like cells, is a major limitation that hinders the effectiveness of doxorubicin against this subpopulation. Therefore, we hypothesize that a combinatorial treatment using doxorubicin with another test compound which can inhibit the breast cancer stem-like population from the bulk of the tumor simultaneously could decrease the dose of doxorubicin that would be desirable.

Our preliminary results indicate that our test compound reduces the $CD44^{+}$ 24^{-} CSC sub-population in breast cancer cell lines. Further, on using doxorubicin along with the test compound, we observed increased cell death compared to doxorubicin alone. Moreover, expression of genes regulating drug-resistance also decreases on treatment with test compound in *in-vitro* studies.

Institute Research Supervisors: Dr N Udupa and Dr Malikarjuna Rao
Partner Company: Strand Life Sciences
Industry Mentor: Dr Vaijayanti Gupta; Director

..

BOYAPATI SUBRAHMANYAM

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
boyapatisubrahmanyam@gmail.com

Research Area

Low-Noise Nano Scale Signal Conditioning Integrated Circuits for Portable Electro-Medical and Electro-Sensor Applications

The aim of this project is to design, optimize, fabricate and test low-noise EMI-immune integrated signal conditioning module for versatile medical and sensor applications. We aim at generic solutions to cover wide range of applications like ambient and environmental sensors, and human body sensors. Moreover, availability of mobile platforms has provided an opportunity for deployment. Such diverse applications necessitate very low power dissipation. However, in general, noise and accuracy performance merits trade off with power dissipation.

As a result, it's a challenge to reduce interference effects and internal noise, while limiting the power to micro watts range. On the other hand, long term stability of the µW (micro watts) dissipation to signal conditioning module—for example for biometric monitoring applications—is desired.

Signal conditioning and conversion of a sensed quantity—which are mainly analog in nature—to another measure play a vital role for emerging "sensor around processor" scenarios. Moreover, while designing conversion techniques and the signal conditioning module, the effect of additional sources of noise such as coupled internal switching noise due to digital modules and choppers will be studied and evaluated in this project. Indeed, while a specific circuit technique helps to reduce effect of one kind of internal noise (say a low-frequency noise), another noise type is increased drastically (say a high-frequency noise with its harmonics). Therefore, the scope of this project is focused on solving such trade-offs using circuit techniques, integrate the designed circuits on a test IC in CMOS process and apply the acquired circuit knowledge to practical application circuits for bio-medical/ bio-sensor and electro sensor applications. In general, target signal conditioning module should be low-power, low-noise, highly-precise and take advantage of techniques and technologies for reducing source/ effect of different kinds of internal noise, and error sources as well as immunity from external noise sources.

Institute Research Supervisors: Prof Maryam Shojaei Baghini and Dr Jean-Michel Redoute
Partner Company: Intel Corporation
Industry Mentor: Mr VK Shankar; Director, Platform Solutions

..

DARSHAK BHATT

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
darshak@ee.iitb.ac.in

Research Area

Study and Design of Integrated Mixer and Local Oscillator Topologies for WiFi and WiMAX Systems

The specific aim of this project is to design and develop Voltage Controlled Oscillators (VCO's) and mixer combinations for WiFi/ WiMAX systems, which present an inherent high degree of immunity against LO (Local Oscillator) and RF (Radio Frequency) feedthrough.

The WiMAX standard requires limited PSD (Power Spectral Density) with -40uW power transmission. To receive extremely low signal level, the front-end receiver requires very low noise figure (NF), high linearity defined as third order intermodulation product (IIP3), better isolation and low power. The mixer is basic building block of front-end receiver. It will convert RF signal to BB signal by providing internal multiplication. It is basically a three-port device called input RF, input LO and output IF (Intermediate Frequency). The Active balanced mixer topologies cancel either LO or RF feedthrough, depending on how LO and RF signals are connected to the circuit. Double balanced mixers, also called Gilbert mixers, theoretically cancel LO and RF feedthrough.

The phase noise of oscillator disturbed the incoming signal constellation and orthogonality of OFDM signal. Therefore, VCO will be designed with lower phase noise. To reduce cross modulation, LO feedthrough of any kind is highly undesirable, and should therefore be minimized at all costs. The RF-MIMO (Multiple Inputs and Multiple Outputs) will be helpful in improving link budget of the network. For this, techniques like removing DC-offset, I/Q balance, and lower phase noise have been adopted in the design.

As stated, higher sensitivity ensures lower packet error rate in receiver. A set of general mathematical properties and design guidelines provide for achieving low power, less area, lower packet error rate, higher SNR, immunity to fading and higher linearity. These design guidelines will prove to be very valuable in simplifying the receiver design. The final outcome of this project ensures simplicity and cost effectiveness in RF front-end receiver design.

Institute Research Supervisors: Prof Jayanta Mukherjee and Prof Jean-Michel Redouté
Partner Company: Intel Corporation
Industry Mentor: Mr VK Shankar; Director, Platform Solutions

..

DEEPIKA PANDEY

Manipal University
Manipal – 576104 Karnataka
deep.gene@gmail.com

Research Area

Study on Production of Gamma-Polyglutamic Acid by Bacillus Sp.

Poly- γ-glutamic acid (γ -PGA) meets the demands of the times with respect to the new biomaterial industry that came up from well-being issues for a healthy life. Naturally occurring polymers have attracted considerable interest from polymer scientists in recent years. This interest arose as a result of an increased awareness of the environment and a desire to produce environmentally safe materials. Not only do these polymers come from natural sources but they are also biodegradable.

Also, the information will let other researchers to know the way forward. There are still some questions related to PGA biosynthesis which need to be answered. Our objective would be to understand the genes involved in PGA biosynthesis. Since microbial production of PGA is not commercially viable yet, a better understanding of PGA biosynthesis and its regulation arising out of this proposed study will enable us to carry out strain improvement by targeting the right gene and provide optimal conditions for higher production of PGA. The key objectives of this research will be:

1) To determine the molecular characterization of genes involved in PGA synthesis.
2) To study the regulation PGA biosynthesis.
3) To establish a lab scale γ-PGA production process with standard culture.

Although γ-PGA possesses vast potential as a new macromolecular material, several problems remain to be solved before it can be practically used. There are certain components in PGA synthetase complex for which function is not clear yet (like pgsC and pgsA genes). There is very little information available on the promoter of pgs operon. The most important step is to construct a mass production system for γ-PGA by applying molecular biology techniques, and hence an extensive knowledge of PGA biosynthesis and roles of PGA synthetase complex is crucial for increasing the production level.

Institute Research Supervisor: Dr Ritu Raval
Partner Company: Tata Chemicals Ltd
Industry Mentor: Dr Ashok Kumar Dubey; Senior Scientist, Tata Chemicals Innovation Centre

..

GOVARDHAN RAO TALLURI

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
govardhan.ece@gmail.com

Research Area

High Speed I/Os for Chip to Chip Interconnects

The aim of this project is to explore and develop on-chip equalizers—if required along with crosstalk cancellation techniques—for multi-lane serial I/Os used for interfacing to high-speed DACs (Digital to Analog Converters). We plan to implement and test four pairs of interconnects with receiver for de-serialization. Target data rates are 6.25Gbps or 12.5Gbps per lane.

As data transmission rate and number of lanes on multi-lane parallel serial I/Os crosses 5Gbps non-ideal effects such as cross talk and skin effects are no longer negligible. For example, this is valid about copper traces on FR4 boards with 20cm length or more. These effects lead to ISI (Inter Symbol Interference) and hence, recently, multi-lane serial link receivers with analog or digital equalizer and cross talk cancellers are reported.

Serialization of the parallel data at the FPGA (or Tx) side or mismatch between traces leads to skew between lanes and hence necessitates skew alignment techniques.

The aim of this project is to design, fabricate and test the interface modules for 12.5GHz SerDes receivers.

Institute Research Supervisor: Prof Maryam Shojaei Baghini
Partner Company: Maxim Integrated
Industry Mentor: Mr Miaochen Wu; Manager, IC Design

..

HIREN KUMAR MANSUKHBHAI

Saurashtra University
Rajkot, Gujarat – 360005
hiren.sherathiya@gmail.com

Research Area

Isolation and Evaluation of Anti-Pathogenic Bacteria from Cotton Rhizosphere

Cotton, the 'white gold', enjoys a predominant position amongst all cash crops in India. Cotton (*Gossypiumhirsutum* L.) cultivation in India covers an area of approximately 9.4 million ha representing about one quarter of the global area of 33 million ha under cotton (FAO 2007). Cotton is an important raw material for the Indian textile industry, constituting about 65% of its requirements. The Indian textile industry occupies a significant place in the country's economy with over 1500 mills, 4 million handlooms, 1.7 million power looms and thousands of garment, hosiery and processing units, providing employment directly or indirectly to around 35 million people.

Main losses in cotton production are due to its susceptibility to insect pests and diseases caused by fungi. Among the disease caused by fungi, *Rhizoctinasaloni*and *Fusariumoxysporum* are the main causative agent for the cotton. There is no commercially viable way to eradicate this disease from the soil. For this reason, many chemically synthetic fungicides are used, which are harmful to the other normal microbial flora of soil. However, a high price is paid from an economic, health and ecological standpoints.

While on the other hand the beneficial effects of rhizospheric bacteria include direct plant growth promotion, biological control and inducing systemic resistance (ISR) in host plants. Specific rhizospheric bacterial strains bring about ISR against multiple pathogens attacking the same crop. Rhizospheric bacterial strains can provide an effective, economical and practical way of plant protection.

Furthermore, certain rhizospheric bacterial strain mixtures have showed synergistic action in plant protection and growth promotion, indicating different mechanisms are involved in disease control. So, the aim of this research is to select such combinations of strains existing naturally within cotton rhizosphere, which can provide an effective, economical and practical way of plant protection and would be beneficial in crop protection.

Institute Research Supervisors: Dr Vasant J Jadiya and Dr B.A Golakiya
Partner Company: Solar Agrotech Pvt. Ltd.
Industry Mentor: Dr T L Dholaria; Managing Director

..

JAILAKSHMI MENON

Anna University, Chennai
Tamil Nadu – 600025
jailakshmim@yahoo.co.in

Research Area

Development of Control Algorithm for Canal Automation

Distribution of large volumes of water within irrigation projects involves network of canals. With increasing demand for food and competing use of water in various other sectors, the pressure is on irrigation professionals to manage water more efficiently since they are the major users of water.

Automating a canal system is implementing, a control system that includes automatic monitoring or the control equipment that upgrades the conventional method of canal operation. The need for canal automation can be summarized as follows:

- To increase the efficiency of the irrigation systems
- To improve the flexibility of irrigation systems
- To optimize the water supply in order to match the expected demands at the offtake level
- To improve water management at the operational and field channel level

Few pilot projects introduced in India:

- The pilot project of dynamic regulation on Majalgaon irrigation project
- The Sardar Sarovar project in Gujarat
- The Tungabhadra project in Karnataka
- PAP project in Tamil Nadu

The results of the above case studies point out the fact that all the modern techniques, computerized automation , adopted by some of the developed countries or recommended by the external consultants cannot be put to use directly by the developing countries as the geographical, climatic and local social conditions may completely differ.

Appropriateness of technology plays a vital role in the ultimate success of any scheme. In this study it is proposed to develop a general control algorithm using modified downstream control method prevailing to Indian conditions.

Institute Research Supervisor: Dr BV Mudgal
Partner Company: Autosys Engineering (P) Ltd.
Industry Mentor: Mr Anup Raj Gauni; Head, Customer Support

..

JAYDEEP BIPIN DESHPANDE

National Chemical Laboratory
Pune – 411008
jaydeep.desh21@gmail.com

Research Area

Process Design for the synthesis of Nanomaterials and Scale-up

The properties of nanomaterials have demonstrated their merit in a vast spectrum of potential applications viz. catalysis, electronics, drug delivery, various biological and medical applications. Nanomaterials show great promise for use in future. While the synthesis methods are known and studied for over last two decades—for example, Pyrolysis, solvothermal reactions and attrition—not much attention has been paid towards their synthesis as a process that can be further taken for large scale production of nanomaterials. While synthesis is close to chemical reactions, obtaining specific shape and size distribution will not allow the usual process development approach to be extended for the synthesis of nanomaterials at large scale. Though some attempts in this area have been made, a host of expensive nanoparticles—for example, silver, iron and gold—are still synthesized using techniques which are untailored and have no good estimate of mass balances and reaction kinetics. It is hard for chemists to fulfill the rising demands of these useful materials.

The proposed study aims at understanding and developing novel ways of addressing these reactions on a large scale. Starting from rigorous experimentation on the lab scale and developing suitable modeling approach that uses the reaction engineering framework, population balance models, nucleation and growth kinetics, reaction kinetics, we aim to understand how the governing process parameters viz. kinetics, hydrodynamics, heat management, etc. affect these reactions. A suitable system will be selected and the process economics will be worked out to support the observations related to scale-up. In a broader view, we aim to develop a guideline for designing reactors for shape and size selective production from sensitive reactions.

Institute Research Supervisor: Dr Amol Kulkarni
Partner Company: NanoXpert Technologies
Industry Mentor: Dr Aditya Pattani; Partner, NanoXpert Technologies

..

MADHAVA KRISHNA C

Indian Institute of Science, Bangalore
Karnataka - 560012
madhav@cadl.iisc.ernet.in

Research Area

Architecture and Compiler Support for Concurrent Program Execution on Application Specific Massively Parallel Processors

Programming of massively parallel processors with correctness guarantees as well as high performance presents a variety of difficult theoretical and engineering challenges. Conventional approaches in architecture research—that target the least common denominator in languages and software research driven by the availability of commodity hardware—are inadequate in addressing these challenges. Making parallel programming substantially easier requires bringing together models and techniques in programming languages, compilers, runtime systems and architectures.

This research addresses the problem of extending a massively parallel architecture to support high level languages for parallel programming. Our approach leverages the compiler and exploits the principles of high level abstraction in programming languages through the use of Instruction Set Extensions and other new constructs within the semantics of existing high level languages.

The targeted base architecture is the 'REDEFINE' reconfigurable SoC platform, which serves as the framework for generating massively parallel architectures for domain specific application accelerators.

Institute Research Supervisor: Prof Soumitra Kumar Nandy
Partner Company: Morphing Machines Pvt. Ltd.
Industry Mentor: Dr Chandan Haldar; Managing Director

..

MONIKA GUPTA

Indraprastha Institute of Information Technology, Delhi
New Delhi - 110020
monikag@iiitd.ac.in

Research Area

Mining Peer Code Review Process

A key technique investigated through this research in context of Software Engineering will be Mining Software Repositories (MSR) in intersection with Business Process Intelligence (BPI). Software Repositories such as Peer Code Review System, Issue Tracking System, Source-code Repository, Version Control Systems and Developer Mailing Lists are diverse IT systems with historical data stored in them. MSR refers to a set of tools and techniques for analyzing the rich data in software repositories to detect interesting facts and provide actionable information about software processes and systems. BPI merges the two technologies: Process Mining and Business Intelligence. It combines the high performance of Process Mining with the analytic capability of Business Intelligence technologies and therefore offers advantages for clear process optimizations. Process owner describes the process to be used and provides guidelines, expectations and access to improve the methodology on an ongoing basis. The historical data in the form of audit trail or workflow stored in diverse IT systems can be analyzed for continuous process improvement.

This research aims to develop a metrics for Measuring Process Performance, Inefficiencies, Imperfections and Compliance for Peer Code Review Process and represent it using intuitive visualizations and process models to help Project Manager in making informed business decisions. Peer code review is a very important and effective way for early detection of defects in a software before it is injected into the software code, which, in turn, reduces the maintenance cost. This research will be on real data from open-source and commercial projects large projects like Google Chromium, Android, Mozilla etc. The research work will be driven by inputs and validation from developers and end-users. We plan to perform empirical data analysis to investigate problems and issues encountered by stake holders and provide solutions resulting in improvement. We propose to apply tools and techniques from machine learning, information retrieval and data analytics to mine software repositories and extract useful insights and patterns to identify weaknesses and hence suggest the best solution. This research will be useful in development of tools/ framework and algorithms designed on the basis of data analysis, which can improve the efficiency and productivity of an organization.

Institute Research Supervisor: Dr Ashish Sureka
Partner Company: Infosys Ltd.
Industry Mentor: Dr Srinivas Padmana Bhuni; Associate Vice-President, Infosys Lab

..

NARENDRA AKITI

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
aakitinarendra@gmail.com

Research Area

Granule Breakage in a Controlled Shear Field - Modelling and Experiments

Granulation is an important size enlargement process used to produce structured powdered products in the minerals, pharmaceutical, and specialty chemicals industries. In wet granulation, a liquid is sprayed onto an agitated powder bed to agglomerate the particles, which are subsequently dried. There are three main mechanisms in wet granulation – wetting and nucleation, consolidation and growth, and breakage and attrition. The last mechanism breakage is the least well understood, although breakage is known to be important in controlling the maximum granule size and in redistributing the liquid throughout the powder bed via process known as destructive nucleation.

Previous studies look at the overall average breakage of many granules of different sizes and structures in the granulator, or the breakage of a controlled pellet or tracer. However, the flow field that is experienced by the granules in these studies is uncontrolled and also poorly understood. There are a few papers where the flow field has been controlled by using specialized geometry and/ or powders—a fluidised couette viscometer where the granule deformation and breakage has been measured and modelled. More recently, a breakage-only granulator filled with an oil and sand mixture has been used to study breakage of single granules and pellets. However, these experimental studies are on a limited number of powders and have never been directly compared. In addition, the modeling work focused on granule deformation, rather than breakage, and has only been performed on a single case in the couette device.

The outcome of this project would be a comprehensive experimental and modeling investigation of breakage of real granules under controlled shear conditions. The results are expected to be used to provide guidance on how to either minimize or maximize breakage in industrial wet granulation process in order to achieve more consistent and reliable granule properties and product performance. Such an outcome would be widely applicable to a broad range of industries which produce granular materials.

Institute Research Supervisor: Prof Devang Khakhar and Dr Karen Hapgood
Partner Company: Procter and Gamble Home Products Ltd.
Industry Mentor: Dr Bhavani Kasibhatla; International Manager

..

NEHA BHARDWAJ

Indian Institute of Technology Delhi
Hauz Khas, New Delhi - 110016
nhbhrdwj7@gmail.com

Research Area

Oil-slick Control and Development of an Intelligent Oil-recovery System

Main objective of this work will be development of a super-absorbent and responsive intelligent system with an added attribute of sensitivity to geomagnetic field.

Most desired properties in any absorbent material are high oil-sorption capacity, good oil adhesion and retention, low water- sorption capacity, improved buoyancy characteristics, and reusability. Many sorbent materials like polymer foams and other polymeric hydrocarbon based materials are known to possess these characteristics. Effort will be made to review the existing literature and to improve upon critical properties through innovative chemistry, mechanics, and engineering of materials' structure and interfaces.
The present situation can be taken up to the next level mainly in terms of absorbency, reusability, and ease of extracting the absorbed oil by designing an intelligent integrated sorption system.

