



Tata Centre
for Technology
and Design
IIT Bombay

TURNING POINT



Tata Centre Newsletter, November 2019

A new head for Tata Centre



Prof Santosh Noronha TCTD's new Professor-in-charge

Prof Santosh Noronha has taken charge as the new Professor-in-charge at Tata Centre for Technology and Design (TCTD), IIT Bombay. He has been in the Dept of Chemical Engineering of the Institute, since 2001. He has also been an active member of the Executive Committee at TCTD. A biochemical engineer by training, he has evolved multidisciplinary interests. His focus on indigenous instrumentation has extended into the creation of low cost virtual laboratory rigs as well as healthcare devices. He coordinates development and deployment of Virtual Labs, an M-HRD ICT project (vlabs.iitb.ac.in). He is also the coordinator of the Healthcare Research Consortium at IIT Bombay, which interfaces with major hospitals and research labs in the Mumbai area, and is now actively engaged in translating several collaborative research efforts into technologies.

At TCTD, his project on Cervical cancer screening turned the innovation Gynaecam into a story of sorts by securing a large CSR grant to make multiple copies for hospitals across India. His other project Development of a telepathology framework also in the Healthcare domain expects external collaborations in 2020.

While extending a warm welcome to Prof Noronha, TCTD hopes to continue taking the mandate of the Centre ahead with as much sincerity.

Gayathri Thakoor,
General Manager, Programs

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Very cool news

Tata Centre is happy to update that the patent application of its funded project Dark colored cool roof coatings has been granted and recorded in the Register of Patents, in mid-October. The patent certificate has been handed over to the Institute. This project has been helmed by Prof. Anand S Khanna along with Dr Narayanan Rajagopalan and Dr Vikram Singh, from the Dept of Metallurgical Engineering & Materials Science. For the Centre, this has been the very first innovation that has been granted patent status and will now move closer to the communities, in the end to end innovation cycle.

Powering electronics through SequelApp

EDUCATION

In contrast with the traditional model, this process of active learning involves the students in app-based activities in electronics and power electronics.

One of the primary goals of a teacher is to actively engage students to participate in the learning process. Prof. M B Patil and his team, from the Dept of Electrical Engineering, have done exactly this by developing a mobile application called SequelApp to promote active learning in the areas of electronics and power electronics. The app is based on the circuit simulator SEQUEL developed at IIT Bombay and is meant for engineering and BSc/MSc students.

The SequelApp allows students to simulate the concerned circuit and visualize the results. Students can change circuit parameters, see how the behavior of the circuit changes, and also compare the simulation results with theoretically expected results. The ability to validate theoretical results using the app has made the learning process exciting and interesting for the students and the simulation results have helped in retaining the subject knowledge more effectively.

The novelty of the app is that it will make several details available to the students, such as graphs and numerical values, which are crucial for understanding the circuit.

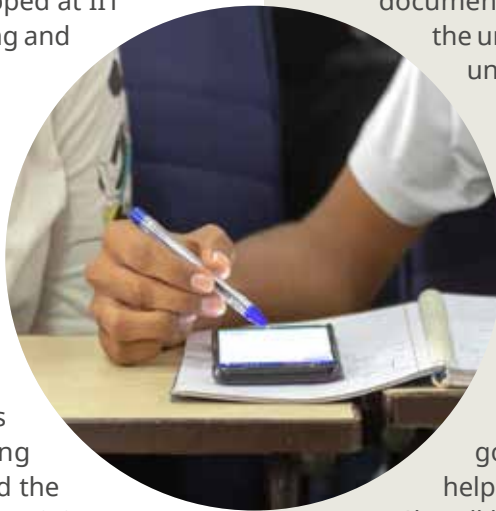
Furthermore, for each SequelApp project, related documentation is made available on the internet for teachers to use directly. This makes SequelApp an excellent companion for teaching. There are a few other apps based on circuit simulation. However, their emphasis does not seem to be academic learning, and they may not provide documentation to teachers or students about the underlying concepts, making SequelApp uniquely placed for classroom learning.

