

Thariq Shanavas

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Indian Institute of Technology - Bombay

Research Interests: Experimental high energy physics, Photonics, Machine learning, Optical communication networks

Education

2015 – Present Undergraduate, [Indian Institute of Technology – Bombay](#), India

Major in Electrical Engineering, Minor in Physics

CPI – 9.03/10.0

Publications

Farsinezhad, S., **Shanavas, T.**, Mahdi, N., Askar, A. M., Kar, P., Sharma, H., Shankar, K. (2018).
Nanotechnology, *Core–shell titanium dioxide–titanium nitride nanotube arrays with near-infrared plasmon resonances*. <http://doi.org/10.1088/1361-6528/aaad58>

Scholarships and Fellowships

- **Internship Grant – Tyndall National Institute** *May 2018 – July 2018*
Financial aid of €3200 (~\$3700) and travel allowance to pursue research at Tyndall National Institute, University College Cork, Ireland
- **J-PARC Asia Summer Student Program** *Nov 2017 – Dec 2017*
Financial support of ¥181,000 (~\$1700) to pursue research at KEK, Japan
- **University of Alberta Research Experience Program** *May 2017 – July 2017*
Financial support of 6000 CAD (~\$4500) to pursue research at University of Alberta, Canada.
- **Kishore Vygyanik Protsahan Yojana (KVPY)** *2015 – present*
Financial award by the Department of Science and Technology, India, for promotion of basic Sciences among high school students to ~250 students in the country.
- **National Talent Search Examination (NTSE)** *2013 – present*
Awarded by the National Council for Educational Research and Training to ~1000 students in the country as support for secondary education.

Key Research Experience

- **Tyndall National Institute, Cork, Ireland** *May 2017 – July 2017*
Demonstration of 20Gbps communication over 10G-class optics enabled by machine learning
Advisors: Dr Cleitus Antony, Dr Paul Townsend
 - Explored the use of neural networks for equalisation at the receiver end and pre-compensation at the transmitter end to compensate nonlinear effects of the channel
 - Integrated recurrent, convolutional and decision-feedback neural networks to a simulation testbed and real time experimental setup.
 - Demonstrated 20Gbps data transfer over 10G-class optics using a convolutional neural network at the receiver, within the acceptable error rate for Forward Error Correction.
 - Explored the use of Genetic algorithms and Particle swarm optimisation to train a recurrent neural network for precompensation.

- KEK, High Energy Accelerator Research Organisation, Japan** Nov 2017 – Dec 2017
 FPGA based controller for self-triggered hybrid pixel detector
Advisors: Dr Manobu Tanaka, Dr Tetsuichi Kishishita
 - Digitally controlled the timing and signal flow in an analog front end ASIC chip for pixel detectors using FPGA.
 - Characterised the field response of the ASIC chip, created the FPGA framework for future development.
 - Worked on noise optimisation of the signal conditioning circuit in the ASIC chip.
 - Characterised the noise spectrum in a proposed new amplifier design for future iterations of the chip through simulation with the ASIC CAD tool. [Report](#)
- University of Alberta, Canada** May 2017 – July 2017
 Modelling of Photonic nanotubes exhibiting near-infrared plasmon resonance
Advisor: Dr Karthik Shankar
 - Analytically modelled and numerically simulated the optical properties of titanium dioxide nanotubes coated with Titanium Nitride.
 - Analytical predictions made by modifying Gans theory for a composite nanostructure led to accurate predictions of the plasmon excitation, results agreed with experimental result.
 - Set up and documented a finite element modelling testbed on the University of Alberta Supercomputing cluster using Comsol to support future work on plasmon resonance.