Three key features of this system will be a superabsorbent smart polymer system which will respond to gentle environmental changes, exhibiting superabsorbent characteristics at one condition and with a slight change in a key parameter (like temperature, pH, exposure to light, electric charge, or magnetic field) becoming collapsible at the latter environmental condition. The second key feature will be regarding its geometry and stability. As the system comes in contact with the oil, entrapment will cause continual volumetric changes inside the system which could be employed to generate a force that, after sufficient contact time, will trigger changes in position. In this way, the entire surface of the system will gradually keep coming in contact with the oil until all of the oil is eventually picked up. The third main feature will be a built-in sensitivity to geomagnetic field such that, after entrapping the oil inside, these objects will align themselves along earth's magnetic field and self-assemble in a formation resembling a giant magnetic compass' needle. This would facilitate easy collection of the large number of individual system elements, after oil removal, using a single retrieval sweep by the recovery ship.

Institute Research Supervisor: Dr Ashok N Bhaskarwar
Partner Company: Petrotech Society
Industry Mentor: Dr Anand Kumar

..

NIDHINA M BHASKARAN

CSIR-CFTRI, Mysore
Karnataka - 570020
nidhinabhaskar@gmail.com

Research Area

Biotechnological Approaches for Value Addition of Industrial Guar Meal

Legume is an important class of plants which are rich in protein and soya bean is a well-studied protein source. Still, there are a lot of other protein sources, which are under utilised as a protein source. Guar (Cyamopsis tetragonoloba) is one of them having high protein content, which is comparable with soya bean. It is an industrially important legume, as guar gum, which has a good market worldwide, is extracted from it. India is the largest producer of guar bean, and hence the largest exporter of guar gum. The left over after the gum extraction is guar meal, which is a rich source of protein with a protein content of 52%. Due to the presence of anti-nutritional factors like trypsin inhibitor, β-mannan and saponins, it is not used for human and poultry consumption. Trypsin inhibitor cause increased pancreatic secretion and decreased protease activity. β-mannan, the gum residue, is a galactomannan polysaccharide, which increases intestinal viscosity and thereby decreases nutrient absorption. Some saponin extracts are found to be toxic for gastro intestinal tract, and the oral administration of the same causes adverse effects. So, the current proposal aims to screen and remove the anti-nutritional factor present in the guar meal or the protein isolate prepared from it so as to make this underutilized protein source as a high protein feed ingredient.

Institute Research Supervisor: Dr SP Muthukumar
Partner Company: Jai Bharath Gum & Chemical Ltd.
Industry Mentor: Mr Rajesh Kedia; Director

..

POONAM MISHRA

Manipal University
Manipal – 576104 Karnataka
mishpoonam@gmail.com

Research Area

Isolation, Purification, characterization and optimization of fermentation conditions of γ-Polyglutamic acid producing Microbes

γ -Polyglutamic acid is an unusual anionic naturally occurring polyamide which is made up of D and L glutamic acid units connected by amide linkages between alpha and gamma carboxylic groups.

It is non-toxic to humans, environment friendly, biodegradable and edible. It, thus, possesses enormous potential as a new macromolecular material.

Cross-linked PGA exhibits an extremely high degree of water absorbency possibly making it a good substitute for non-degradable hydrogels. In cosmetics, PGA finds its use in providing the nourishing moisturizing factor (NMF) to the skin, high water absorbing property of PGA would be of an enormous potential in agriculture where it could be used in the form of hydrogels. Application of PGA in water reservoirs (as bioflocculant), biodegradable diapers (high water absorbency) and slow release systems for drug and fertilizers makes it a potential candidate for study.

Although γ -PGA possesses vast potential as a new macromolecular material, several problems remain to be solved before it can be practically used. The major problem is higher production cost of PGA making it a commercially unfavorable entity compared to the existing ingredients. Also the yield is quite low.

At present, the most important step is to develop a cost economical mass-production system for g- PGA and subsequent modification for specific applications.

We hereby propose to isolate good PGA producing microorganisms followed by optimization of PGA production process.

Institute Research Supervisor: Dr Ritu Raval
Partner Company: Tata Chemicals Ltd.
Industry Mentor: Dr Ashok Kumar Dubey; Senior Scientist

..

SHAMAYEETA REY

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
shamayeeta.ray@gmail.com

Research Area

Structural Characterization of Regulatory Proteins Useful in Developing Biosensors for Water Purification System

One of the most abundant environmental pollutants in recent times are natural and man-made aromatic compounds discharged through industrial and urban activities and geochemical cycles (Shingler 2003). They pose to be environmental threat because of their high toxicity and persistency as many of these compounds can't be degraded or utilized by most organisms.

A large number of bacteria acquire catabolic ability to biodegrade a variety of aromatic pollutants and use them as their sole carbon and energy source by employing different strategies (Diaz et. al. 2000). The first step towards biodegradation involve detecting the presence of the pollutants and their types at the contaminated places which is performed by regulatory proteins like XylR (Xylene Catabolism Regulatory Protein) and DmpR (3,4-Dimethylphenol Regulatory Protein) . Both DmpR, XylR activate operons encoding genes required for catabolic biodegradation of aromatic alcohols. These proteins belong to NtrC family of enhancer-binding proteins (EBP) and are a class of transcriptional regulators that act on prokaryotic promoters from a distance (Mi Na Kim et. al., 2004). These NtrC family of regulators are composed of three major domains – the alcohol binding, N-terminal signal reception domain or the A-domain, the central ATPase activity harboring transcriptional activation domain or the C-domain and the C-terminal DNA binding domain or the D-domain (reviewed by North et.al. 1993).

In this project, we would mainly focus on these transcriptional activator proteins, and aim to determine the X-ray crystallographic structure of each sub-domain and in consort so as to understand the structural basis of specificity of interaction between them and their chemical effectors. Proper knowledge at the molecular level of this enzyme system can aid designing of an ideal biosensor system by engineering and manipulating these regulators, so as to detect the presence of the aromatic pollutants in the aquatic environment.

Institute Research Supervisor: Dr Ruchi Anand and Prof Matthew Wilce
Partner Company: Piramal Enterprises Ltd.
Industry Mentor: Dr Arun BalaKrishnan; Head of Operations (Natural Product and External Liaison), Piramal Healthcare Ltd.

..

SOUJIT SENGUPTA

Indian Institute of Technology Madras
Chennai, Tamil Nadu - 600036
soujit.sengupta@gmail.com

Research Area

Graphene-Based Composite for Capacitive Deionization and Water Purification

Capacitive deionization (CDI) is an emerging desalination technology. In CDI, ions are adsorbed onto the surface of porous electrodes by applying a low voltage electric field, producing deionized water. Liquid flows between the high surface electrode pairs having a potential difference of 1.0-1.6 V DC. The negative electrodes attract positively charged ions such as calcium, magnesium, and sodium, and the positive electrodes attract negatively charged ions such as chloride, nitrate, and sulphate. The major mechanisms related to the removal of charged constituents during water treatment are physisorption, chemisorption, electrodeposition, and/ or electrophoresis. Unlike ion exchange, no additional chemicals are required for regeneration of the electrosorbent in this process. Adsorbed ions are desorbed from the surface of the electrodes by eliminating the electric field, resulting in the regeneration of the electrodes. The efficiency of CDI strongly depends on the surface property of electrodes such as their surface area and adsorption properties.

There are a variety of electrode materials and configurations to enhance the CDI performance. Development of ideal electrode material depends on:

1. High electrical conductivity,
2. High specific surface area
3. Controllable pore size distribution

The development of novel electrode material having the above characteristics with improved high rate of electro-adsorption capacity is important for capacitive deionization. The objective of the research is to carbon aerogel/ xerogel types of material which can give above required propertied for development of most cost-effective CDI system.

Institute Research Supervisor: Prof T Pradeep
Partner Company: Thermax Ltd.
Industry Mentor: Mr Kiran Deshpande; General Manager

..

SUBHADEEP DAS

Indian Institute of Technology Bombay
Powai, Mumbai - 400076
subhadeep@iitb.ac.in

Research Area

Engineering Amyloids for Nanotechnology and Neuronal Cell Regeneration

Neurodegenerative diseases are characterized by degeneration of certain types of neurons. Given the limited regenerative capacity of the brain, current therapy is limited to rehabilitative measures. This limited capacity is due to loss of the neural ECM to promote cell division and remodelling of the tissue. Thus to address the problem to repair brain damage necessitates neuron transplantation from exogenous source. Stem cell transplantation is a part of this cell replacement therapy. These implanted stem cells must be given suitable biochemical and contact mediated cues so that they develop suitably to restore functional tissue. These functions of providing development specific cues are provided by the scaffold in which the stem cells are seeded.

Here, we propose to develop novel amyloid based biocompatible scaffolds which will have the desired morphology and surface chemistry to permit cell adhesion and differentiation.

Although amyloids are associated with a wide range of pathological diseases, and the use of amyloid inspired material may seem counterintuitive in this context, but the presence of evolutionary conserved and functional amyloids have demonstrated that these materials are not inherently cytotoxic. Moreover, the robustness of amyloidgenic material is an added advantage.

Several biophysical studies including CD and FTIR would be done to characterize the peptides conformational state; SEM and AFM for morphological characterization. Cell-based assay would be done to assess the toxicity of the biomaterial. The non-toxic peptide based hydrogels would be then suitably modified adding specific neurotropic factors so that stem cells seeded inside it differentiate into neurons. Detailed rheological study would be done to fabricate the scaffold such that it is in compliance with natural brain tissue.

Finally, these hydrogels would be tested *in vivo* on mouse models to check host immune reaction against them and how effectively they can regress neurodegenerative diseases.

Institute Research Supervisor: Dr Samir Maji and Dr John Forsythe
Partner Company: Piramal Enterprises Ltd.
Industry Mentor: Dr Arun BalaKrishnan; Head of Operations (Natural Product and External Liaison), Piramal Healthcare Ltd.

..

SUSHRUT SANDEEP BHANUSHALI

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
ssbhanushali@gmail.com

Research Area

Investigation of Thermo-Physical Properties of Nanofluids

With the progress of modern technology, energy consumption has increased manifold and hence the challenge of heat transfer and cooling. Despite considerable previous efforts, major improvements in cooling capabilities have been restricted, as the traditionally used fluids in thermal management systems like water, glycols, paraffin oils inherently have very poor thermal conductivity, at least two orders of magnitude lower than solids. Metals as solids have orders of magnitude higher thermal conductivities as compared to liquids. Thermal conductivity of liquids with suspended solids could be expected to be significantly higher than of the base fluid alone.

Nanotechnology does not only miniaturise the dimensions of the material, but also gives an entire different set of properties which could be explored and exploited. Nanofluids are a new class of emerging engineering materials, consisting of nanometer sized particles dispersed in base fluids, which exhibit an enhancement in thermo-physical properties. Nanofluids have an unprecedented combination of the characteristic features desired in energy systems (fluid and thermal systems) such as increased thermal conductivity at low nanoparticle concentrations, strong temperature-dependent thermal conductivity and non-linear increase in thermal conductivity with nanoparticle concentration.

The research would involve synthesis and long term stabilization of nanofluids, mostly by wet chemical methods and investigating their thermal and rheological properties such as thermal conductivity, specific heat capacity, dynamic viscosity and density by varying the nanomaterial parameters such as particle size, particle shape/ morphology, surface charge and interfacial chemistry, chemical environment like the pH and base fluids. Further, optimization of the heat transfer co-efficient and figure of merit under various conditions would be carried out using the experimental data.

Institute Research Supervisor: Prof Ganesh
Partner Company: Thermax Ltd.
Industry Mentor: Mr Kiran Deshpande; General Manager

..

Research Projects
Batch 2
April 2014

..

AJAY KRISHNAN

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
m.ajaykrishnan@gmail.com

Research Area

Influence of Temper Conditions on the Environmentally Assisted Cracking of AA 7085 Alloy

High strength Aluminum alloys are extensively used for strategic applications because of their high specific strength with weight-effective performance and damage tolerance. As they rely on the precipitates for strengthening, they form local galvanic cells leading to localized corrosion such as pitting and exfoliation. Pits/exfoliation acts as initiation sites (also known as precursor events) for environmentally assisted cracking (EAC). Understanding these precursor events that initiate EAC and also the factors that govern the EAC growth are of great interest.

This project will investigate:

a) The effect of precursor events on AA 7085, a newly developed low quench sensitive alloy, using micro-electrochemical techniques that would reveal the correlation between alloy chemistry, microstructure and heat treatment.
b) EAC growth behaviour
c) Modify the precipitate state (size, shape, number density) through an appropriate heat treatment to enhance the mechanical properties (yield strength and tensile strength) of high strength aluminium alloys without sacrificing the toughness and EAC resistance. This will be done through non-conventional heat treatment.
d) Role of fabrication: The influence of machining, surface protection techniques on SCC will be examined to arrive at robust components. The study will indicate special precautions, if any, to be implemented during above processing to ensure no detrimental effects are introduced due to consumable, cutting & forming tools.

Actual EAC experimentation involves conducting slow strain rate and fracture mechanics tests for better understanding of the EAC initiation and growth.

Project outcomes

1. Better understanding on the EAC behavior of a new developed alloy in addition to development of a non-conventional heat treatment.
2. Non-conventional heat treatment will receive better attention from Industries who are interested in creating new profiles for the existing precipitation hardenable aluminum alloys

Institute Research Supervisor: Prof V S Raja
Partner Company: Godrej & Boyce Mfg Co Ltd
Industry Mentor: Mr S M Vaidya; Executive Vice President & Business Head, Godrej Precision Systems

..

AKULA DURGA VARA PRASAD

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
durga.mems@gmail.com

Research Area

Microstructural Engineering in Wire Rod: Possibilities

With increase in demand for producing lighter weight components and structures, there is a strong need to produce steels with superior strength and ductility. High carbon steel wires with superior strength and ductility are one of such materials that are used in tire cord, tire beads, conveyors, hoses and bridge cables. The strength is a strong function of steel composition, quality, microstructure and the wire drawing process. Pearlite is an important constituent of these wires, which imparts great strength and toughness after drawing operation.

A wire has a typical composition of carbon varying within 0.65-1.3%, manganese between 0.2-0.8% and other elements in traces. The prime objective of drawing is to increase the strength of the wire without much drop in ductility and fatigue resistance. Adequate ductility ensures proper distribution of stresses during processing of wires as well as during service. Hence, it becomes important for any wire manufacturer to understand the processes that determine the wire ductility under different loading conditions. Ductility of a wire is generally measured in terms of tensile elongation, resistant to torsion loading and bend-value. Each of these values depends fully or partially on parameters like final wire microstructure, residual stresses, aging and surface quality. Torsional ductility is the key parameter, which decides the performance of cables which are used in suspension bridges.

However the exact microstructural or mechanical parameters that determine the torsional ductility of steel wire are still somewhat unknown. Although published literature indicates that inter-lamellar spacing of pearlite, its morphology and residual stress after drawing play a significant role in determining the torsional ductility, but most of these works fail to establish a model that quantitatively determines the torsional ductility.

Institute Research Supervisor: Prof Indradev Samajdar
Partner Company: Tata Steel Ltd
Industry Mentor: Dr Saurabh Kundu; Head Product Research Group, Tata Steel - R&D

..

ANKIT KUMAR AGARWAL

Institute of Chemical Technology
Matunga, Mumbai-400019
ankit.agrawal62@yahoo.com

Research Area

Development of Smart Drug Eluting Stents

The drug eluting stents are mainstay of the cardiovascular therapeutic strategy. The major drawback of the existing drug eluting stents includes exposed drug coat surface. This uncoated drug in the direct contact with the arterial wall sometimes results in localized drug toxicity arising due to overdose and also increases the propensity of degradation of sensitive drug molecules like Sirolimus and Everolimus.

The prime focus of the proposed project is to develop cost effective stents with innovative nanotechnology. By coating stents with drug eluting biodegradable polymeric nanoparticles, the combined potential of nanotechnology and localized drug delivery devices will be harnessed. It will, in turn, pave new and therapeutically effective frontiers for developing indigenous stents at an affordable cost, improving the treatment options for the patients at large without compromising the overall therapeutic benefits. It may also prove useful to achieve unmet needs in this segment.

Institute Research Supervisor: Prof Vandana B Patravale
Partner Company: Sahajanand Medical Technologies Pvt Ltd
Industry Mentor: Mr Ankur J Raval; Assistant General Manager, Research and Development

..

ANUP KUNDU

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
anupkunduabc@gmail.com

Research Area

Numerical and Experimental Investigation of Heat Transfer Enhancement in Heat Exchanger

Heat exchanger has many potential applications such as in process industries like breweries, paper, chemicals, food and beverage, textiles, automobile industries, power systems etc. in a wide variety of fluids and temperature parameters. A high performance of heat exchanger means high thermal efficiency, low cost, small in size, and light weight. Heat transfer enhancement of heat exchanger depends on fluid flow and heat transfer between fluid and channel surface. Efficiency of heat exchanger can be achieved by changing flow characteristics and also increasing surface area. Large surface area in heat exchanger improves heat transfer since the heat transfer occurs on the surface. Mini/micro-channels are the suitable option to improve heat transfer efficiency in heat exchanger due to high surface to volume ratio.

In this project, heat transfer enhancement in heat exchanger using mini/micro-channel and textured surface of the channel will be investigated by experimentally and numerically for single phase and two phase flows.

The specific objectives of the proposed project are:

(a) To investigate hydrodynamic and thermal characteristics of mini/micro-channel in heat exchanger for single phase and two phase flow system.
(b) To investigate the effect of texture surface of mini /micro channel on heat transfer enhancement in heat exchanger.
(c) To develop a computational fluid dynamics (CFD) model to predict hydrodynamic and thermal behaviour of mini/ micro-channel in heat exchanger.
(d) To numerically simulate predicted results will be validated with experimentally measured data.

Deliverables of this research project:
1) An experimental investigation of micro-channel design for boiler and novel type of heat exchanger.
2) Theoretical and Computational validation of the proposed micro/textured channels.

This could result in a novel boiler convective heat exchanger and/or compact heat exchanger.

Institute Research Supervisor: Dr Rajneesh Bhardwaj
Partner Company: Forbes Marshall Pvt Ltd
Industry Mentor: Mr D K Kuvalekar; Head, Central Research and Development

..