The SequelApp platform has been used in IIT Bombay as well as in some other institutes like SPIT and K. J. Somaiya College of Engineering, in Mumbai. Several workshops have been conducted at engineering colleges to offer the teachers the benefits of the app. A training session was also broadcast recently to all government colleges in Gujarat, with the help of Vishwakarma Govt. College of Engg, Chandkheda, and by actively using the facilities at the Bhaskaracharya Institute for Space Applications and Geo-informatics, Gandhinagar.

The project team is planning to approach the Board of Studies at the University of Mumbai to encourage the use of the app in engineering colleges in the city. Another possibility that is being explored is promoting this app at coaching institutes to help students fare better in the GATE exam.

Prof. Patil expects that a comprehensive set of projects would be available with SequelApp for teaching power electronics as well by May 2020. The team is in the process of preparing promotional material which will include results of surveys conducted, feedback from students and teachers, in order to reach a wider range of target users.

Narravula Jahnavi,
Tata Fellow 2018-2020



Faculty and students at K.J. Somaiya College in a SequelApp session

Kulhads for plastic bottles

WASTE MANAGEMENT

During the recently held IIT Bombay Marathon, Team Zero Waste replaced the plastic bottles of water with *kulhads*, making a delightful difference



Members of Team Zero Waste celebrating a successful marathon in a 'plastic free manner'



Volunteers filling *kulhads* with water at a hydration point

Could a 21 km half marathon have left more than just footprints in the sand?

In 2018, 4,000 participants in IIT Bombay Half Marathon used around 13,000 PET bottles to quench thirst at hydration stations and instead generated 156 kg of single-use plastic water bottles as waste. Many of these littered the pristine campus and left behind a sizeable carbon and water footprint. This year, Team Zero Waste (TZW) at IIT Bombay set out to help this event make a difference to the environment.

So while Fitizen India organized the marathon by charting route maps for the runners, TZW ensured that the PET water bottles were replaced with earthen cups of water. This group of students from across IIT Bombay and supported by Tata Centre, looked for alternatives to the plastic bottles. Care was taken to find local vendors to reduce the carbon footprint of transportation and delivery. Paper cups, a seemingly obvious alternative, was found even more difficult to recycle due to the waterproof plastic coating on the inside. Having zeroed in on *kulhads* (glasses made of baked clay) as the best available option considering the overall impact and cost, a deal was struck with Asians Tiger, a group of local artisans.

A team of 100 volunteers that included students, faculty members, and campus residents participated in transportation, cleaning, filling and post-use segregation of the *kulhads*. Several hydration points were set up along the running route, where volunteers kept filling the *kulhads* for the runners. Some runners also poured the water directly into their mouths instead of sipping, thus helping reuse multiple times.



Making a change is never without challenges. *Kulhads* had to be cleaned by student volunteers before use. Empty *kulhads* weighed more than what plastic bottles would have at the time of disposal. To avoid sending the used *kulhads* to a landfill, these were collected and sent to Prof. Bakul Rao's lab, at CTARA, to be used in a wastewater treatment project.

The response to the first half-marathon in India that was free of plastic bottles has been overwhelmingly positive. Dr. Ankita Asthana, the marketing head of Fitizen, said: "This marathon would be an inspiration to conduct all others in a plastic-free manner." Participants also praised the uniqueness of the initiative by not limiting the message to slogans and banners, and several took their used *kulhads* home as souvenirs. The Tata Trusts' newsletter also expressed interest in speaking about the effort by TZW in its recent edition.

Of course, there was the downside too. Although plastic water bottles were replaced with *kulhads* at the marathon, energy drinks were still provided by the manufacturer in PET bottles. This initiative will hopefully inspire groups aiming to reduce plastic consumption and waste to join forces for lasting changes.