Other research experience

- Particle discrimination using Machine learning and Matched filtering** Mar 2018
Course Project, EE338: Digital Signal Processing
Dr. V M Gadre, Department of Electrical Engineering, IIT Bombay
 - Used logistic regression and matched filtering to discriminate pions and electrons in the signal from a scintillation detector.
 - Analytically modelled the detector output to compare against incoming signal for matched filtering, used the same model to generate training dataset for the ML classifier.
 - Achieved over 98 percent accuracy for both techniques under reasonable noise conditions. [Poster](#)
- Portable calibrated pulse generator** Jan 2017 – Apr 2017
Dr. Pradeep Sarin, Department of Physics, IIT Bombay
 - Designed a high precision GHz level pulse generator for the purpose of calibrating the electronic readout of Silicon and Diamond particle detectors.
 - Implemented a low noise transconductance amplifier circuit followed by an attenuator block to convert a voltage pulse into a micro ampere current pulse.
- Design of multicycle RISC Processor – Course Project, EE309: Microprocessors** Oct 2017
Dr. Virendra Singh, Department of Electrical Engineering, IIT Bombay
 - Designed and simulated a multicycle RISC processor optimised for performance.
 - Implemented a Von Neumann architecture, used a shared data and instruction memory.
 - Implemented and verified the design on an FPGA. [Report](#)
- Image forgery Detection – Course Project, EE325: Probability and Random Processes** Nov 2017
Dr. Gaurav Kasbekar, Department of Electrical Engineering, IIT Bombay
 - Used statistical analysis to detect copy-move forgery in digital images.
 - Images segmented to subcells, statistical moments extracted in the Fourier domain. [Report](#). [Presentation](#)

- Matsya, Autonomous Underwater Vehicle | AUV-IITB** Oct 2015-Oct 2016
International RoboSub, AUVSI & US Office of Naval Research
 - Part of a 30 member team aimed at developing unmanned AUVs. The team came second in the world at the international Robosub competition 2016, San Diego, California.
 - Developed the DC-DC boost converter, motor drivers, battery hot-swapping capability and water seepage detection modules.
- Simulation of Spiral RF inductors** Apr 2016 - June 2016
Dr. Dipankar Saha, Department of Electrical Engineering, IIT Bombay
 - Studied and simulated Spiral RF inductors in the micron scale using finite element techniques.
 - Extracted the S parameters as a function of the frequency of operation.
- Coverage Control of multi-agent robotic systems** Nov 2016 – Feb 2017
Dr. Sukumar Srikant, Systems and Control Engineering, IIT Bombay
 - Proposed a decentralised controller for autonomous mobile robots, drawing inspiration from patterns observed in the seed distribution of a sunflower.
 - Proposed a Lyapunov-type proof for the stability and convergence of the system.
 - Numerical simulations carried out for the proposed controller. Results found to agree very well with coverage objective. [Report](#)

Positions of Responsibility

- Manager, Maths and Physics Club, IIT Bombay** 2017 – 2018
 - Led a team of six sophomore students to foster enthusiasm in mathematics and physics, tending to a community of 400 – 500 in campus and an outreach of over 6000 online.
 - Introduced Scientific Computing Championship to promote interest in Numerical methods for scientific research, first ever conducted to this scale in campus.
 - Oversaw five times improvement in year-to-year participation in Summer of Science initiative, where the club matches senior students to mentor enthusiasts in an area of their interest.
 - Organised institute-wide quizzes, talks, group discussions and mentoring activities to promote interest in the fundamental sciences.
 - Coordinated funds and mentorship to over 100 freshmen to pursue technical projects as part of Institute Technical Summer Projects – 2017. [Work Report](#)

Technical Skills

Programming Languages : C++, MATLAB

CAD and Scientific Packages : Eagle, Altium, SolidWorks, AutoCAD, Cadence, Comsol Multiphysics

Other software : Atmel studio, Arduino, HTML, CSS, Latex, gnuradio, VHDL, Xilinx ISE

Extracurricular Activities

- Completed a year-long course on playing the Keyboard.
- Gave a talk on Control loops and the PID algorithm for the Robotics club, IIT Bombay.
- Participated in the Summer of Science initiative under an experienced senior mentor, on Cosmology under the Maths and Physics Club. [Report](#)
- Secured first prize in Electric Jhatka General Championship by the Electronics club, an institute-wide circuit design competition.