AVICK SINHA

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
avicksinha@gmail.com

Research Area

Numerical and Experimental Study of Superheated Liquid Jet

The flashing phenomenon occurs when both aerodynamic fragmentation and violent boiling control the flow dynamics of two phase liquid jet. The thermodynamic characteristic of the liquid jet in a combustion chamber plays a significant role in combustion efficiency and emission control. Understanding the physics and mechanisms of superheated jets is still a fairly open problem and little work has been done in this area. The computational and experimental characterization of flashing jets and sprays would aid in providing the correct inputs to downstream combustion modelling for automotive and aero combustor applications. Detailed spray diagnostics in terms of droplet size distributions, spread angle, penetration lengths will be obtained in this study. The results would be beneficial in the design of the next generation fuel-efficient and emission compliant automotive engines and aero combustors. To improve the heat load requirement of aero engines, the enthalpy of the inlet fuel need to be elevated to higher temperature. The mass flow rate may drastically get reduced due to the phase change process and the time scale over which it occurs is comparable to the time required for the liquid to flow through the nozzle. This will dramatically affect the flow rate. Both experimental and numerical studies will be carried out to study the droplet characteristics and velocity profiles of flashing jet. Numerical simulation of a homogenous superheated flow will be carried out and validated using experimental measurements. Further investigation of realistic fuel properties, including the effect of transport properties will be done. Numerical simulation of a superheated fluid into a different density medium may be carried out in the future. Effect of various inlet parameters will also be studied to give a better understanding of the primary atomization and secondary breakup of the jets that determines the nature of such complex flow.

Institute Research Supervisor: Prof Shivasubramanian Gopalakrishnan
Partner Company: GE India Technology Center Pvt Ltd
Industry Mentor: Mr Subhrajit Dey; Manager, Turbomachinery Aerodynamics & Program Manager, Linear Compressor

..

BABITA MUKHIJA

Punjab Agricultural University
Ludhiana, Punjab - 141027
babita.mukhija@yahoo.com

Research Area

Characterization of native *Bacillus thuringiensis* isolates against *Mylabris pustulata* Thunberg in Pigeonpea and optimization of Bioprocess parameters

Pigeonpea (*Cajanus cajan*) is an important Pulse crop, however its cultivation is affected by many pests, *Mylabris pustulata* Thunberg (Coleoptera: Meloidae) being the most devastating. In order to manage the insect, the use of *B. thuringiensis* (Bt) product is gaining importance as an alternative to chemical pesticides, as these are known to cause ecological and biological health hazards (Kandibane *et al* 2010). But at indigenous level particularly in this pest, it is imperative to evaluate diverse genetic stocks of Bacillus thuringiensis and to elucidate the cry gene composition of these strains. The project is designed to study the microbial diversity in terms of *cry* genes in the natural habitat (soil) of Punjab. Different samples of bacteria will be collected from different zones of Punjab state in addition to inhouse collections already made. The collected samples would be subjected to isolation of *B. thuringiensis* strains following conventional techniques. Upon isolation, the strains will further be subjected to molecular conformation with regard to their diversity. After differentiating, the isolates the potential of each isolate would be tested on target insect under lab conditions. The isolates which show promising toxic effects would be tested under field conditions by collaborating partner (Industrial partner) in different parts of Punjab. The bioprocess parameters of the most potent and stable isolate would be standardized under lab conditions. In future, the potent strains could also be shared with different labs and tested in agricultural zones all over the country for commercialization of the product to generate the revenue for the farmers by enhancing the yield of the crop. The potential isolate can be subjected to patent rights and commercialization by the collaborating entrepreneur (Industrial partner).

Institute Research Supervisor: Prof Veena Khanna
Partner Company: Sampurn Agri Ventures Pvt Ltd
Industry Mentor: Mr Sanjeev Nagpal; Director

..

CHANDRESH KUMAR MAURYA

Indian Institute of Technology Roorkee
Uttarakhand - 247667
ckm.jnu@gmail.com

Research Area

Anomaly Detection in Big Data

Anomaly detection has drawn a slew of attention in recent years, although term has been known as outlier detection in statistics several decades ago. Everyday large volume of data is being generated and dumped into data centers. For example, flight navigation data, health care monitoring data, social media data, video surveillance data etc. This has coined the term Big data in data mining folklore. Big data contains rare events or anomalous points that need to be found out –for example, less than 2% of all visitors who visits Amazon website make a purchase. Similarly, given EEG data, how can we efficiently and timely find points or subsequences that are indicative of abnormal condition of the patient? Given satellite imaginary, how can we accurately identify the deposition of water on remote planet? How can we develop devices capable of raising alarm that can detect fault in the plant operation?
Thus, anomaly detection problem can be interesting due to business perspective, security, maintenance etc. The problem becomes challenging because of noise, heterogeneity, high dimensionality of the Big data and failure of the current tools and techniques to handle the Big data efficiently. The task of anomaly detection is to find unusual pattern in the data that do not conform to the normal behavior. The key objective of the research is to study traditional as well as modern approaches taken, techniques employed to solve aforementioned problem.

Institute Research Supervisor: Dr Durga Toshniwal
Partner Company: Robert Bosch Engineering and Business Solutions Ltd
Industry Mentor: Mr Gopalan Vijendran Venkoparao

..

CHIRANJEEVI YARRA

Indian Institute of Science, Bangalore
Karnataka - 560012
chiranjeevi.yarra@ee.iisc.ernet.in

Research Area

Analysis of Temporal Contours of Spoken Language Learning

Spoken language learning (SPL) involves developing complex skills such as spoken communication, often influenced by several factors including learner's age, native language and environments. Analyzing and tracking a language learner's temporal performance contour and developing a personalized recommendation system for improving the learning skill would be potentially helpful for the learner. SPL, especially spoken English language training (ELT), is a growing market in India -- a study, carried out by the iValue Consulting Private Limited, reported the expected ELT market growth to be USD 4.67B in 2015.

The temporal dynamics of a learner's performance can be tracked by analyzing several SPL assessment measures including fluency and pronunciation. Estimating SPL measures reliably from a spoken utterance still remains a challenge particularly in real-life scenarios. Based on the analysis of performance dynamics, the personalized recommendation system would "predict" the learner's future performance with respect to the gold-standard measures available from a professional speaker. Depending on the learner's progress the system would "prescribe" appropriate interactive lesson materials to help the learner improve his/her performance toward the gold-standard one. The challenge lies in designing a statistical prediction model which can incorporate different demographic and SPL assessment metrics in predicting learner's future performance. Similarly, the challenge in designing a statistical prescription model lies in generating an interactive dialog script which would help a learner practice required spoken units to boost his/her performance.

Computing a learner's SPL performance requires a quantitative comparison between the dynamics of the learner's and the gold-standard utterances. Dynamic models of an utterance can be learnt using hidden Markov model. Kalman filter could be used to predict learner's future performance based on the available assessment measures. For prescribing the learning materials, a generative personalized dialog model could be used with emphasis on words or phrases that would improve learner's overall SPL performance.

Institute Research Supervisor: Dr Prasanta Kumar Ghosh
Partner Company: Xerox India Ltd
Industry Mentor: Dr Om D Deshmukh; Senior Research Scientist

..

DINESH BAPURAO BALGUDE

Institute of Chemical Technology
Matunga, Mumbai-400019
dinesh.balgude@gmail.com

Research Area

Modification of Renewable Resources for Coating Applications

The proposed research work is divided into two parts including functionalization of renewable resources (Cashew Nut Shell Liquid-CNSL and/or its derivatives) for water based coating applications and for the replacement of conventional toxic monomers generally used in polymer/coating industry followed by hybridisation of the same via sol-gel technology to formulate coatings for industrial applications.

The first part of research methodology involves chemical modifications of CNSL & their derivatives via addition or condensation reaction mechanism to yield functional CNSL. The functional CNSL will then be utilized to develop water-based binders such as polyesters and polyurethane. The water dispersibility can be achieved by further modification of functional CNSL with various water dispersing agents. The synthesized products will be evaluated for their general coating properties against their petroleum-based counterparts. These binders can further be explored in paint formulations for various industrial applications such as industrial, original equipment manufacturer (OEM) and coil coatings.

The second part of the research work involves hybridisation of the binders developed in the first stage by inorganic nano-materials via sol-gel technology. The combination of organic & inorganic moieties in the developed polymer is expected to improve the overall coating properties. The effect of inorganic nano materials on performance properties of the coatings including mechanical, chemical, electrochemical, thermal, colour, degree of hydrophobicity and anti-corrosive properties will be studied.

Also, one of the functional CNSL can be explored in unsaturated polyester resin (UPR) as eco-friendly substitute for toxic monomer like styrene. The synthesized styrene free UPR can further be formulated to develop bio-composites with enhanced performance properties.

Institute Research Supervisor: Dr Anagha S Sabnis
Partner Company: Nova Surface-Care Centre Pvt Ltd
Industry Mentor: Dr Swapan Kumar Ghosh; Director

..

GUNJANKUMAR JAGDISHBHAI MEHTA

Saurashtra University
Rajkot, Gujarat – 360005
pdma.aish@gmail.com

Research Area

Isolation, Identification and Evaluation of Quorum Sensing Inhibitors (QSIs) From Medicinal Phytoextracts

Quorum Sensing (QS) refers to the density dependent ability of bacteria to control gene expression through communication pathway mediated by stimulatory concentration of certain chemicals known as auto-inducer(s). Such molecules are secreted by self and/or other bacteria. QS is ubiquitous in all Gram +ve and Gram –ve pathogens where it facilitates many vital processes such as expression of virulence factors, toxins, harmful enzymes, biofilm formation, antimicrobial resistance and mating.

In the face of the increasing level of antibiotic resistance in pathogenic bacteria, we are in strong need to identify the drug targets that are important for the ability of bacteria to cause disease, but are not essential for bacterial proliferation or survival. Therefore, our technological innovation is focused on disrupting the QS mediated expression of virulence and pathogenesis which assures the potential answer to the increasing antibiotic resistance problem.

The project is functionally innovative as the regulation of virulence via QS confers a strategic advantage. The use of quorum sensing inhibitors (QSIs) is therefore highly promising, particularly against the multi-antibiotic resistant bacteria. There are number of ways to inhibit QS which includes competitive inhibition, signal binding, degradation of the signalling molecule, and inhibition of upstream precursors or genetic regulation systems.

Many eukaryotic organisms such as plants and algae are able to produce and secrete compounds that inhibit the QS signals of bacteria. Therefore, our essence of research revolves around identification and characterization of potential QSIs from medicinal plants and algae found in India. The model organisms for the present study will be *Pseudomonas aeruginosa* ATCC PA01 and *Erwinia caratovora* MTCC 1428.
Expected outcomes by the end date will be:

1. Identification and molecular characterization of QSIs followed by toxicity studies.
2. Development of resistance free & broad spectrum antibacterial formulation
3. Development of New Chemical Entities(NCE) and QSI analogues.

Institute Research Supervisor: Dr Vasantba Jadeja
Partner Company: Skymax Research & Regulations
Industry Mentor: Mr Anil Rasiklal Kadivar (Patel); Director

..

KARTHIKEYAN PALANISWAMY

Tamil Nadu Agricultural University
Coimbatore - 641 003
karthikswce@gmail.com

Research Area

Techno - Economic Prospects and Environmental Perspective of Recycling Agricultural Plastic Waste towards Sustainable Productivity

The application of plastics in agriculture is gaining importance as it is available in a wide range of variety at a reasonable cost and has useful properties such as high strength to weight ratio, flexibility to moulding to any shape and size with varying strength, colour and transparency, corrosion resistance, and the relatively less polluting plastics industries. The scope of adoption of plastics in agriculture is very wide in agricultural system including conserving the natural resources, enhancement of production, productivity and quality of produce. In the developed countries, plastics have become an inevitable part of agricultural production to utilization system. For years, the growing use of plastics in agriculture has helped farmers increase crop production irrespective of the growing season, improve food quality over the crops in open field and reduce the ecological footprint of their activity.

While the usage of Plastics in Agriculture is increasing over the period, more than half the plastics are disposed by burning on-farm, with most of the remainder buried or dumped on-farm. Due to inefficiencies of open combustion, emissions from open burning are much greater per mass of material burned than emissions from controlled incineration (e.g., 20 times as much dioxin, 40 times as much particulate matter). These emissions pose risks to human health. Based on the current disposal practices used for agricultural plastics, and the potential pollution and resource conservation impacts associated with improper disposal practices such as burning, there is a strong national need to develop a comprehensive stewardship program for waste agricultural plastics to address the lack of adequate management systems for these waste products, and the potential environmental impacts associated with improper disposal. The key objective of the research program was to identify best practice for the cost effective collection and recovery of Agricultural Waste Plastics.

Institute Research Supervisor: Dr I Muthuchamy
Partner Company: Joegeetha Plastic Pipes
Industry Mentor: Mr Gladson Christa Jeevan

..

KAVITHA MANOHARAN

Alagappa University
Karaikudi, Tamil Nadu
kavithamanoharan25@gmail.com

Research Area

Nanoparticles Based Biodegradation & Power Generation by Waste Water Bacteria

Textile industry effluents contain high concentration of organic and inorganic chemicals, high amounts of surfactants, dissolved solids, fluctuating temperature and pH, possibly heavy metals (e.g. Cu, Cr, Ni, Pb) and strong colour due to dyes. Colour is removed to make water suitable for general and industrial applications. Wastewaters may require colour removal before discharge into watercourses. From these reasons, colour content should be determined carefully. These dyes require treatment to prevent ground water contamination in the ecosystem especially in rivers, ponds and agricultural lands. This treatment has been achieved by many biotechnological and microbiological techniques. In this particular technical procedure, the work starts with collection of wastewater samples from the textile dye industry. All samples are transported to the laboratory condition and screened to obtain the dye decolourizing organism. Different analytical methods like COD, BOD, TSS, TDS and decolourization assay are the important measurements to be characterized simultaneously. Similarly physiochemical parameters like pH, temperature, incubation time, colour, odour, media composition, nitrogen sources, and carbon sources are also to be monitored. After certain analytical studies, the bacterial isolates are purified and they are examined through biochemical assay and stored in refrigeration for further studies. Because of some bacteria feed off pollutants, it also raises the possibility that bacteria could be used to convert industrial waste, sewage and uranium waste into electricity. Thus obtained bacteria are technically treated with nanoparticle association for the process of power generation by reduction and oxidation process that occurs in bacteria. For this process an electrical chamber with salt solution that involves the approach in electron transfer which relays electrons between the bacterial bio catalytic systems associated with nanoparticle. Nanotechnology is fast gaining importance in wastewater treatment. The use of nanoparticles in Reactive Remediation Technology is of great interest to wastewater treatment. This present study aims to isolate and optimize the bacterial strains obtained from textile wastewater effluent having the ability to degrade the dyes and generation of electrical power associated with nanoparticle.

Institute Research Supervisor: Dr Arumugam Ayyakannu
Partner Company: Sree Akzya Dyeing
Industry Mentor: Mr Aravindh Paramasivam

..

MANOJ KUMAR PUNIYA

Indian Agricultural Research Institute
New Delhi - 110012
manojkumarpuniya114@gmail.com

Research Area

Anthocyanins as ingredients for food industry: Strategy for extraction, functional characterization and enhanced stability

Anthocyanins in recent years have emerged out as one of the most promising ingredients for functional food industry because of their colorant and pharmaceutical properties. They are naturally occurring flavonoid compounds, associated with a wide range of biological properties including antioxidant, anti-inflammatory, anti-cancerous and anti-diabetic effects. The food and medicinal industries are thus increasingly interested in sources with high content of anthocyanins for development of functional foods. The global natural colorants market is rising due to increased demand for natural colors and ingredients with 'clean label'. The color market is estimated at $1.3 billion in 2017, and natural color market is estimated at $ 0.66 billion of that total.

Together, both Black carrot and Black soybean can have commercial applications as food colorants and food supplements. With respect to black soybean, huge amount of bioactive anthocyanins are lost in waste water. Utilization of this water into anthocyanin rich extract can turn this into a profitable venture. Consumer today is increasing demanding foods with natural color due to growing awareness of harmful effects of synthetic colorants. Anthocyanins (E-163) are the promising natural food colorants in hues of purple, pink and red and have GRAS (generally recognized as safe) status. Optimization of scale up process for the industry is the need of the hour and there is a need to optimize processing extraction conditions, and increase their stability in order to retain their color and functionality. An understanding of the composition and content of anthocyanins will aid in utilization of anthocyanins resource materials for food applications. The objective of this research is to investigate a potential industrial process for the extraction of anthocyanins for use as natural pigments and to characterize the anthocyanin compounds present in the industrial processing waste.

Institute Research Supervisor: Dr Anil Dahuja
Partner Company: Prathista Industries Limited
Industry Mentor: KVSS Sairam – Ram; CEO & President

..

MURUGAN EZHUMALAI

PSG College of Arts & Science
Coimbatore, Tamil Nadu - 641014
emurugan888@gmail.com

Research Area

Designing and Prototyping of Computer Interfaced Embedded Design for Psychological Patients & Future Warrior Hand Wear System

GSR (Galvanic Skin Resistance/ Response) is an upcoming technological trend in Bio-medical instrumentation. This study is on Electrical characterization of human emotion to visualize it, measure it and record it. This system is a man-computer synergistic combination system which has non-invasive technology for bringing psychological counseling, instantaneous patients/soldiers monitoring and subsequently delivering the required treatment. The proposed design has a high end controller which collects the signal from the subject and transmits it to Lab view NI (National Instruments) application software which is specifically designed for analyzing the acquired details of patient. It shows the instantaneous mental & clinical body condition of the soldier, who is with stress & abnormal psychological condition. It is proposed to use most effective designs in the software algorithm best suited and use smart wearable textile material along with suitable sensors to detect exact psychological conditions of the soldier. GSR opens up the possibility of actual electrical characterization of human emotion which provides invaluable insides or stepping in to the human emotion, behavior and related studies. The possibilities and applications for the study are both practical and viable. The proposed work could solve the major issues in the field of “man-machine” sector. It could lead to developing a psychological assessment tool for emotional issues, sleep disorder diagnostics and as well end up giving medical advice by non-verbal communication. The proposed system would sense the electrical activity of individual also to indicate the corresponding emotional state. It would enable to establish relationship with emotional state with bio-signals of the body for measuring and recording, in numerals the states of human emotions. This research work may open up opportunities for medical investigations, diagnosis, understanding psychological and neurological conditions of patients/soldiers.

Institute Research Supervisor: Dr Venkat Subramaniam
Partner Company: Arche Biologics
Industry Mentor: Mr T Vijay Venkat; Managing Partner

..

NAVEEN KAUSHIK

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
naveenkaushikiitr@gmail.com

Research Area

Germanium as Channel Material for Future CMOS Applications

Further scaling of conventional Si transistor technology is highly challenging due to severe short channel effects (SCE) at scaled dimensions, which has resulted in significant research efforts to look for alternate channel materials and device architectures. This research will investigate the Germanium (Ge) as channel material for scaled, low power and high performance logic applications.

Fin/GAA based devices on Ge: Ge FinFETs and Ge Gate All Around (GAA) transistors with superior short channel effects (SCEs) due to the electrostatic control by the gate from multiple sides can lead to reduced leakage/off current for low power applications. Higher career mobility in Ge further helps to improve the on state characteristics. Our research will focus on realizing high quality gate stacks on Ge fins/GAA structures that act as basic building blocks for future CMOS logic technologies.