Participant reviews can be seen at TZW's Facebook page: <https://www.facebook.com/tzw.iitb>

Team Zero Waste



The latest batch of Tata Fellows

The new batch of Tata Fellows went through a quick round of introductions and had their journey sketched out in a recent orientation session.

After a series of technical interviews and written tests, 15 students were awarded the prestigious Tata Fellowships for the academic year 2019-2021. 11 Master's students and 4 PhD students were selected from across various departments, from a pool of about 100 applicants. In late September, they were evaluated for their technical skills as well as their interests to contribute to developing technologies that served as social innovations for communities.



The evaluation process for the selection of Tata Fellows



Prof Sanjay Mahajani addressing the new batch of Tata Fellows

An orientation session was conducted for the students in early October where the Centre's different activities were outlined and the faculty members and project staff were introduced. Prof. Sanjay Mahajani, the then Professor-in-charge along with the incoming Prof. Santosh Noronha, Prof. Shishir Jha and Prof. Arti Kalro gave the Tata Fellows an overview of their journey for the next year and a half, and discussed about their expectations from the Fellows. They were also updated that they would embark on the TCTD Yatra, their first immersive trip together as Tata Fellows, in November-December.



Discovering fabrication in the Product Realisation Lab

The orientation session involved the first visit to the Product Realisation Lab and the Centre's administrative office. We congratulate and welcome the new batch of Tata Fellows and hope they take the Centre to new heights with their contributions.

Vrushali Gardare,
Tata Fellow 2018-20



Electrospray-based air purifiers for indoors

WASTE MANAGEMENT

This project aims to develop a mitigation technology to reduce indoor air pollution, thereby contributing to the improvement of public health.



Size and concentration of air particles being analyzed



Electrospray based air cleaning system

With urbanization and economic growth, air pollution problems have increased considerably. Broadly speaking, air pollution exposure occurs both in indoor and outdoor environment. The awareness regarding the impact of outdoor air pollution levels on climate and health has given rise to regulatory measures to control emissions from outdoor sources. However, no regulatory control exists on indoor pollution and its effects are being recognized only now. The exchange of pollutants between indoor and outdoor air has significant repercussions on the indoor air quality also. Not just the exchange of air, but the smoke from chulhas and poor ventilation systems have also contributed to the depreciating indoor air quality.



The concept of home-based water purifiers was not common 50 years ago, but people have now begun to realize the importance of pure drinking water and the ill effects of drinking untreated water. Similarly, in the years to come, air purifiers will hopefully become a common sight in households.

Prof. Rochish Thaokar, Prof. Y.S. Mayya and Prof. Chandra Venkatraman along with their research scholars, from the Dept of Chemical Engineering, are working on electro-spray-based air purifiers. In the current market of air purifiers, filter-based systems which are inefficient and require regular replacement of the filters are used. During the process of replacement, there is a high risk that one

might disperse the captured dust particles. An alternative solution to this problem could be ionizing technology which has entered the arena of the air purifier market. Although attractive because of its filter-less nature, this technology tends to form ozone during the corona discharge, which is harmful. Hence there is a need to go for such a filter-less corona-less technology. Electro-spray based systems have the potential to stand up to this challenge.

The solvent requirement in the electro-spray technology is of a few microlitres per hour, which makes the usage and replacement of solvent more manageable compared to the filter-based system. The technology to capture the particles through dispersing charged solvent droplets requires the knowledge of particle and aerosol mechanics. The faculty members are addressing the issue of making the right electro-spray, change of solvent to a water-based system, use of finer nozzles, and use of appropriate surfactants. A scale-up will also be a significant challenge in case of its applications to HVAC (Heating Ventilating and Air Conditioning) systems. The research team feels that once the system is functional in a realistic room environment, it can be optimized for power supply, which will bring the cost down significantly.

Sneha Iyer,
PhD Tata Fellow 2018-21



Wishes for the outgoing PIC

Tata Centre wishes Prof Sanjay Mahajani the very best.