Moreover, this work will also explored, the use of 2D interfacial layers made of transition metal dichalcogenides (TMDCs) to solve high contact resistance problems in source/drain contacts, which remains an impediment to realize high performance Ge transistors.

Institute Research Supervisor: Prof Saurabh Lodha
Partner Company: Applied Materials, Inc
Industry Mentor: Dr Aneesh Nainani; Senior Technologist

..

PADMA ISHWARYA SHANKARAN

CSIR- Central Food Technological Research Institute
Mysore, Karnataka - 570020
pdma.aish@gmail.com

Research Area

A combined computational modeling and experimental approach to investigate the influence of non-wheat particulate ingredients on volume and structure development in baked food systems

Development of starch-gluten matrix and the entrainment and retention of gas cells in this structural network are central to the quality of bakery products. Nucleation, growth and stability of the gas cells during the baking process are significant in deciding the textural quality of the baked product. Inclusion of industrially important and functional non-wheat particulate ingredient in the bakery products is a challenging task owing to its negative impact on the air entrainment and growth kinetics of the gas cells. It is important to alleviate the deteriorative effects of added particulates on the gas cell stability and subsequently the structure and volume development of the product. Evaluating the effect of added particulate on the bubble size distribution, growth and retention are difficult in real time due to the complex and simultaneous variations in the rheology and interfacial properties of the dough. The current proposal is intended to develop a combined computational modeling and experimental approach to predict and understand the influence of non-wheat particulate ingredients on the structural properties of dough system of selected baked goods.

Institute Research Supervisor: Dr C Anandharamakrishnan
Partner Company: General Mills India Pvt Ltd
Industry Mentor: Dr Kiran Desai; Scientist, Baked Goods R&D Team

..

PORSELVAM SUBRAMANIAN

CSIR-Central Leather Research Institute
Adyar, Chennai - 600 020
praveen1.pap@gmail.com

Research Area

Study on Influence of Pre-Treatment and Co-Digestion on Biogas Production from Slaughter House Solid Waste With Other Organic Waste

There are about 2500 registered slaughterhouses in India, out of this, only limited slaughterhouses are modernized and the remaining are small and medium scale. In these cases, municipalities are not able to invest on modernization and treatment system and hence solid waste is disposed-off along with municipal solid wastes in opening dumps leads to foul odour, groundwater contamination and also gaseous emissions contributing to global warming.

Anaerobic treatment is a suitable method for organic-rich solid waste (ORSW) in Indian context as compared to other methods. Anaerobic treatment of ORSW from Slaughter house produce energy (methane) and the digested sludge can be utilized as organic fertilizer. But, slaughterhouse waste (SHW) generation is not uniform due to diversity in meat consumption among Indians (High during Sundays & festival days and low during other days). SHW contains high protein and lipid contents with low C/N ratio, resulting in an increase of pH and VFA/alkalinity ratio above 8 and 0.4 respectively and leads to ammonia inhibition problems and also affects the biogas production.

In this proposed research study, to improve the C/N ratio, to feed the anaerobic digester uniformly and maintain feed rate, other organic solid wastes (vegetable market wastes, food wastes and sewage sludge) are proposed to be mixed with SHW for anaerobic co-digestion process, so as to reduce the concentration of nitrogen and increase the biogas production. In addition, the effect of pre-treatment methods before anaerobic treatment process which influence the hydrolysis rate will also be studied as it is the rate limiting step. Enhancement of biogas production will be evaluated. Also potential certified emission reduction due to implementation of this proposed process in the place of current practice will also be estimated.

Institute Research Supervisor: Dr S V Srinivasan
Partner Company: Envian Engineers Pvt Limited
Industry Mentor: Mr K Ravichandran

..

PRATICHI SINGH

Banaras Hindu University
Varanasi, Uttar Pradesh - 221005
pratichi.singh@gmail.com

Research Area

Quaternary Catalyst for Control of Diesel Engine Exhausts Emissions

Diesel engines are in conflict between the goals of emission reduction and optimization of fuel consumption. To fulfill future more stringent exhaust gas limits which aims to reduce NOx emission from 0.180 (Euro V) to 0.080 g/km (Euro VI), further developments on diesel engine technology are necessary. Therefore, diesel engine has become the decisive factor to reach the emission targets. The main pollutants of diesel engines are carbon monoxide (CO), nitrogen oxides (NOx), CO, particulate matters (PM) and hydrocarbon (HC). Control of CO, NOx, and HC emissions has been achieved to a satisfactory level through three-way catalytic converters (TWC) in fuel rich condition. As diesel engine works in lean condition, TWC is not suitable for diesel engines. As well as there exists a trade-off between soot and NOx emissions i.e. reduction in NOx emissions results in increased soot release and vice versa. Therefore, in order to reduce NOx, CO, and HC as well as PM emissions, the effective four-way catalytic system (FWC) are needed to be developed.

FWC systems consist of several components. In multicomponent system, performance of one component affects the working of another part. One exhaust treatment component's performance or durability cannot be sacrificed for the sake of another. Therefore, efforts have always been put towards the creation of a single-component technology solution. The key of this technology is to develop the highly active catalyst for FWC which can catalyze all components simultaneously at desired temperature.

Currently, noble metals are used in vehicular exhaust after-treatment systems. However, the major drawbacks are their narrow temperature window for catalytic activity. They are very costly and their availability is limited. Therefore, the aim of the present project is to design and develop highly active non-noble metal catalyst for four-way simultaneous removal of diesel engine emissions.

The significance of the present work is to remove all the pollutants CO, HC, NOx and PM simultaneously over PGM-free low cost catalyst.

Institute Research Supervisor: Prof Jitendra Pandey
Partner Company: IBIDEN Co Ltd
Industry Mentor: Dr Kazushige Ohno; Board Member & R&D Operation Manager

..

RAHUL DUBEY

Indian Institute of Technology Delhi
Hauz Khas, New Delhi - 110016
rahul.dubey2011@gmail.com

Research Area

Adaptive and Intelligent Protection Scheme for Transmission Network Including Facts and Off-Shore Wind-Farms

Use of Flexible AC Transmission Systems (FACTs) and off-shore wind farms gaining momentum in modern power transmission network to extend the power transfer capability without going for expansion planning. Even if the inclusion of FACTs and wind-integration improves operational aspects, on the other hand the protection system faces becomes serious challenges. Most versatile FACTs device which has attracted wide-spread attention is the Unified Power Flow Controller (UPFC), which improves the transient stability. However, presence of UPFC in a fault loop affects the voltage and current signals at the relay point, which in turn affects the trapping characteristics of the relay. The problem is further compounded when wind-farm is integrated to the transmission network. Due to uncertain wind speed variation, the relaying end voltage fluctuates continuously and the tripping boundaries of the relay get affected. Thus, generating adaptive relay tripping characteristics, is one of the most challenging issues for transmission line distance relays as the present day transmission systems is subjected to more stressed environment with respect to power system operation. Thus, inclusion of FACTs devices such as UPFC seriously impacts the performance of the distance relays as the apparent impedance changes and the reach setting of the relay is significantly affected due to integration of off-shore wind-farms to power transmission system. Thus, generating adaptive tripping characteristics of the relay for appropriate operating conditions is a demanding concern and the same is addressed in the proposed research work.

Expected milestones of the project:

- Developing Adaptive distance relay setting for transmission network connecting with FACTs and wind-integration.
- Building the complete mathematical framework for developing relaying scheme.
- Impact of extreme operating conditions on the performance of the relay to be assessed.
- Ensuring the selectivity and speed of the relay to be optimal and suitable for relaying application.
- Further, wide-area information will be considered to make the relaying scheme more adaptive and intelligent.

Institute Research Supervisor: Dr Bijaya Ketan Panigrahi
Partner Company: Robert Bosch Engineering and Business Solutions Ltd
Industry Mentor: Mr Gopalan Vijendran Venkoparao

..

RAHUL JAIN

Indian Institute of Technology Delhi
Hauz Khas, New Delhi - 110016
rahuljain9@gmail.com

Research Area

Runtime System Adaptation for Optimal Energy-Performance Trade-off

Multi-core systems are expected to run many processes concurrently at the best possible performance. The different processes have their own runtime resource requirements from the system, which also varies with phases of a single program. Any mismatch between the process resource requirements and the runtime resource allocation leads to sub-optimal performance and power.

Through this research, it is intended to investigate: Can the system reorganize at runtime to provide appropriate resources to varying needs of processes which can provide the optimal Energy-Performance metrics? Our proposed investigation will focus on a combined optimization of the run-time environment based on several individual techniques, some of which are already known:

1. *Dynamic Voltage and Frequency Scaling*: The voltage and frequency parameters have a direct impact on the system power. However, their use needs to be judiciously applied because they cause performance losses, and may result in overall increase in energy.
2. *Runtime Cache Reconfiguration and Partition*: The cache can be sized in accordance with the demand on the cache system. Power can be saved during periods of light memory traffic by turning off cache banks. The cache could also be partition dynamically to provide dedicated access to single/few processor cores.
3. *DRAM Bank/Channel allocation*: The DRAM bank and channel allocation and bandwidth could be controlled to respond to varying performance and power requirements at run-time. A data intensive process could be allocated dedicated DRAM Bank(s) and/or DRAM channels based on the process data bandwidth requirements. Parameters such as bandwidth could be controlled to achieve different power dissipation targets.

The research plans to study how different individual power-saving mechanisms interact with respect to the extent of power saved and degree of performance compromised, and ultimately, arrive at a practical strategy for selecting the combination of the different techniques that satisfies a given power budget, and delivers the maximum performance within that budget.

Institute Research Supervisor: Prof Preeti Ranjan Panda
Partner Company: Intel Technology India Pvt Ltd
Industry Mentor: Mr Sreenivas Subramoney

..

ROHIT KUMAR

Indian Institute of Technology Delhi
Hauz Khas, New Delhi - 110016
rohitkumaroct@gmail.com

Research Area

Catalytic Tri-reforming of Methane for Syn-gas Generation over Multi-functional Catalysts

India is both a major energy producer and consumer. A projection in 12th five year (2012-2017) plan document of the Planning Commission of India indicates that total domestic energy production of 669.6 million tons of oil equivalent (MTOE) will be reached by 2016-17, which will meet around only 71% of expected energy consumption. CO_2 emission and global warming resulting from energy production is another serious matter of concern. Considering 15.8% projected share of natural gas in total domestic energy production in 2016-17, utilization of methane (natural gas) and CO_2 via tri-reforming of methane (TRM) could be an ideal solution of these problems [1]. Tri-reforming of methane not only consumes CO_2 but also generates synthesis gas ($CO+H_2$). The further downstream processing of synthesis-gas produces methanol, hydrogen and ammonia. Synthetic diesel, petrol, jet fuel can also be produced from synthesis gas through Fischer Tropsch process. Although there is well established 'steam reforming of methane' (SRM) process for synthesis gas generation. But, TRM offers huge advantages over conventional SRM in terms of CO_2 emission avoidance, fuel saving and economics. For example, the data available in literature reveals that there would be 46.7% CO_2 emission avoidance and 30.9% fuel saving by implementing TRM over SRM for methanol synthesis [2].

Tri-reforming of methane is the process where steam reforming, dry reforming and partial oxidation of methane are combined in a single reactor. The aim of research project is to study this novel process by suitable catalyst development and process parameter optimization. Detailed kinetic modeling and study of reaction mechanism can help in thoroughly understanding the phenomena occurring in the process.

[1] 12th five year (2012-2017) plan report of the Planning Commission of India
[2] Halmann, M.; Steinfeld, A. Thermoneutral tri-reforming of flue gases from coal- and gas-fired power stations. Catalysis Today 2006, 115, 170-178.

Institute Research Supervisor: Dr Kamal K Pant
Partner Company: Petrotech Society
Industry Mentor: Dr NV Choudary; GM, Process Technology, HPCL

..

SAJAL SAHA

Bidhan Chandra Krishi Viswavidyalaya
Mohanpur, Nadia, West Bengal - 741252
sajalsaha.saha@gmail.com

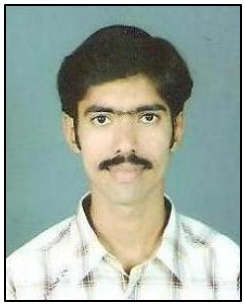
Research Area

From Wastes to Assets - Use of Iron Slime in Agriculture

The present research proposal aims to explore the possibility of utilizing by-products generated through iron ore based steelmaking into useful assets through their use in agriculture. While disposal of these by-products require substantial monetary involvement in one hand, this, on the other hand also accounts for loss of valuable resource. Thus a paradigm shift in the psychology of dealing with waste is required for converting them into assets. Results of some preliminary works suggest increase in inorganic carbon, available and total nitrogen, available phosphorus and potassium content of soil on addition of iron slime which improved further when applied in combination with organic manure under water logged condition. Increase in soil pH due to iron slime application makes it more potential resource for use in rice based cropping system under acidic soils. In spite of these benefits the possible addition of heavy metals and contamination of the food chain due to addition of iron slime also needs careful appraisal. This also opens up possible fortification of agricultural produce with useful micro elements for the benefit of the consumers. An effect of iron slime on soil biota including activity of different soil enzymes also merits importance. A research project is thus envisaged for detailed investigation on the effect of iron slime on: different soil physical, chemical and biological parameters including activity of soil enzymes in rice based cropping system; assessment of risks relating to the possibility of heavy metal loading of the soils; exploring the potentiality of iron slime as an indigenous source of different micronutrients and studying the effect of organic manures, conventional chemical fertilizers, bio fertilisers and management options for proper utilization of iron slime in rice based cropping system in West Bengal.

Institute Research Supervisor: Dr Prasanta Kumar Patra
Partner Company: Tata Steel Ltd
Industry Mentor: Dr A K Mukherjee; R&D

..



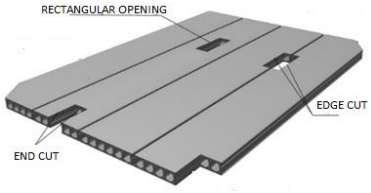
SAMEER KUMAR SARMA PACHALLA

Indian Institute of Technology Hyderabad
Telangana - 502205
ce13p1007@iith.ac.in

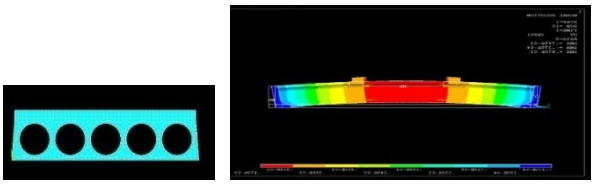
Research Area

Effect of Openings in Prestressed Precast Hollow Core Slabs

Different openings and holes are provided in the prestressed precast hollow core slabs (PPHCS) for various mechanical electrical and plumbing (MEP) service requirements. The location and size of these holes/openings plays a major role in the strength and failure modes of these elements. Typical openings will be at (i) Edges (reduction of bearing width, etc.) and (ii) Middle of span. The effect of these openings on reduction of strength and change in failure modes are evaluated by carrying out full scale testing of hollow core slabs and through finite element studies.



(i) Service Ducts and Holes in PPHCS



(ii) Finite element modelling of hollow core slabs

Objectives and Scope:
Research will be carried out for the evaluation of two cases:
Case 1: Providing Pre-planned Openings in the slab and carrying out detailed study on the effect of openings on shear and flexure capacities
Case 2: During the drilling of service ducts in slabs there is a possibility of discontinuity or accidental damage to the PS strands. This accidental damage will cause reduction in both flexural and shear capacities of the slabs. The effect of the damage and the reduction in the strength are evaluated by doing full scale testing of hollow core slabs with cut strands.

Deliverables:

- Improved guidelines to assess the effect of openings on the hollow core slab
- Simplified formula to evaluate the reduction in strength and stiffness due accidental damage of strands.

Institute Research Supervisor: Dr S Suriya Prakash
Partner Company: Preca Solutions India Pvt Ltd
Industry Mentor: Mr Shridhara CN; Head - Technical & Marketing

..

SAMMIT EKANATH KAREKAR

Institute of Chemical Technology
Matunga, Mumbai-400019
sekarekar@gmail.com

Research Area

Development of Nanocontainers for Performance Applications

The nanocontainers can be formed by loading of active ingredient inside the shell and encapsulation of shell by polyelectrolyte layer. The nanocontainers which are formed by encapsulation of polyelectrolyte layer can be used in number of applications such as biomedical, sustained drug delivery, catalyst, textile, etc. The polyelectrolyte layer forms a matrix structure on encapsulated material thus can be used in various applications to import ingredients in responsive manner. These nanocontainers are important due to responsive and sustained release of active ingredients. Responsive release of these active ingredients depends on pH, temperature, mechanical stimulation or their combinations.

In Layer by Layer synthesis of nanocontainer one or more layer of polyelectrolyte can be formed on the surface of core material/template, which shows responsive and controlled release. A multifunctional shell structure of LbL nanocontainer can be prepared using assembly of oppositely charged species (polyelectorlytes and nanoparticles) on the surface of the core material.

The halloysite nanoclays are made up of basically kaolin inside that positive and outside which negative charge exist(at pH 8). These have ability to absorb active ingredients inside the lumen and release according to external environmental pH conditions when encapsulated by polyelectrolytelayer.

These nanocontainers can be dispersed into various paint formulations in order to release their corrosion inhibiting/self-healing constituents when mechanically ruptured, which will occur when the coating is damaged by impact or abrasion. The aim is to develop nanocontainers with a built in capability to retain functionalities and restore their structural integrity automatically after the damage.

Nanocontainers synthesized by using halloysite nanoclay and layer by layer method can be used in cosmetic and medical Textile applications by entrapment of aloe Vera extract and Mosquito repellent oil respectively. The objective is to develop such nanocontainers to enhance the effectiveness of existing cosmetic and textile products.

Institute Research Supervisor: Dr Dipak V Pinjari
Partner Company: Suyog Infraspaces Pvt. Ltd.
Industry Mentor: Mr Ravindra Sahasrabuddhe

..

SANKEPALLY SAMARA SHEKAR REDDY

Institute of Biotechnology, Amity University
Jaipur, Rajasthan-302006
samarreddy11@gmail.com

Research Area

Abiotic Stress Tolerance in Oryza sativa.L (paddy) Mainly Drought and Salinity Tolerance Using Genetic Transformation Techniques

Rice is a staple crop in major parts of India, but it is facing some major challenges like abiotic stresses (drought, salinity etc.) and its productivity is greatly affected by these abiotic stresses. *Oryza sativa* L. is the most economically important cultivated rice species of the *Oryzeae* tribe (*Poaceae*). Twenty one varieties of Indica rice were selected and cultured on basal MS,N6, ½ MS, ½ N6 culture medium, supplemented with different concentrations of growth hormones (IAA,BAP,KIN,2,4-D), sucrose (3.0%) and mannitol (1.0%) lead to induction of callus, multiple shoot proliferation and profuse rooting. These plantlets were transferred to greenhouse, after acclimatization in lab conditions.

Agrobacterium strains will be grown in AB medium and then infecting will be done on callus, shoots and roots. Checking of infected callus, shoots and roots with media containing different concentrations of salt will be done. Those which will show positive results will be tested for molecular analysis and then field work will be done on varieties showing positive results.

Institute Research Supervisor: Dr Bharat Singh
Partner Company: Varsha Bioscience and Technology
Industry Mentor: Dr A John Peter; Managing Director

..

SHIBIN KRISHNAN TC

National Physical Laboratory (CSIR-NPL)
New Delhi 110012
shibikrish.tc@gmail.com

Research Area

Growth of $In_xGa(Al)_{1-x}N$ Based Heterostructures and Characterization for High-Efficiency Nitride Solar Cell

The semiconductor shows great promise in converting solar energy efficiently into electricity while the current technologies only harness very small ranges of photons to make charge carriers. The Nitride based solar cells with concentrator technology assure to result in significant enhancement in efficiency and reduction in cost. The III-nitride based systems have been extensively utilized for LED devices for more than a decade; however, recently, $In_xGa(Al)_{1-x}N$/GaN based systems have received a considerable attention for its potential application in photovoltaic. The $In_xGa(Al)_{1-x}N$ alloy has additional advantages for use in solar cells, such as high radiation resistance, high thermal conductivity, a large absorption coefficient and tunability of band gap which extends from 0.7-3.4-6.2 eV (to cover the complete solar spectrum). Thus, InGa(Al)N based solar cell structure can be engineered to cover almost 95% of the sun's wavelength, potentially achieving a high solar to electricity conversion efficiency.

The objective of the proposed research is to efficiently harness the available solar energy by designing an environmental friendly, robust and highly efficient novel Nitride based photovoltaic devices. We shall design the basic structure of solar cell and grow wide-band gap $In_xGa(Al)_{1-x}N$/GaN hetero-structures to investigate the practicability for next generation high efficiency solar cells. Initially, literature survey will be carried out to familiarize with the state of the art technology of InGa(Al)N based solar cell. InGa(Al)N/GaN single & multi-quantum well structures will be grown as step graded interlayer on substrate like sapphire & silicon by Nitride Molecular Beam Epitaxy technique. Optical, structural and electrical characterisation will be performed to analyse the growth parameters for the epitaxially grown films. The feedback from these characterisations will provide inputs to optimize the design of structures/devices with desired specifications and higher conversion efficiency.

Institute Research Supervisor: Dr Govind
Partner Company: Simco Global Technology & Systems Ltd
Industry Mentor: Mr Navin K Singhal; President

..

SUBHRAKANTI NANDA

Bengal Engineering and Science University, Shibpur
Howrah, West Bengal 711103
sknanda.online@gmail.com

Research Area

Investigations on Permanent Magnet Synchronous Generator (PMSG) for Different Renewable Energy Sources

This research work is explicitly aimed at developing a PMSG based scheme which will convert wind energy into electrical power connected to grid. The proposed work is proposed to be oriented along two lines-

- Investigation in Electrical Machine Design, Fabrication and Testing
- Investigations in Power Converter and implementation of an appropriate scheme

The said generator along with an appropriate converter can be used in pico-hydel system as well. For a grid interactive PMSG, the generator side converter is used to control the dc link voltage and grid side converter is responsible for the control of power flow injected into the grid. For a power flow from source to load a constant dc link voltage has to be maintained. The generator side converter boosts up the dc link voltage by reducing the modulation index of the sinusoidally switched power devices of the generator side converter. But there is a minimum limit of modulation index that has to be maintained for having continuous current flow. Same is true in case generated voltage is higher- to maintain constant dc link voltage modulation index has to be increased but there is a maximum limit of modulation index. So for such obvious restrictions on the range of modulation index (corresponds to range of generated voltage) the generator has to deliver current for maximum power transfer in order that high overall efficiency is achieved and the resources are optimally utilized. However if generated voltage does not fall into this range, there is a need of extra power electronic converter which can step up or step down the generated voltage to maintain the dc link level at the same time deliver rated current to the load. In the absence of this extra power, electronic converter the range of generated voltage gets reduced or an extra transformer needs to be connected in between grid/load and inverter. A Cuk converter is therefore proposed for this system for extension of the generator operating ranges. All the control schemes are being implemented on FPGA platform.

Institute Research Supervisor: Dr Mainak Sengupta
Partner Company: G.E. Motors Pvt Ltd
Industry Mentor: Mr Koushik Pyne

..

VEERA ASHA KUMARI AKETI

Indian Institute of Technology Hyderabad
Telangana - 502205
ch13p1001@iith.ac.in

Research Area

Improving the Efficiency of Dense Medium Cyclone Treating High NGM Coal Using CFD and PEPT Methods

Currently there is a huge amount of cost involved in the procurement of imported low ash coals. Most Indian coals have difficult washing characteristics due to the presence of a high proportion of near-gravity material (NGM) and partial oxidization of the coal during open pit mining. In typical coal washing plants around 80% of the ROM coal (-20 +0.5 mm) fraction is treated through dense medium separation process. The difficult washing characteristics due to the presence of high NGM in Indian coals makes the dense medium cyclone (DMC) an obvious choice for most of the washeries. The conventional cyclones very poorly separate coals, specially having fines below 3 mm fraction and >25% NGM content.

The available current conventional cyclone designs are unable to produce low ash clean coal while separating such high NGM and fine materials produced during the crushing operations. In recent years, the successful adaption of computational fluid dynamics (CFD) techniques in DMC made the possibility of predicting the performance of medium segregation using simplified Eulerian approach and coal partitioning using the Lagrangian reference frame. Latest development in multi-phase CFD models will further speedup and allow simulating the performance accurately. Validation of NGM particle trajectories will be made against PEPT data. PEPT is a tomographic technique that enables a single radioactive tracer particle moving inside a piece of equipment to be tracked accurately. These models can be used to understand the NGM particle behavior and explore potential new designs for improved coal separation.

The aim of the project is to quantify of NGM effect on cyclone performance and further to develop a novel cyclone design suitable for high NGM coal having significant fine coal fraction using CFD technique. The research activities included in project are directed towards mineral characterization followed by computational studies with various potential design concepts to improve the ability to separate high NGM and produce clean coal with reduced high ash materials.

Institute Research Supervisor: Dr Rahul Purandare
Partner Company: National Mineral Development Corporation (NMDC) Ltd.
Industry Mentor: Mr G E Sreedhar

..

VENKATESH VINAYAKARAO

Indraprastha Institute of Information Technology, Delhi
New Delhi – 110020
venkateshv@iiitd.ac.in

Research Area

Semantic Analysis & Synthesis of Source Code

Learning, Mining and IR Techniques have been used for various software engineering activities. Vector space models represent text as vectors and are used to retrieve traceability links, bug similarity and bug localization. Topic models such as LDA have been tuned to model software artifacts for automatic annotation. Text classifiers have been applied to find duplicate bug reports. Binary decision diagram has been applied to detect similarity between activity diagrams. Such advances in ML, Mining and IR have opened up opportunities to improve software development tools.

Modeling source code in several ways for several tooling purposes have been proposed and experimented. For instance, ASTs and PDGs abstract source code to help visualize structural and control-flow information. Probabilistic generative models help with prediction tasks such as code completion. Clone detection research has contributed towards better reuse and refactoring. Semantic analysis of source code has led to interesting applications such as automated code completion, code search and plagiarism detection. The domain of program analysis, comprehension and synthesis is quite mature on one hand and fast evolving on the other with the ever growing need for complex software systems.

The research focus is to combine static analysis techniques with techniques that utilize big-data towards a better software engineering experience. The work looks primarily at modeling source code while using other (software and non-software) artifacts as information sources. Beyond structural and syntactic opportunities, I look forward to explore the applications of semantic analysis. I look to apply this knowledge towards developing better tooling support for developer productivity and software maintenance.

Institute Research Supervisor: Dr Rahul Purandare
Partner Company: Microsoft Research
Industry Mentor: Dr Aditya Nori; Senior Researcher and Member of Programming Languages & Tools

..

Research Projects
Batch 3
April 2015

..

ABHIJNAN CHAKRABORTY

IIT Kharagpur
West Bengal - 721302
chakraborty.abhijnan@gmail.com

Research Area

Designing Information Retrieval Systems Optimized to Users' Sampling Strategies

Due to the enormous amount of information being carried over online systems, most users take the help of Information Retrieval (content recommendation, search or ranking) systems to find important information. The current Information Retrieval (IR) systems emphasize content's "recency" over content's "relevance or long-term importance", e.g.

- News-websites are getting updated almost every hour to show breaking news.
- Twitter, Facebook, Google+ are showing trending topics every half-an-hour or so.

A user who is sampling (i.e. logging into) these websites at time t, is only getting top K most popular information, computed based on the instantaneous popularity at t. However, while looking back after a longer time period (a week, month or a year), she must not miss any information which was really important (or popular) during that longer period. Moreover, there is a limit on the amount of information she can process depending on her idle time as well as cognitive limit.

Faced with the above constraints, the user is following an ad-hoc sampling rate. To get more eyeballs, the IR system designers want her to spend more time on their systems. Therefore, their time window of showing top K popular information is thinning gradually forcing the user to sample more. As the sampling rate is approaching the limit for the user, she is feeling exhausted, and gradually becoming inactive on that particular system.

In this work, we want to first systematically measure the effect of such frequent information change in the IR systems, and investigate efficient sampling strategies. Finally, we want to design IR systems which honour individual user's sampling strategies, yet maximize coverage over information with "long-term importance", and minimize the delay in getting such information.

Institute Research Supervisor: Prof Niloy Ganguly
Partner Company: Google India Pvt Ltd
Industry Mentor: Mr Rahul Sami

..

ADINARAYANA GANJIGUNTA

Acharya Nagarjuna University
Guntur, Andhra Pradesh - 522510
adinaraya530@gmail.com

Research Area

Improvement of Tropical Maize by Introgression Superior Alleles Responsible For Increase of Lysine, Tryptophan & B - Carotene

Malnutrition is a serious global health problem, which is responsible for a number of disorders that range from susceptibility to infectious diseases and increased childhood mortality. In recent study, 42% of Indian children are malnourished, and was considered as a national shame. Cereal foods contribute to approx. 50% of our dietary protein however they are devoid of several essential amino acids, such as lysine and tryptophan. Most cereals contain 1.5-2% lysine, and even low levels of tryptophan. Endosperms of food crops, such as corn and wheat, are also low in pro-vitamin A (1-10%) as compared with non-pro-vitamin A carotenoids. Improvement of pro-vitamin A, amino acid levels of major food crops as corn, wheat, and rice may be accomplished through genetic engineering of relevant biosynthetic pathways. Despite the preliminary success, the issues governing regulatory approvals kept them far-reaching to children and general public at highest risk. On the other hand, marker-assisted breeding can be performed as an alternative approach to entail integration of pathways, pyramiding of multiple traits in local elite varieties.

Leveraging agriculture, towards reducing malnutrition and meeting demands of food security, by adding two of the most important nutritional traits (QPM and β-carotene) into commercially important elite lines, can provide a sustainable solution to eliminate malnourishment in India, and is a major innovation in the proposed project.
The proposed research is divided into two areas (1) Identify, characterize and understand the genes responsible for the phenotypic differences in carotenoid content and composition among tropical crop Germplasm. (2) Gene introgression for breeding new elite maize varieties together with β–carotene and quality protein. This work will provide nutritionally improved maize varieties, addressing the client-oriented value-chain and alleviating malnourishment, together contributing solutions to nation's greater good and be a prime example in **"make in India"** global initiative.

Institute Research Supervisor: Prof K R S Sambasiva Rao
Partner Company: Nuziveedu Seeds Ltd.
Industry Mentor: Dr Sateesh Kumar Puligundla

..

DARSHEEN JITENDRABHAI KOTAK

Institute of Chemical Technology
Matunga, Mumbai - 400019
darsheenkotak16@gmail.com

Research Area

Design and Development of Non-Invasive Drug Delivery Systems for Large Molecules

Osteoporosis is a disease characterized by low bone mineral density (BMD) and structural deterioration of bone tissue, which lead to bone fragility and increased susceptibility to fractures, especially of the hip, spine, and wrist. In 2013, sources estimate that 50 million people in India are either osteoporotic or have low bone mass. Osteoporosis continues to pose a major health concern as resulting fractures if not addressed in time could severely hamper the quality of life and even be in debilitating.

Teriparatide, also referred to as recombinant human parathyroid hormone (1-34) (hPTH [1-34]), stimulates bone formation and has anabolic properties. Currently Teriparatide is given SC (Forteo injection) once daily over a period of 28 days for the treatment of osteoporosis. Problems associated with the SC injection include pain, discomfort to patient, and special care for the injection is required. Therefore, there is a requirement for non-invasive delivery route for administration, which could provide immense benefits by prescribing patient-friendly therapy and improve patience compliance, a critical requirement for successful therapy.

It is proposed to investigate nanocarrier-based systems for the same. Our lab has a patent on sublingual delivery of insulin (Molecular weight 5808 Dalton). With Teriparatide having molecular weight 4218 which is lower as a first line strategy, it is planned to explore the same system. Further attempts to make the liquid system of Teriparatide into tablet/film dosage form, for convenient administration, would also be a thrust in formulation development. Project as anticipated would involve the following:

- Development of an innovative non-invasive formulation with good stability and high bioavailability
- Physicochemical characterization and stability by CD Spectra, MALDI etc.
- In vivo bioavailability and pharmacokinetics in animal model
- Preclinical pharmacodynamics evaluation of bone mass density (BMD) in a model of osteoporosis
- Following R&D development, the project would be scaled up and procedures for further clinical evaluation would be initiated by the partner company.

Institute Research Supervisor: Prof Padma V Devarajan
Partner Company: Zim Laboratories Ltd
Industry Mentor: Mr Anwar Siraj Daud

..

DHIVYARAJA KUMARAN

Indian Institute of Technology Madras
Chennai, Tamil Nadu - 600036
dhivyan26@gmail.com

Research Area

Advanced Micro Spray Cooling Technologies for High Power Density Hydraulics

Being a leading developing nation, industries in the country should focus on developing energy efficient, high power density systems such as nuclear power plants, high efficiency coal thermal power stations and other such systems. Cooling high power density systems is a rate-limiting challenge in developing such efficient power systems. It is quite clear from the literature that forced convection based cooling technologies have reached a point of diminishing returns. The hydraulic power systems of the future will therefore require disruptive, more compact and efficient cooling technologies to be incorporated into the designs. It has been shown that two-phase spray cooling from a single nozzle can result in heat transfer rates that may be two orders of magnitude more than current state of the art.

However, the challenge in bringing these systems to industrial scale applications has been to translate the technology into a compact design on a power pack. The objective of the current project is to fill that gap by designing, developing, building and characterizing a micro-spray (µSpray) array cooling system for use with the next generation hydraulic power packs.

As part of the project, we will develop a µSpray array that will be employed to spray a coolant onto a target surface. The coolant flow rate will be controlled actively using a series of micro valves at a point which is well inside the stable operating envelope in the parameter space.

The key challenges to be overcome in the design phase are as follows:

1. Designing the µSpray array such that intersecting sprays lead to beneficial results.
2. Ensuring that the atomization is sufficient to cause complete evaporation upon impact.
3. Ensuring efficient removal of the vapour from the heat transfer zone.
4. Integrating the µSpray array with micro valves, so as to provide control.

Institute Research Supervisor: Prof Mahesh V Panchagnula
Partner Company: Eaton Corporation
Industry Mentor: Dr Nikhil S Tambe

..

INDU ELIZABETH

Academy of Scientific and Innovative Research (AcSIR)
CSIR-CECRI
Karaikudi, Tamil Nadu - 630006
induelizabeth20@gmail.com

Research Area

Novel Electrode Materials for Lithium Ion Batteries

Li-ion batteries (LIB) are most convenient form of power sources because of long cycle life, wide temperature range of operation, low self discharge rate and high performance in terms of capacity and energy density. The major components in a commercial lithium ion battery are graphite anode, $LiCoO_2$ cathode, separator and electrolyte. But, these anode and cathode materials possess the inherent drawback of low reversible capacity of 200 and ~140 $mAhg^{-1}$ respectively which eventually limits its overall performance. In spite of several attempts not much commercial success has been obtained. Hence, my research plan will be centered on the development of newer high capacity and high voltage anode and cathode materials for lithium ion batteries and also fabricating coin and pouch cells for several applications.

Plan of work

1) Development of High capacity anode materials for Rechargeable Li ion batteries (Capacity above 600 mAh/g)

- Si based anode materials from bio waste.
- Metal/Carbon nanocomposite anode synthesized using chemical process.

2) Development of Lithium rich High voltage cathode materials (Capacity above 160 mAh/g and voltage up to 5 V)

- High voltage layered/spinel cathode material based on Co and Ni
- Lithium rich high capacity nanocomposite cathode material

3) Physical Characterizations

4) Electrochemical Characterizations with coin cells

- Cyclic Voltammetry
- Impedence studies
- Galvanostatic charge/Discharge studies

5) Fabrication of coin and pouch Li ion batteries (3.7V) by suitably engineering the materials for multifarious applications viz. integrating with solar lanterns, solar hats etc in association with industry.

Institute Research Supervisor: Dr B P Singh
Partner Company: EON Electric Ltd
Industry Mentor: Mr Sunil Trikha

..

JAGREETI GUPTA

Punjab Agricultural University
Ludhiana, Punjab - 141027
jagriti20.gupta@gmail.com

Research Area

Morphological and Physiological Parameters of Subtropical Ornamental Trees Under Salt Stress

Soil salinity is a problem of global concern. Salinity affects about one third of irrigated land, causing a significant reduction in crop productivity. Salt affected area in India is 6.73 million ha. For this reason researchers have paid considerable attention to this important environmental problem over the last decades. The recorded salinization of the arid and semi-arid ecosystems is the result of a high evaporation of water from the soil coupled with an irregular rainfall. Salinity is of rising importance in landscaping because of the increase of green areas in the urban environment where the scarcity of water has led to the reuse of wastewaters for irrigation. Very less information is available on salt stress tolerance of ornamental trees in India and abroad however, no research work has been conducted on effect of different concentration of salts on ornamental trees under Punjab Conditions. So selection of tree species suitable for salt affected area is essential. Keeping in view the above cited reasons, the present investigations entitled, "Studies on Morphological and Physiological parameters of Sub- tropical ornamental Trees under salt stress" is going to carry out at the Experimental Farm of Department of Floriculture and Landscaping, with following objectives:

- To screen out the tree species for cultivation under saline condition
- To quantify the metabolites for salinity tolerance
- To study the morphological and physiological characteristics of trees under salt stress

This research will:

- Help in screening of planting material suitable for salt affected arid and semi-arid region.
- Boost the demand of tolerant tree species in salt affected areas, which lead to production of large number of nursery plants, which in turn increases the employment opportunities and also provide opportunity to increase nursery area in salt affected regions.