Prof Sanjay Mahajani

Prof Sanjay Mahajani handed over the baton of Professor-in-charge at Tata Centre, IIT Bombay, to Prof Santosh Noronha, also from the Dept of Chemical Engineering, in mid-October. After a long and eventful five years' span of being at the helm, Prof Mahajani has had much to contribute to the Centre.

Right from the initiation of a unique and vibrant entity such as Tata Centre for Technology and Design (TCTD), in IIT Bombay, to the progress of it in terms of the variety of research projects, the learning of the Tata Fellows and the gradual growth of the ancillary activities across domains, Prof Mahajani has been a pillar of support all through.

Being one among the popular faculty members in the Institute, the Tata Fellows over the past five years sought

to be mentored by him through their academic learning, and learned to relate to TCTD's mandate even better. His attention to details at the Tata Fellows' orientations in local and international ground, the feedback that he sought from the students after the Yatra and his intent in getting as many students to understand the market connect through the I-NCUBATE program have been noteworthy.

Some of Prof Mahajani's research projects with TCTD – Feasibility study of jaggery making and related products, Process design for reclamation of waste sand from small foundries and Gasifier based cookstoves to manage garden waste – have been the successful ones followed by many researchers and communities.

The team at TCTD has looked up to him for timely guidance and direction, through many moments of the Centre's growth in the past five years. Prof Mahajani's thoughts on preserving the identity of the core staff at TCTD, making it not as corporate but distinctly different from the rest of IIT Bombay, have brought the team this far.

While Prof Mahajani can be seen sitting just a department away in IIT Bombay and is also a PI to a few TCTD projects, his role as the man at the helm will be missed for everything that he has worked at putting together. TCTD wishes him well in the times to come.

Gayathri Thakoor,
General Manager, Programs



News & Updates at Tata Centre

TCTD projects at Social Alpha Energy Challenge 2.0:

A few project teams supported by Tata Centre, have made it to the finals of the Social Alpha Energy Challenge 2.0. These projects include Gasifier based cookstoves to manage garden waste, Conversion of plastic into fuel oil through pyrolysis, and Low cost and rugged solar PV microinverters, among others. These project teams are now expected to pitch their products to a final jury in New Delhi. This initiative from Social Alpha has been undertaken to identify promising innovations in sustainable energy and incubate them in their journey from the lab to the market.



Steering Committee meeting held:

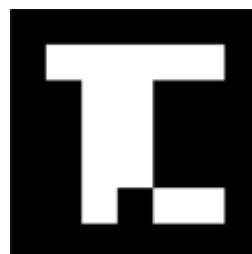
TCTD's Steering Committee and the Executive Committee met in end-September at IIT Bombay. While very few members of the Steering Committee along with Mr Manoj Kumar of the Tata Trusts were available, the Director of the Institute opined that the meeting be noted as another in the series for the Committee. After a presentation of TCTD's progress through the years was made, there was active discussion on how to pave the way ahead in the near future.

Welcoming new team members:

TCTD's project team extends a warm welcome to a host of new staff members this quarter – Pooja Bhawar – media, Vasundhara Vedula, Gopal Mahajan – outreach, Keval Mamania, Aakash Kamble, Dr Juned Shaikh – Lab.

New brand identity for TCTD

The media team at TCTD has been working at a new brand identity over the past few months. The new logo has seen a lot of appreciation from faculty members, Tata Fellows, researchers and staff.



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Management students to work on live TCTD projects:

The third batch of management students from Somaiya Institute of Management Studies and Research (SIMSR) will be associated with TCTD as interns working on live TCTD projects. These students come in with a few years of market experience, have the required technical background and are most interested in helping the Centre with need assessment, stakeholders' analysis, customer identification and business model formulations. For most TCTD projects, this six-month engagement with the SIMSR post-graduate students is a win-win experience.

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