Institute Research Supervisor: Dr R K Dubey
Partner Company: Beauscape Farms
Industry Mentor: Mr Avtar Singh Dhindsa

..

PIYALI DHAR

Indian Institute of Technology Madras
Chennai, Tamil Nadu - 600036
piyalidhar92@gmail.com

Research Area

Pre-treatment of Lignin by Non-Conventional Methods and Catalytic Conversion to Useful Compounds

Biomass has become an important renewable feedstock for production of energy, fuels and chemicals. Lignin, a natural polymer and constituent of lignocellulosic biomass is produced 50 million tonnes annually by the pulp and paper industry. The major commercial use of lignin is still restricted to low value products and combustion. The unique chemical structure and properties of lignin makes it a potentially valuable source for bulk and fine chemicals. My research topic focuses on three routes of valorization of lignin- ball milling, microwave irradiation and ultrasound.

Mechanochemical activation by milling of lignin creates high energy environment at the molecular level due to localized pressure and frictional heating. This enhances chemical reactivity while carrying out in situ reactions with lignin in the mill. In ultrasonic treatment, the microcavities produced by the acoustic waves create localized hotspots with very high temperatures. The shock waves generated by the collapse of these cavities induce mechanical effects such as surface changes, particle size reduction, intense mixing and heating. One of the aims of my research is to study and compare the effect of these techniques on the structure and properties of lignin. Microwave is a source of selective dielectric heating which can be utilized for its high energy efficiency and as a green route for production of phenolic compounds from lignin.

The catalytic conversion of lignin can be combined with non- conventional methods such as ultrasound, microwave and traditional ones such as milling. Catalytic conversion helps to make the process less energy intensive, increase selectivity and minimizes the use of solvents. The research goals that I have set for my PhD would help me study the future potential of these methods for production of green fuels and chemicals from lignin, compared to conventional techniques such as combustion and pyrolysis.

Institute Research Supervisor: Dr R Vinu
Partner Company: Thermax Limited
Industry Mentor: Mr R S Jha

..

SAMEENA NAAZ MALIK

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
naaz_1709@yahoo.in

Research Area

Development, Optimization, Modelling and Scale-Up of A High Performance Pre-Treatment System for Complex Industrial Wastewaters for Biodegradability Enhancement, Colour And Toxicity Reduction Along With Concomitant Biofuel Production

Preamble and Motivation: This proposal endeavours to investigate the effect of Synergistic combination of Advanced Oxidation based pre-treatment (Ozone/H202, Wet Air Oxidation etc)of complex industrial wastewater to facilitate biodegradability enhancement along with concomitant colour and toxicity reduction(e.g biomethanated distillery spentwash - COD 50,000 mg/L, BOD < 15%, intense colour). The pre-treatment effect will be evaluated in terms of biogas production potential along with its effect on enhancing aerobic oxidation and composting rates. The pre-treatment process will be evaluated, optimized and scaled-up in bench and pilot scale ozonation/H202 system available with Industrial partner. The entire process will be modeled, simulated and scaled-up using MATLAB platform. Further, the entire process chain of pre-treatment, enhanced biogas generation and composting will be demonstratedusing pilot scale ozonation/H202 system at a distillery site using existing full scale digesters and composting system. The concept will also be evaluated with other wastewaters (eg.pharma industry). The techno-economic analysis of the process will be done using Super-ProDesign simulator and the LCA will be done using GaBI simulator platform.

Description of innovation: The objective is to develop an efficient and sustainable pre-treatment system for complex industrial wastewaters to enhance biodegradability with concomitant colour and toxicity reduction. The pre-treated wastewater with higher biodegradability will have potential for biofuel generation, enhanced/improved downstream treatment via aerobic oxidation, composting etc. The sustainability of the pre-treatment system will be due to its selective application targeting only biodegradabiliy enhancement rather than complete COD destruction and its integration with energy positive biofuel production.

Institute Research Supervisor: Dr Prakash Chandra Ghosh
Partner Company: Ozone Research & Applications India Pvt Ltd
Industry Mentor: Mr Vishal Waindeskar

..

SRINIVASA SUDHARSAN GOVINDAN

Thiagarajar College of Engineering
Madurai, Tamil Nadu - 625015
srinivasasudharsan8@gmail.com

Research Area

Advanced Controllers for Optimizing Wind Energy

Due to the enormous amount of information being carried over online systems, most users take In the present day scenario of power crisis and depletion of raw materials of the conventional energy resources, the investments on the renewable sources increased drastically. Many researches are carried in fixing the problems with the renewable energy sources and inventing new techniques to process the energy sources. This is one such research which deals with fixing the problems related to the optimum operation of the wind turbine and also proposes a novel technique to store the wind energy which is generated in small scale. The first section of the project deals with the power quality improvement of the wind energy along with the fatigue load mitigation in the turbine blades. This is done by individual pitch control governed by the intelligent controllers with the help of the evolutionary algorithms. This would reduce the size of the turbine blades and other parts thereby yielding two merits: i) material cost is very much reduced since it is more costlier material ii) power output is increased in low wind speed condition. The second work proposes an alternated energy storage system which could be used both in small scale and also in large scale. This system proposes the electricity to hydrogen to electricity cycle. This method completely eradicates the problem of grid integration and also transmission line limitations. This method would also be an evolution in the process of distributed generation storage. In real time point of view the above mentioned research would bring down the wind turbine from its bulky nature, high initial cost, large area of wind farm and highly secured grid integration, so that it could be decoupled from large wind farm to small, completely in-house wind turbines.

Institute Research Supervisor: Dr S Arockia Edwin Xavier
Partner Company: Vaata Infra Limited
Industry Mentor: Mr V R Raghunathan

Research Projects
Batch 4
April 2016

..

AKASH DILIPKUMAR PATEL

Hemchandracharya North Gujarat University
Patan, Gujarat - 384265
akashp1324@gmail.com

Research Area

Economic and Environmental Potential of Industrially Useful Microalgae Cultivation

Microalgae are highly diversified group of organisms. Each microalga has unique bio-molecule content that can be recovered from its body (cells) after growing in suitable water medium. Microalgae are also getting more attention from researchers worldwide due to its benefits in using waste water and CO2 from environment. Many of the species are still unexplored, which may have high economic value. Furthermore, optimization of growth conditions and nutrient requirements for large scale cultivation of interested species is still going on for different applications. Many process and conversion technologies have been tested already and some are under the scrutiny of researchers for extraction and purification of products from microalgae feed stocks. However, development of economic, sustainable and energy-efficient technology requires more research in this direction.

The main objective of the study is to develop economic, environment and energy-efficient microalgae cultivation system that is co-located at bio-power plant. The algae cultivation system receives CO2 from bio-power plant chimney and high Total Dissolved Solids (TDS) wastage blow down from cooling tower. Later, the harvested algae biomass can be dried using excess heat from bio-power plant. Based on this concept, Abellon Clean Energy is keen to support this project leveraging access to their 9.9 MW bio-power plant facility located at Bhavnagar district of Gujarat. Gujarat, with 1600 km long marine diversity rich coast line and suitable climate conditions, has high potential for algae cultivation and if commercialized, microalgae have the potential of rendering commendable economic and environmental benefits to the state. This unconventional production uses non-productive land, generates additional employment and reduces dependency on fossil-fuels. Moreover, it would open new avenues for making sustainable biomass available for bio-energy generation by facilitating large-scale micro-algae cultivation at coastline of Gujarat. Co-location of algae projects with carbon emitting and waste water generating industry would serve sustainable algae biomass production and waste minimization.

Institute Research Supervisor: Dr. Beena Patel
Partner Company: Abellon CleanEnergy Ltd.
Industry Mentor: Mr. Pankaj Patel; President & Board Member

..

ARCHANA RAJENDRAN

CSIR-Central Electrochemical Research Institute
Karaikudi, Tamil Nadu - 630006
archanaraj.89@gmail.com

Research Area

Fabrication of Porous Ti and Ti Alloys with Multi Element Substituted Nano-Structured Titania Layer Having Bioactivity, Antibacterial Activity and Bone Cell Responses for Biomedical Application

Ti and Ti alloys are finding ever-increasing applications in biomaterials due to their excellent mechanical, physical and biological performances. Although Ti has higher mechanical strength, its elastic modulus has to be further reduced to avoid bone resorption due to stress shield. Porous Ti can show better biological fixation by promoting bone tissue in growth into the pores of the implants, which enables homogeneous stress transfer between bones and implants. Further development of porous Ti- based alloys containing low elastic modulus elements such as Nb, Zr, Ta etc mimicking human bone modulus are yet to be explored. Although these metals are approved as medical grade materials, during orthopedic application direct bone formation on their surface is very slow. The bioactive coating technologies so far developed on these metals surface still have many shortcomings. In clinical cases it is also found that during implantation these metallic implants are easily susceptible to bacterial infection. Therefore, there is a pressing need to develop new methodologies to improve the bioactivity of the medical devices without any external coatings.

The main theme of the present proposal is to fabricate porous Ti and Ti alloys with compatible biomechanical properties via powder metallurgy route. The surface chemistry and morphology of thus fabricated porous Ti and Ti alloys will be modified by chemical and thermal treatment or hydrothermal treatment. Substitution of ions such as Mg+2, Ca+2, Sr+2 in an in-situ process enhances the new bone formation and Ag+ ions are expected to induce antibacterial activity on the metal surface. The effect of surface roughness, surface topography and patterning, surface chemical state of the metallic materials on osteoblast cell attachment and proliferation will be evaluated. Thus developed porous Ti and Ti alloys can be used to design orthopedic and dental devices with high bioactivity, antibacterial activity and cytocompatibility.

Institute Research Supervisor: Dr. Deepak Kumar Pattanayak
Partner Company: Höganäs India Pvt. Ltd.
Industry Mentor: Dr. Kumar M. Iyer; Head, Operation & Technology

..

BHASKAR BETHI

National Institute of Technology, Warangal
Telangana - 506004
bethi.bhaskar@gmail.com

Research Area

Development of Pilot Scale Cavitation Assisted Catalytic Membrane Reactor for Wastewater Treatment

Among various industrial water effluents, textile industrial effluents, having high concentrations of dyes, high toxicity and more color, cause serious problems to the ecosystem. Many treatment methods are available for the treatment of such effluents using conventional biological treatment - adsorption. These methods are unable to completely degrade the dye molecules present in waste water due to complex and biological resistance of the dye molecules. Amongst various dye effluents azo dyes are more non-biodegradable under aerobic biological conditions. Therefore, it is necessary to find an effective treatment technology for complex and non-biodegradable molecules to degrade or breakdown such complex molecules into smaller molecules. For this, advanced oxidation processes (AOPs) have been developed and evaluated since the 20^{th} century to degrade azo dyes from wastewater. Among AOPs, electrolysis and photo catalysis are extensively studied. Recently, hydrodynamic has been widely applied as an advanced oxidation technology in waste-water treatment. This involves the generation of cavities, and growth and/or collapse of cavities. Sudden collapse of these cavities leads to the formation of hydroxyl radicals, which are powerful oxidants for the degradation of many organic pollutants. These hydroxyl radicals are reacted with organic pollutants in the presence of water and produce water, CO2 and some intermediate compounds. These intermediate compounds may be poisonous to humans/ aquatic life. Though research to study the degradation of organic pollutants present in waste-water is underway but researchers have not concentrated on separation of these intermediate compounds and reuse of water from proposed AOP's such as hydrodynamic cavitation, photocatalysis etc. Researchers have also found that single AOP's are not able to completely mineralize the wastewater. It was also proved that hybrid AOP's give the mineralization of wastewater to an extent. The proposed research is also a hybrid advanced oxidation process. The proposed research will consider the separation of these degraded organic pollutants and toxic pollutants from waste-water by adopting a novel membrane reactor to hydrodynamic cavitation. The membrane reactor will also help in carrying out secondary reactions and separation of generated products in the system.

Institute Research Supervisor: Dr. Shirish H. Sonawane
Partner Company: K-Pack Systems Pvt. Ltd.
Industry Mentor: Mr. A. N. Prakash; General Manager

..

DEEPAK CHANDRAKANT AKIWATE

Indian Institute of Technology Hyderabad
Telangana – 502205
me14resch11001@iith.ac.in

Research Area

Acoustic Analysis of Periodic Structures

The noise produced from various sources like Automobile, Transportation, Marine and Heavy industries is one of the major concerns to environment. The high frequency noise produced can be attenuated by available traditional acoustic solutions. To attenuate the low frequency noise, traditional solution using Barriers and Enclosures is not effective due to the requirement of higher thickness and weight. The industries require lightweight-high stiffness solutions for low frequency noise control. One of the proposed solutions for the above problem is periodic structured sheet absorbers. Though research on the problem is being done since several decades, the physics behind working of periodic structure in noise control remains an open challenge. The main objective of current research is to understand the physics of acoustic energy dissipation in periodic structures and develop a validated theoretical model. The proposed hypothesis for modelling of periodic structure is based on structural-acoustic coupling. The effect of various parameters like material, shape of periodic structure and damping will also be studied to get better understanding of the physics involved.

The specific objectives of proposed research are:

a) Development of a mathematical modelling of periodic structure used for low frequency noise attenuation
b) Parametric study and identification of critical design parameters to establish design methodology for tuning sheet absorber parameters in order to achieve a higher absorption coefficient at defined lower frequencies
c) Measurement of acoustic properties of periodic structures

Deliverables of proposed research:

a) Validated mathematical model to design low frequency sheet absorbers
b) Parameters for critical sheet design for tuning frequencies

The elucidating physics of acoustic energy dissipation will be beneficial in efficient designing of acoustic sheet absorbers for low frequency noise attention, which will replace the thick and heavy acoustic panels.

Institute Research Supervisor: Dr. B. Venkatesham
Partner Company: Eaton Technologies Pvt. Ltd.
Industry Mentor: Mr. Nagendra Singh; Manager, Structural Dynamics, M&S CoE

..

HARSHAL AGARWAL

Academy of Scientific and Innovative Research (AcSIR)
Chennai, Tamil Nadu - 600113
harshalagarwal@acsir.res.in

Research Area

Thermal Management of High Temperature Proton Exchange Membrane Fuel Cell (HT-PEMFC) Integrated with Fuel Reformer and Vapour Absorption Machine

Proton Exchange Membrane fuel cell (PEMFC) is projected as an alternative power source in transportation, stationary, industrial and strategic energy generation sectors due to its various advantages such as high electrical efficiency, robustness and silent operation. It is desirable to integrate a liquid-fuel reformer with PEMFC system in order to circumvent the obstacles faced in sourcing and storing hydrogen. Compared to the conventional Low Temperature (LT) PEMFC systems, the High Temperature (HT) PEMFC is a desirable option to integrate with fuel reformer as it is tolerant towards CO poisoning, which comes with reformed hydrogen. Also, since the HT-PEMFC operates at 160-200 oC, the heat generated within the stack is of high quality. Therefore, thermal management presents interesting opportunities in a reformer + HT-PEMFC integrated system. Specifically, the heat generated within the stack can be valorised in multiple ways so as to achieve combined heat and power efficiency of the system in excess of 70%. A unique option to utilize the heat from the stack is to integrate the HT-PEMFC system with a Vapor Absorption Machine (VAM) so as to achieve space cooling in addition to power generation. This option is relevant to tropical countries such as ours, and has never been experimented with to the best of our knowledge. I propose to explore this novel heat integration approach in this research work. The scope of my research will include designing of stack components based on CFD simulations; Aspen based process simulations to optimize heat integration between reformer/HT-PEMFC/VAM sub-systems and finally experimental investigation on a suitably designed test bed for validation of simulations. This work shall culminate with the prototype development of an optimized integrated thermal management strategy between fuel reformer, HT-PEMFC and vapor absorption machine.

Institute Research Supervisor: Dr. Santoshkumar D. Bhat
Partner Company: Thermax Ltd.
Industry Mentor: Mr. Samir V. Kulkarni; Head, Strategic Planning Group

..

INAYATHULLAH GHORI

Indian Institute of Technology Hyderabad
Telangana – 502205
inayath2020@gmail.com

Research Area

Development of a Low-Cost Screening System Devised To Identify Cardiac Diseases in a Rural Healthcare Setup

Cardiac diseases are on a rise in both urban and rural Indian population. Effective management and patient outcome depends hugely on the time taken for intervention. While the AHA (American Heart Association) and ESC (European Society of Cardiology) guidelines are pushing their health care workers to minimize intervention time in minutes – Indian counterparts owing to lack of proper infrastructure and low resources are still struggling with early diagnosis and referral issues. For example, according to American Heart Association guidelines the proposed time limit for acute myocardial infarction is 90 min (door-to-balloon time) – patients in Indian setups are often seen presenting after several hours to even days after the acute attack with damage that is often irreversible. Not only does the late diagnosis cripple the patient for a lifelong suffering with poor quality of life, but it also adds to the additional health care burden on the country. This project explores the present status of primary cardiac screening in different countries, shortfalls in primary health care management in India and a potential solution to effectively screen cardiac diseases for timely intervention in a low resource setting. The focus is on exploring newer screening methods (Optical Imaging) as well as enhancement of existing technology (Ballistocardiography, Phonocardiography, Electrocardiography & Echocardiography) to integrate with patient's clinical presentation for effective decision making.

For Echocardiography, an automated screening system with computer assisted diagnosis is proposed wherein we utilize optical tracker attached to 2d echo probe and utilizing several open source modules – including Visualization Toolkit (VTK), 3D Slicer, open source 4D reconstruction toolkit – Synchograb4D (which utilizes ECG gating) and allows for retrograde gating. The automated echocardiography system aims to provide valuable information at times where skilled personnel aren't available and the use of 4D reconstruction allows for advantages with respect to field of view & spacial resolution and easy integration and data streaming from closed/proprietary echocardiography machines.

Institute Research Supervisor: Dr. Renu John
Partner Company: Kamineni Hospital Ltd.
Industry Mentor: Dr. Sagar Bhuyar; Consultant Interventional Cardiologist

..

JYOTI SHANKAR JHA

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
jyoti.jha@iitb.ac.in

Research Area

Microstructure Based Fatigue Modelling of Titanium Alloy (Ti-6Al-4V)

The microstructural damage that can lead to the propagation of cracks under fatigue loading conditions is a major concern with respect to the structural integrity of gas turbine-engine components in aircrafts. The large variation in load coupled with the presence of small cracks may cause fatigue crack nucleation and growth till catastrophic failure of the fan blade of the aero engine. Titanium alloy (Ti–6Al–4V) offers very high strength and good resistance to fatigue crack growth.

From a materials science perspective 'fatigue' consists of three stages: cyclic deformation of the material, fatigue crack nucleation and then propagation of the crack until it becomes critically sized, propagates and the component fails. The prediction of fatigue cracks as a function of the alloy microstructure and deformation conditions is not understood properly.

The purpose of the present study is to contribute to an understanding of fatigue crack nucleation and its growth as a function of microstructure.

Ideally, the fatigue tests should be done on those specimens that are machined off from the blade; however, an alternative proposed approach is to design the fatigue test specimen, which imitates the existing fan blade with respect to microstructures and other mechanical properties. The microstructure and the mechanical properties can be modified using Heat treatment and thermomechanical treatment.

The different fatigue tests on the specially designed specimens are required to be carried out to study the crack nucleation and its growth.

The modelling of fatigue crack growth in the Abaqus/Matlab framework is needed to be carried out to simulate the crack growth for different kinds of microstructures.

To improve the fatigue crack growth life, this work will be carried out in collaboration with KCTI, Bharat Forge Ltd. and Indian Institute of Technology, Bombay and the outcome of this work will be implemented by Bharat forge Ltd.

Institute Research Supervisor: Prof. Asim Tewari
Partner Company: Bharat Forge Ltd.
Industry Mentor: Dr. Suraj Toppo; Assistant Manager

..

KARANVEER SINGH ANEJA

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
kvsaneja@iitb.ac.in

Research Area

Graphene-based Anticorrosive Coatings

To meet the global need of steel today, nearly a billion ton of steel is produced every year. Despite having superb properties like strength, hardness, conductivity (electrical and heat), steel is prone corrosion and rusting. The most widely used method to control corrosion of steel is galvanization, which is further strengthened by chromatizing. Due to the adverse effects of chromium (VI) on human health and environment, its use is restricted in many countries including the whole of Europe. Zinc coatings, on the other hand, are less ductile than the steel substrates and can induce flaking or cracking on deformation thereby compromising coating's corrosion resistance properties. Also, fluctuating costs and availability of pure Zn can be an issue in coming years for steel industry. Next generation graphene material can be a possible solution for reduced Zn or Zn free coatings and also replacing Cr(VI) coatings in the near future.

The aim of this research study is to optimise and scale up graphene production process to an industrial level buy evaluating different process parameters and raw material sources. On successful modelling of the production process, the produced graphene will be used to formulate Chrome free and Zinc free/reduced Zinc based coatings for steel wire applications. Suitable lab scale and pilot plant trials shall be carried out to evaluate these coatings. On successful completion of the research study, the developed coating system will help reduce the impact of coatings on environment and will go a long way in protecting the steel wires against the menace called corrosion.

Institute Research Supervisor: Prof. A. S. Khanna
Partner Company: Talga Resources Ltd.
Industry Mentor: Mr. Mark Thompson; Managing Director

..

RAJPREET KAUR GORAYA

Punjab Agricultural University
Ludhiana, Punjab - 141027
ft.rajpreetgoraya@gmail.com

Research Area

Development of Low Sugar/Sugar Free Ice Cream and Whey Beverages with Improved Physico-Chemical And Sensory Attributes

With an advent of new technology, changing food habits of the populace and environmental concerns, dairy industry is re-appropriating its products to deliver food like ice cream having low calorific value and proper utilization of its byproducts (like, whey) with greater palatability. Ice cream is relished by all age groups of people throughout the world. In India, annual growth rate of ice cream is 12 – 15% with market value of 2500 crores per year, but it is termed as "the diabetes capital of the world". An alarming increase of diabetic and obese people in all age groups population has raised concern in scientific community including Milkfed to develop low calorie foods including ice cream with reduced or no sugar content. However, this poses a challenge to ice cream manufacturers with respect to quality and needs simultaneous redressal. Whey, a byproduct of dairy industry, invites an equal attention for its disposal both for environmental and economic concerns. Hence, research on improving characteristics of low sugar/sugar free ice cream and whey beverages development will be carried out under following objectives:

- To optimize the processing parameters of mix to improve the physical attributes of ice cream
- To optimize the formulation of ice cream mix for making low sugar/sugar free ice cream
- To develop simple technology for manufacturing variety beverages from paneer whey
- To study the storage stability of the developed products
- To scale up the production of developed products at commercial level and calculate
- economics

Keeping in view the Milkfed's provisions for the low/sugar free ice cream and economic utilization of whey, it is planned to develop an appropriate technology on the basis of above objectives which will be commercialized.

Institute Research Supervisor: Dr. (Mrs) Usha Bajwa
Partner Company: The Punjab State Cooperative Milk Producers Fed. Ltd.
Industry Mentor: Mr. S. R. Saini; Additional Managing Director

..

SANDEEP KUMAR

University Institute of Engineering & Technology, Kurukshetra University
Kurukshetra, Haryana - 136119
sk.kd@live.com

Research Area

Synthesis & Characterization of Graphene-based Conductive Ink for Flexible & Printable Electronics

Flexible devices/systems requires features like bendable, conformally shaped, elastic, lightweight, non-breakable, low cost, roll-to-roll manufacturable. Electronics devices such as RFID, sensors, transducers, larger area displays etc. can be printed over flexible substrates by various printing technology (flexography, gravure, inkjet etc.) using conductive inks. Conventionally, copper and silver ink has been widely used by industries for various printable devices but those are not flexible in nature. Moreover, silver ink has electro migration problem as well as is difficult to print while copper ink does not have sustainable conductivity. Graphene is a very exotic material and termed by many as designer materials because of engineered and versatile properties such as high intrinsic carrier mobility (200000 cm2v-1s-1), high young's modulus (1.0 Tpa), high optical transmittance (~97%), stretchable (~20%). In order to exploit excellent electrical properties of graphene for flexible electronics applications, the development of conductive ink is essentially required. The challenges associated with the development of graphene ink is related to precise control of ink stability, dispersion, viscosity, surface tension, specific gravity, zeta potential etc. Therefore, during my research work, focus will be on developing graphene-based conductive ink by achieving milestones required to formulate ink for commercial production of flexible electronic devices/ systems.

The proposed project is to formulate & characterize graphene ink and its printing over various flexible substrates using different printing technology. Large area printing technology will be utilized to fabricate flexible electronic devices like RFID tags, Sensors (strain gauge, pressure etc.), electrodes, TFT, large area display etc. and characterized to measure the performance of ink. At the successful completion of project, the technology for production of graphene-based commercial inks will be available for technology transfer and commercial exploitation.

Institute Research Supervisor: Dr. C. C. Tripathi
Partner Company: Cymk Inks LLP
Industry Mentor: Mr. Dipak Kumar Maiti; Project Manager

..

Research Projects
Batch 5
May 2016

..

ASHOK BABADEV JAGTAP

Punjab Agricultural University
Ludhiana, Punjab - 141027
ashok01biotech@gmail.com

Research Area

Identification and Characterization of High Temperature Stress Responsive Genes in Maize (Zea mays L.)

Maize is one of the most important cereal crops of India with tremendous possibilities of its diversified utility. Climate change will lead in the future to an occurrence of heat waves with a higher frequency and duration than observed today, which has the potential to cause severe damage to temperate maize. Heat tolerance is not controlled by a single thermotolerant gene in cereals. Different components of tolerance determined by different sets of genes are critical for heat tolerance at different stages of the life cycle of the crops. Considering the burgeoning fields of epigenetics and transcriptomics, analysis of gene expression regulation is playing an important role in understanding gene-interactions that lead to traits of interest. In maize, on the basis of preliminary phenotyping an inbred line CML25 (tolerant) and LM11 (susceptible) to heat stress has been identified. There is lack of information about the nature and number of genes involved in heat stress tolerance and linked molecular markers to the heat tolerance component traits. The present investigation aims to:

(i) Investigate the transcriptomic response of inbred CM25 and LM11 to high temperature stress condition

(ii) Use SNPs captured from RNA sequencing data of CML25 & LM11 for identification of genes/SNPs contributing tolerance to heat stress (iii) Mapping of heat tolerance component traits in bi-parental mapping population and phenotypic of F2:F3 families. Co-location between candidate genes and QTL will give strong indication of the effects of these genes in field. These could be incorporated into inbred lines by marker-assisted selection to combat heat stress. This study will help gain insight into gene expression changes in response to heat stress in different tissues. Comparisons of expression profiles between the tolerant and susceptible lines will provide insights into molecular pathway for heat tolerance. The genomic regions associated with heat tolerance component traits will be known.

Institute Research Supervisor: Dr. (Mrs.) Yogesh Vikal
Partner Company: Maxim Crop Sciences Pvt. Ltd.
Industry Mentor: Dr. Santosh Taware; Global Director, R&D

..

BARNALI BANERJEE

National Institute of Technology, Rourkela
Rourkela, Odisha - 769008
banerjeebarnali0@gmail.com

Research Area

Fundamental Investigations of Cationic Surfactants with Bitumen Product Components

Surfactants (surface active agents) are amphiphilic in nature. Because of this they exhibit a dual affinity towards both hydrophilic and hydrophobic surfaces and responsible for most of the interfacial phenomena. In most of the cases, reduction of interfacial tension to a greater extent is beneficial for several applications such as solubilization, emulsion, enhanced oil recovery, environmental remediation, food processing, pharmaceuticals, nanoparticles synthesis etc. where rheological behaviors of solid/liquid and liquid/liquid systems in the presence of surfactants are of great importance. On the other hand, considering the higher-end application at oil industry, bitumen are viscous impure mixtures of hydrocarbons that occur naturally in asphalt, tar, mineral waxes, etc. or are obtained by fractional distillation of petroleum suitable for coating aggregates. The colloidal behavior of bitumen products is of high importance in determining its stability, the adhesion of the product with aggregates on the road and the performance of bitumen emulsions. Though, the interfacial behavior of bitumen and its emulsions has been explored in the past but often through the lens of bitumen developers rather than interfacial and surfactant scientists. Thus, the present scheme deals with the interfacial and rheological behavior of bituminous products i.e. asphaltenes and napthenic acids, which will attempt to characterize the interfacial behavior of bituminous components using the tools of colloid science and, in particular, the interfacial rheology of these systems. The surfactant systems in use for most bitumen emulsions are cationic in nature. A quarternary ammoinium salt system can be used as a model surfactant that can be extended to mixed surfactant system for enhanced interfacial behavior. A key element of the project will be to determine if interfacial rheology plays a role in the stability of bitumen systems as it does for well-known foam systems.

Institute Research Supervisor: Dr. Santanu Paria
Partner Company: Shell India Markets Pvt. Ltd.
Industry Mentor: Dr. Girish Rao; R & D Manager

..

EJAZ AHMAD

Indian Institute of Technology Delhi
Hauz Khas, New Delhi – 110016
ejaz.alchemy@gmail.com

Research Area

Catalytic Conversion of Biomass Derived Residual Lignin into Aromatics and Value Added Chemicals

Lignin constitutes approximately 15-25% weight of lignocellulosic biomass, albeit is underestimated potential feedstock for producing fuel and chemicals from renewable sources. In contrast, it contributes to 40% of fuel value of total biomass on earth. Furthermore, aromatic nature and presence of functional groups in lignin derived chemicals makes it a suitable precursor for production of a wide range of chemicals including drug design, medicinal chemistry, polymers, coating and many more.

In this project, it is proposed to develop an efficient and techno-economically feasible catalytic process for conversion biomass derived residual lignin (obtained through Kraft, Sulfite, Organosolv, Pyrolysis, Steam, Explosion, AFEX, Hot Water & other methods) into aromatics and value added chemicals via hydrogenation / de-polymerization reaction preferably below 300oC. In this regard, acid/base catalyzed process or a combination of both the catalysts will be studied in order to maximize aromatics product yield and selectivity. Development of such environment friendly and efficient process to convert readily available biomass derived residual lignin into value added aromatics chemicals is of great importance to meet energy and high value chemical demands. In addition, integration of lignin conversion process with existing biomass conversion technologies (industrial units based on fermentation, sugar mills, pulp & paper industries etc.) can lead to the development of complete biomass valorization based Bio-refinery.

Thus, this project can have a great societal and commercial impact. It will reduce our dependence on conventional fossil fuel sources and cause less CO_2 emission. This project has very high potential to yield several novel processes and novel catalysts in the form of patent, papers and thesis.

Institute Research Supervisor: Prof. K. K. Pant
Partner Company: Hindustan Petroleum Corporation Ltd.
Industry Mentor: Dr. Peddy V. C. Rao; General Manager, R&D

..

GUNDAPPA SAHA

Indian Institute of Technology Guwahati
Guwahati, Assam - 781039
s.gundappa@iitg.ernet.in

Research Area

Immunosuppression during Leishmania Infection and Immuno-Therapeutics against the Parasite

Leishmaniasis (kala azar) is one of the most neglected parasitic diseases in the world. Despite advances in chemotherapeutic inventions, high cost, toxicity, duration of treatment and development of drug resistance are the major drawbacks of chemotherapy. Therefore, there is a huge urge to develop novel strategy for long term treatment, which can be addressed by the development of novel immuno-therapeutics. Since Toll-like receptors (TLRs) are promising areas of research nowadays, these receptors can be chosen to be the basis of novel strategies (International Immunology, 17, 1, 1-14).

The activation of these receptors triggers a cascade of signaling processes leading to the activation of pro-inflammatory cytokines (Th1 response) via NFkß activation. Since the parasite interacts with the cell surface of the host, the surface proteins of the invading parasites can be studied to know the interaction of those proteins with the TLRs followed by its downstream effect.

To develop an efficient vaccine molecule against Leishmaniasis, it is needed to study the cause of immunosuppression during infection. Since the parasite plan a survival strategy inside the host cells, a protective immunity against infection is necessary to up regulate the Th1 response over Th2 response with the production of various pro-inflammatory cytokines from CD4+ cells. The discovery of TLR specific molecules (chemical or biological) will give a huge thrust to the scientific community associated with public health. These molecules can be delivered in various forms to increase its efficiency and will be tested in animal models prior to commercial development. It is also very crucial to understand different modalities of cell death to elucidate pathogenic mechanism and development of TLR specific immuno-therapeutics, which can pave the way in controlling and treating Leishmaniasis. The current project has potential for making significant advancement towards discovery of vaccine/ immuno-therapeutics against the pathogen.

Institute Research Supervisor: Dr. Vikash Kumar Dubey
Partner Company: Cadila Pharmaceuticals Ltd.
Industry Mentor: Dr. Bakulesh M. Khamar; Executive Director, R&D

..

GUNJAN GURUNATH NAIK

Department of Technology, Savitribai Phule Pune University
Pune, Maharashtra - 411007
gunjan.naik@unipune.ac.in

Research Area

Adaptive Kernel Framework for Active Mechanism for Effective Segmentation Strategies

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. For segmentation of brain tumor, Active methods use energy minimization principle and require good stopping criterion. In Active contour models, the use of energy minimization as a framework is considered whereas, Active shape model captures variation in shape. These variations will be compared with new data in order to segment the image. Initialization of contour selection of parameters of energy terms decides the convergence of segmentation. These values are hardcoded due to which the tuning of parameter has to be done every time with change in test image. The current snake uses parametric approach which fails, as there is no consideration of statistics of given image. So, a new methodology is needed which will use nonparametric approach along with adaptive kernel.

Adaptive Kernel Framework for Active Mechanisms for effective segmentation strategies:
1) Mathematical modeling of Adaptive kernel strategy
2) Platform independent implementation of the framework
3) Benchmarking of test data
4) Testing on data collected from collaborative institute

Institute Research Supervisor: Dr. Aditya Abhyankar
Partner Company: Persistent Systems Ltd.
Industry Mentor: Dr. Shubhangi Kelkar; Chief Learning Officer, Learning and Development

..

HAMENT THAKUR

Punjab Agricultural University
Ludhiana, Punjab - 141027
hemantt114@gmail.com

Research Area

Genetics and Molecular Mapping of Leaf Curl Virus Disease Resistance Gene(s) in Chilli Pepper (Capsicum annuum L.)

Chilli is an important vegetable and spice crop. India is the largest producer, consumer and exporter of chilies in the world. According to an estimate for 2014, in India, green chillies were cultivated on 0.008 million hectare with a total production of 0.068 million tones. India contributes about 40% of the total world production and is at the top in terms of international trade, exporting 17% of its total production (FAO 2013-14).

Chilli is susceptible to various pathogens including viruses, which cause heavy production losses. Natural occurrence of more than 45 viruses, including chilli leaf curl virus has been reported by different workers infecting chilli worldwide. Chilli leaf curl virus is the most destructive virus in terms of incidence and yield loss. In severe cases, 100 percent losses of marketable fruit have been reported.

Exploitation of host plant resistance is effective, economical, ecologically safe and durable approach of disease management, especially the ones caused by viruses. Some multiple virus-resistant varieties have been developed at Punjab Agricultural University, Ludhiana. These include Perennial, BG-1, Lorai, Punjab Lal and CH-27. Despite efforts by various research groups, it was not possible to establish genetic control of the resistance gene(s). To sustain production and enhance profitability of chilli cultivation, it is important to identify sources of resistance and utilize them in resistance breeding programme. Recent developments in molecular breeding, especially mapping of resistant genes followed by marker assisted selection (MAS) will facilitate the resistance breeding programme in chilli. This work finds little precedent and thus this research is expected to be important in future crop improvement programmes.

Institute Research Supervisor: Dr. Salesh Kumar Jindal
Partner Company: Verdenta Hybrid Seeds Pvt. Ltd.
Industry Mentor: Dr. Piyush Kumar Gupta; Managing Director

..

KAUSHAL RAMESHCHANDRA PARMAR

Indian Institute of Technology Delhi
Hauz Khas, New Delhi - 110016
kaushalrparmar@gmail.com

Research Area

Catalytic Decomposition of Methane in Fluidized Bed Reactor

Demand for hydrogen production is increasing significantly in various sectors. Refiners produce hydrogen by steam reforming of methane (SMR) and other hydrocarbons, which is highly energy intensive and also generates CO_2 gas. Natural gas decomposition using catalytic route is an environmentally attractive approach for producing CO_2 free hydrogen and thus reduce carbon footprints. The byproduct of this process is carbon nanotubes (CNT), which is a high value product.

Considering the above, Hydrogen Corpus Fund (HCF), a joint project on catalytic decomposition of methane to produce clean hydrogen and high value carbon tubes was carried out between HPCL, IIT Delhi and CHT during 2010-2013 and 2013-2016. The main feature of the project was to produce clean hydrogen along with high value CNTs. The project has identified the catalyst combination that yields very high catalytic activity and various process parameters are optimized. Methane conversion up to 93% has been observed in the laboratory scale study.

However, the major challenge in this process is separation of carbon from the spent catalyst and the demonstration of the catalyst performance at higher scale of operation. The major drawback was the faster deactivation of the catalyst due to the plugging of the (fixed bed) reactor with CNFs. A viable alternative process that can overcome the above drawback would be a fluidized bed process in which the carbon nanotubes are continuously removed. Thus, to take advantage of results obtained earlier and to provide a head start towards (fluidized bed) process optimization and separation of high-valued products, HPCL would be continuing the second phase research work with IIT Delhi.

Institute Research Supervisor: Prof. Kamal Kishore Pant
Partner Company: Hindustan Petroleum Corporation Ltd.
Industry Mentor: Dr. Peddy V. C. Rao; General Manager, R&D

..

MAHESH MAROTI DHAKATE

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
mmd889991@gmail.com

Research Area

Optimum Design and Scale-up of Air Jet Mills: Experimental and Computation

Grinding is an important size reduction process used to produce sub-micron range product particles in the chemical industries such as mining, pharmaceutical and minerals. Air Jet Mills are commonly used for grinding of solid material in the industry. Air Jet Mill has several advantages; however, it is still an energy intensive process as only 2% - 5% of the energy supplied is used to create desired products.

The energy efficiency of jet mill is controlled by the operating parameters and inside mill conditions of the jet mill. The inside mill conditions such as grinding chamber pressure and amount of holdup in the grinding chamber which will influence the breakage mechanism are controlled by the operating parameters such as feed rate, classifier frequency and grinding pressure. Understanding the breakage mechanism helps to achieve the optimum of breakage at all the locations of jet mill and specific energy requirement in each section thus improving the energy efficiency.

Project Aim (Objectives):
a) To undertake flow visualization for the measurement of 3D flow pattern using particle image velocimetry (PIV)
b) To understand the fluid and particle mechanics in Jet mills using Computational fluid dynamics (CFD) and Discrete Element Method (DEM)
c) Validation of CFD and DEM simulation with experimental observations
d) To develop the relation between flow pattern and the mechanism of particle breakage on the basis of this understanding analysis of all the location of Air Jet mill regarding the local efficiency of particle breakage
e) On the basis of step (a) - (d), to develop design procedure for Air Jet Mill
f) To study the performance of Air Jet Mill and validation of design procedure development of step (e)
g) To recommend optimum design of Air Jet Mill

Institute Research Supervisor: Prof. Devang Khakhar
Partner Company: United Phophorus Ltd.
Industry Mentor: Prof. Jyeshtharaj Joshi; Consultant

..

NEERAJ CHANDRAKANT HANUMANTE

IIT Bombay - Monash University Research Academy
Powai, Mumbai – 400076
neerajhanumante@iitb.ac.in

Research Area

Agent-Based Modelling For Sustainability Assessment (ABMS)

Sustainable development calls for harmonious interactions between its three dimensions--dimensions of sustainability--ecological, social, and economic. Achieving sustainable development is a complex process owing to its interdisciplinary nature, multiple feedbacks, and multiple spatial, and temporal scales involved. This makes sustainability assessment, i.e. assessment of state of the system from the point of view of sustainability for policy decisions, difficult.

Conventional tools used for sustainability assessment are often data-intensive, and do not address dynamics of the system. Hence, novel methods need to be developed for sustainability assessment. One such effort to develop the model, covering basic elements of human-nature system, for sustainability assessment was carried out by USEPA in 2006. However, because of its lumped handling of real world entities, its ability to address emergent phenomenon due to local interaction is limited. The proposed work will attempt to address this limitation and develop a model which can assist in making policy decisions from sustainability perspective. The proposed model will be based on modification of the aforementioned USEPA model.

Agent-based Modeling, and Simulation (ABMS), a relatively novel method in science and engineering, would be employed to modify the model. ABMS endows the modeled real world entities with the individuality, and complex behavior emerges from the local interactions. Thus, the proposed model would be able develop deeper understanding of the system by capturing diversity of the real system, and subsequently evaluate whether it is sustainable or not. Further, the proposed model may also incorporate geographic information.

Expected outcomes/deliverables:

a) An improved decision making tool for sustainability assessment-based on ABMS.
b) Assist in sustainability assessment of a proposed project during its site selection stage to identify possible effects on the region as a whole.
c) Identification of programs under corporate social responsibility to induce maximum positive impact on the local community.

Institute Research Supervisor: Prof. Yogendra Shastri
Partner Company: Tata Chemicals Ltd.
Industry Mentor: Ms. Alka Talwar; Chief CSR and Sustainability Office

..

RAVI BHANDARI

Indian Institute of Technology Bombay
Powai, Mumbai – 400076
ravib@cse.iitb.ac.in

Research Area

Improving Road Safety Using Smart Sensing

Globally over 1.3 million people were killed in road related accidents in 2014. India alone accounts for over 10% of these deaths. Over-speeding and dangerous driving have been identified as the major causes for these deaths.

It is observed in cities like Mumbai and Bengaluru, that bus drivers do not always entirely stop the bus at prescribed stops. They either stop it at a distance away from the bus stop, or give it a rolling stop. This is a hindrance for senior-citizens in boarding the bus. Also, in Bengaluru, many instances have been reported where drivers stop the bus in the middle lane, which puts the commuters under threat of being run-over by speeding vehicles once they try to board or deboard. Other than this, over-speeding and rash driving are common observations in many cities.

Many of the above mentioned issues can be detected automatically. The research proposes a Blackbox which will contain GPS, Camera and Accelerometer. Combining these different sensors will require techniques from machine learning and computer vision, which are technically challenging and research worthy for real road scenarios.

Institute Research Supervisor: Dr. Bhaskaran Raman
Partner Company: Microsoft Research
Industry Mentor: Dr. Venkat Padmanabhan; Principal Researcher

..

SNEHKUMAR NARENDRAKUMAR SHAHANI

Department of Technology, Savitribai Phule Pune University
Pune, Maharashtra - 411007
snehshahani@gmail.com

Research Area

Techniques of Privacy Preserving Data Aggregation in an Untrusted Distributed Environment

In smart applications like hospitals and energy systems a lot of data is owned by distributed entities like hospitals, smart meters and sensors. Data originating from these distributed entities contain personally identifiable information (PII) which should not be shared with any central aggregator during data collection or analysis. So there is a need to develop techniques to preserve privacy while analyzing the data. Domains of application for aforementioned techniques are in smart cities, healthcare domain, website analytics, etc. In smart cities, privacy preserving aggregation can be used in applications like smart meter data aggregation and participatory sensing. In healthcare applications like anonymous health surveys and anonymous electronic health record (EHR) analysis can use these techniques. In website analytics these techniques can be used for anonymous web log aggregation. Solution techniques are to be evaluated based on ability to work with untrusted aggregator, fault tolerance, and ability to work without any facilitator. Available solutions in the literature focus only upon one of these parameters.

Differential Data Privacy (DP) is a recent but well-established definition for providing mathematical guarantees for privacy of data. Proposed research work is aimed at designing data aggregation techniques to provide utility and DP assurance under the above mentioned constraints. This will be achieved by using a mix of cryptographic techniques to ensure that the aggregator only learns about the aggregate statistics and not about personally identifiable information under above constraints. The core of research is to provide privacy to the endpoint (entity which owns the data like hospital, sensor, smart meter, etc.) before it is shared with any other entity.

Institute Research Supervisor: Dr. Jibi Abraham
Partner Company: Persistent Systems Ltd.
Industry Mentor: Dr. R. Venkateswaran; Sr. Vice President

..

VAISHAKHI SHARADKUMAR TRIVEDI

Tata Memorial Hospital
Mumbai, Maharashtra - 400012
trivedi.vaishakhi@gmail.com

Research Area

Characterization of Therapeutically Relevant Alterations in Human Cancer

Cases of thyroid cancer, a subtype of head & neck cancer have been steadily increasing, up by 30% over the past decade, making it the second most common cancer type in India. Thyroid cancer is histologically and clinically a diverse cancer type, posing several challenges to clinicians. A proportion of patients show good clinical outcome following conventional radio-iodine (RAI) treatment, while many others show innate or acquired resistance leading to the most aggressive malignancy. In the past decade promising results of precision medicine have been evident worldwide, with majority of the work focused on chronic myeloid leukemia, lung cancer and breast cancer.

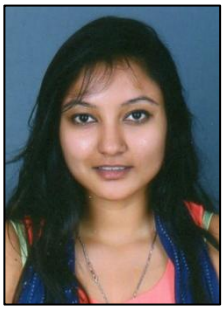
Our study aims to systematically profile genomic alterations in ~1000 RAI treatment non-responder Indian thyroid cancer patients for therapeutically relevant ~200 cancer-related genes. This large scale profiling using next-generation sequencing (NGS) and sensitive mass-spectrometry-based genotyping techniques will be helpful to discover therapeutically relevant and ethnicity specific alterations. Probable outcome of this study will provide first landscape of therapeutically relevant and ethnicity specific genetic alterations in Indian RAI refractory thyroid cancer patients. This profile can be further utilised to design specific molecular diagnostic assays for routine diagnosis and precision medicine in clinics and for testing of novel pharmaceutical compounds in laboratories.

Institute Research Supervisor: Dr. Kumar Prabhash
Partner Company: Natco Pharmaceutical Ltd.
Industry Mentor: Dr. G. Venkata Ramana; Coordinator-Drug Development

..

Research Projects
Batch 6
October 2016

..



ANTARA DASGUPTA

IIT Bombay - Monash University Research Academy
Powai, Mumbai – 400076
antara.dasgupta@monash.edu

Research Area

Improved Flood Forecasting Using Data Assimilation

The present study is primarily focused on improving flood forecasting accuracy utilising alternative data sources such as remote sensing and crowd sourced data within a comprehensive data assimilation framework addressing uncertainties. If the number of lives lost due to floods in developed and developing countries are compared, a wide gap becomes apparent which is primarily a function of the disaster preparedness and the climatic resilience of the riparian communities. In the Indian scenario the population density in low lying flood prone areas is alarmingly high and robust flood early warning systems do not exist due to the dearth of appropriate hydrometric data for a hydrodynamic model setup.

The expected outcome of this study is proving the utility of the aforementioned sources of distributed flood observations such that their use can be operationalized for ungauged catchments. The study will be tested for catchments with varied data availability and hydrological properties to assess the performance of the methodology for different environments.

1. Objective: To reduce the uncertainty in Water Level extraction from SAR and optical data.
   Question: How much can the accuracy of Water Level extraction from SAR imagery be improved by supplementing it with Optical data?
2. Objective: To efficiently collect, process, validate and extract useful information from crowd-sourced (CS) data.
   Question: How can the uncertainty associated with crowd-sourced (CS) data be quantified?
3. Objective: To retain the effects of assimilation for longer lead times using evolutionary particle filter techniques.
   Question: How does the inclusion of CS data along with RS data for assimilation impact the model's predictive ability?
4. Objective: To assess model performance for assimilation using RS data alone, CS data alone and a combination of both.
   Question: How can the decay of assimilation effects on the model trajectory be slowed for longer lead times?

Institute Research Supervisor: Dr. RAAJ Ramsankaran
Partner Company: Skymet Weather Services Pvt. Ltd.
Industry Mentor: Dr. Makarand Kulkarni

..

NITYA SHARMA

Amity Institute of Immunology and Virology
Amity University
Noida, Uttar Pradesh - 201313
nitya.sharma2289@gmail.com

Research Area

Development of Immunodiagnostic Assays of Meningococcal Antigens for Vaccine Development

Among various important bacterial diseases, meningococcal diseases caused by Neisseria meningitidis serogroups lead to significant morbidity and mortality all over the globe, especially in sub-Saharan Africa Meningitis belt. The information on meningococcal disease epidemiology in many Asian countries including India is scanty hence the disease burden is underestimated. Currently available multivalent vaccines against meningococcal disease are mostly conjugate vaccines, which are highly costly and cannot be afforded by people in developing countries.

Hilleman Laboratories is currently working on development of a low-cost multivalent meningococcal conjugate vaccine, which is derived from chemical coupling of antigenic bacterial polysaccharides (PS) to T-cell dependent carrier proteins, which are effective in all age groups.

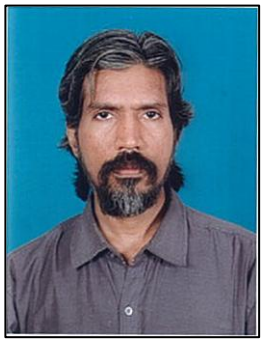
The development of meningococcal conjugate vaccine includes bacterial PS production by fermentation, its downstream purification, conjugation of PS to a suitable carrier protein to produce a monovalent conjugate bulk and combining conjugate bulks of various serogroups to develop a multivalent vaccine for pre-clinical and clinical evaluation. Immunoassays are required to identify and estimate the amount of polysaccharide present in the sample during this whole development e.g. during fermentation, purification, conjugation and in the preparation of the stable multivalent vaccine formulation.

Due to the lack of any commercially available test, developing these assays such as competitive inhibition ELISA etc. and their qualification is quite an important part of the whole meningococcal vaccine development. The assays will also be required for release of vaccine for sale after vaccine licensure.

The current PhD research project will aim to develop and qualify the required ELISAs for serogroup A, C and X of N. meningitides, which not only will support the ongoing vaccine development but also will become base for the indigenous diagnostic test for meningococcal infections in clinical settings and help in evaluating the actual burden of the meningococcal disease in India.

Institute Research Supervisor: Dr. M. M. Premlatha
Partner Company: MSD Wellcome Trust Hilleman Laboratories Pvt. Ltd.
Industry Mentor: Dr. Manoj Kumar Chhikara; Director, R&D

..



RAJ DORAI ARJUNAN

Indian Institute of Technology Madras
Chennai, Tamil Nadu - 600036
raj_arjunan@yahoo.com

Research Area

Design and Development of Affordable Haptic Interface for Virtual Reality/Augmented Reality Based Medical

Experiential learning is must for surgical training. Touch and Feel of tissue is critical for surgical experience. Primary focus of this research is to design and develop an affordable virtual reality (VR) surgical simulator with haptic feedback.

This VR simulator would be developed for the Department of Neurosurgery, AIIMS, Delhi in collaboration with Merkel Haptics Systems, a leading haptic based technology company based in Chennai. The simulator would simulate endonasal endoscopic surgical approach for the removal of brain tumor. Dr. Ashish Suri, a leading neurosurgeon from AIIMS; Dr. Manivannan an expert in Haptics from IITM and Dr. Prem Kalra an expert in computer graphics from IITD are the guides for this research project.

Endonasal endoscopic approach is a minimally invasive technique to remove brain tumors and lesions. The surgeon has to perform the surgery through the nasal cavity and sinuses with great dexterity. An endoscope transmits images on to a monitor and the surgeon has to look at the monitor and perform procedures like dissection, suction, drilling etc. Anatomical landmarks, depth perception and hand-eye coordination are few of the various skills that the surgeon has to master before operating on a patient. A VR simulator with realistic graphics and haptics feedback would be an ideal supplement for neurosurgery education and skills training lab at AIIMS.

The proposed simulator is aimed at minimizing the steep learning in the endonasal approach and furthermore train the surgeons to handle surgical complications. Current training methods involve patients, animals, and cadavers. The simulator can enhance our learning in the wake of increased healthcare need, patient safety and animal ethics. Once validated, a curriculum can be developed and adopted at different neurosurgery training facilities. This would enable the transfer of skills from simulation labs to Operation Theater in a cost effective manner.

Institute Research Supervisor: Dr. M. Manivannan
Partner Company: Merkel Haptic Systems
Industry Mentor: Mr. PBC Paul; CEO

..

RESHMA AYSWARIA

Bharathiar University,
Coimbatore, Tamil Nadu - 641046
reshmapkd1991@gmail.com

Research Area

Optimization of Endophytic Actinomycetes Bioactive Extracts for Textile Industry

Textile fibers are the main raw material of the textile industry. According to their origin these fibers are divided in to natural and chemical ones (Plekhanov et al., 2012). The colonization of microorganisms on textile materials leads to the biodegradation (Heywood, 2003; Bellini, 2001).

Bacterial degradation is more intensive than fungal attack. The damaging bacterium belongs to the genera Cytophaga, Micrococcus, Bacillus, Cellulobacillus, Pseudomonas and Sarcina. (Lewis et al., 1980). To protect the textile from degradation antimicrobial agents, Quaternary ammonium, Triclosan, Cyclodextrin are being used.

Recently, an awareness of general sanitation, contact disease transmission, and personal protection has led to the development of antibacterial fibers to protect wearers as well as maintain quality and durability of the textiles (Chun and Gamble 2007). The continuous exposure of commonly used antimicrobial agents has caused change in the population of normal microbial flora of epithelial cells and also been a cause for environmental pollution (Sikkema et al., 1995).

To combat the situation, nano-particle encapsulation and plasma sputtering are two main techniques applied in textile industry, which are very expensive (Shahidi et al., 2010) making it a huge challenge for the manufactures to produce bioactive fiber at a low cost. Hence, the present study focuses on a biological approach, identification of antimicrobial substances from endophytic actinomycets isolated from medicinal plants and minimizing the harmful effect on human and environment on its application.

Institute Research Supervisor: Dr. V. Brindha Priyadarisini
Partner Company: Garment Wash Effectzs
Industry Mentor: Mr. G. Thiyagaraj

..

RUTESH VALLABHBHAI SAVALIA

Institute of Chemical Technology
Matunga, Mumbai-400019
ruteshvs@gmail.com

Research Area

Development and Application of Nanomaterial-based Sensors for Sensitive Determination of Drugs in Biological Fluids

Nanomaterial-based sensors for the detection of drugs at the point-of-care provide an enhanced functionality that encompasses a wide range of applications in clinical diagnostics and biological research. The use of carbon-based nanomaterials (e.g. carbon nanotubes, fullerenes and graphene) and noble metal nanoparticles for electroanalytical applications, most likely, relates to their ability to promote electron transfer in electrochemical reactions.

The proposed research is based on the development of simple and pragmatic electrochemical bio-sensing strategy for ultrasensitive and specific detection of drugs by sensing process in single analysis system. The performance of the developed sensor can be affected by the choice of nanomaterials, transducers and binders used for modification. The optimization of the parameters and quantification of the detection limits for each modified sensors would be investigated employing various electrochemical techniques. The electroactive surface area of the sensor will be determined. The selectivity of the sensor in the presence of other interfering metabolites will be studied. The pharmaceutical formulations of the drug will be analyzed to demonstrate the practical application. Furthermore, to test the reliability of the proposed methodology, the developed sensor will be applied to the determination of drugs in real matrix samples. The proposed electrochemical bio-sensing approach will exhibit high sensitivity and selectivity for target drugs with a dynamic response range.

This proposed strategy will present a simple, realistic platform towards ultrasensitive drug detection and would become a versatile and powerful tool for point-of-care regulation of the drugs by Paragon Industries. Thus, the purpose of this work is to develop sensors utilizing electrochemical nanotechnology for determination of drugs by using a simple, inexpensive and reliable technique. The developed sensors would then be incorporated and employed by Paragon Industries for the routine analysis of the drugs in quality control laboratories and for therapeutic drug monitoring.

Institute Research Supervisor: Dr. Sanghamitra Chatterjee
Partner Company: Paragon Industries
Industry Mentor: Dr. Kishor P. Patolia