Sabareesh Nikhil Chinta

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Research Interests

Spintronics, Device modeling, Device simulations on TCAD, Semiconductor optoelectronics, FinFETs

Education

Indian Institute of Technology, Mumbai, India

Major: Electrical Engineering (with honors)
Minors: Physics, Computer Science
Cumulative Performance Index of 9.02 on a scale of 10.00

Johnson Grammar School ICSE, Hyderabad, India

International Baccalaureate Diploma Program
Points: 38 out of 42
Indian Certificate for Secondary Education
Percentage: 95.5%

Research Experience

Designing Single Photon Avalanche Photodetectors in CMOS technology with high IQE and low dark current
Guide: Prof. Rajeev J. Ram *(May 2013 – July 2013)*
Research Laboratory of Electronics, Massachusetts Institute of Technology

The project encompassed developing a monolithically integrable single photon avalanche photodiode biased in Geiger multiplication with very high quantum efficiency (EQE) and responsivity and low dark count rates (DCR) at a low operating wavelength of 422 nm and cryogenic temperatures. I determined the optimal STI parameters to maximise EQE to DCR ratio.

Energetics of spintronic devices for Boolean and non-Boolean logic
Guide: Prof. Bhaskaran Muralidharan *(January 2014 -)(ongoing)*
Department of Electrical Engineering, IIT Bombay

We are attempting to determine the energetics of spintronic logic devices that incorporate separate read and write modules coupled magnetically and isolated electrically. We are also working to establish the time-delay product for this logic.

Expansion of SPARKS HTML5 circuit simulator to include non-linear and active devices
Mentor: Concord Consortium - **Google Summer of Code** *(June 2013 – September 2013)*

As a part of Google Summer of Code 2013, I have extended a circuit simulator to support non-linear and active devices by setting up a time-based differential equation solver that solves all time-based circuits with one-port devices and some multi-port devices. I incorporated Runge-Kutta approximations and iterative Newton-Raphson methods to analyze circuits with arbitrary independent sources. Circuits may be constructed on online virtual breadboards collaboratively.

Design and simulation of Si – SiGe photodetectors in 32 nm CMOS technology

Guide: Prof. Rajeev J. Ram *(May 2012 – July 2012)*

Research Laboratory of Electronics, Massachusetts Institute of Technology

We evaluated the impact of bandgap engineering and dopant diffusion through the Si-SiGe heterojunction on the internal quantum efficiency (IQE) of the photodetectors. I observed the effect of temperature, strain and work function tailoring on the IQE, and formulated an empirical model to fit IV characteristics of the photodetectors on IBM's EOS 12 chip.

Simulation of 3D trapezoidal bulk FinFET devices in 22 nm CMOS technology

Guide: Prof. Jakub Kedzierski *(July 2012 – January 2013)*

Lincoln Laboratories, Massachusetts Institute of Technology (visiting faculty, IIT Bombay)

We attempted to evaluate the effect of trapezoidal shape of the Ivy Bridge Trigate FinFETs on the threshold voltage variability with temperature and along the transverse axis and determine if the taper favorably affects FinFET performance or was introduced only because of technology constraints.

Modeling of interfacial scattering in aggressively scaled FinFETs for TCAD Monte Carlo simulations

Guide: Prof. Udayan Ganguly *(July 2013 –)(ongoing)*

Department of Electrical Engineering, IIT Bombay

We attempted to reconcile discrepancies between results of Monte Carlo and drift-diffusion simulations on Sentarus TCAD for sub-10nm FinFETs at low gate and source-drain fields. I am working on developing a complete model for quantum potential correction with surface scattering effects included.

OTHER PROJECTS

Automation of copper vapor lasers in a Pulsed Power Supply (PPS) system to process uranium

Electronics Corporation of India Limited *(May 2011 – July 2011)*

I programmed a PPS system using a programmable logic controller (PLC) to automate operation of a copper vapor laser used to obtain enriched uranium. I used ladder logic to program pulse shape and frequency.

Optical mouse hack to design a handheld scanner

Guide: Prof. Juzer Vasi *(March 2011 – April 2011)*

I led a team of three to hack an optical mouse using an Arduino Duemilanove to design a handheld scanner by combining movement detection and image capture. I employed Arduino software to process the inputs.

Game development on FPGA

Guides: Prof. M.B. Patil, Prof. J. John *(February 2012 – May 2012)*

I created generic libraries in Verilog for interfacing LCD display unit with FPGA ensuring a special focus on modularity, and employed a G-sensor for intuitive Human-Machine interaction to maximize end user experience. I also implemented a level-up mechanism that makes the speed of cars a function of time.

LITERATURE SURVEYS

- Surface Plasmon Resonance along cylindrical interfaces and modifications of Kretschmann configuration for non-planar interfaces
- Qubits in semiconductor-based quantum computers – their initialization, computation and readout

ACADEMIC ACHIEVEMENTS

- Secured *All India Rank 8* in IITJEE 2010, *All India Rank 1* in AIEEE 2010- B.Arch, *All India Rank 99* in AIEEE 2010- B.Tech, *All India Rank 11* in VITEEE 2010 and *All India Rank 31* in ISAT 2010
- Secured *Silver Medal* in the *International Junior Science Olympiad (IJSO) 2008*, held in South Korea
- Recipient of the prestigious *Aditya Birla Group Scholarship* and *OPJEMS* (OP Jindal Engineering and Management Scholarship): the only Aditya Birla scholar from IIT Bombay for the years 2010 - 14, and the only freshman OPJEM scholar from IIT Bombay for the year 2010-11
- Recipient of the esteemed *A*STAR scholarship* offered by the Ministry of Education, Singapore in 2007
- *KVPY and NTSE Scholar*: Awarded the prestigious KVPY scholarship in 2009 and the NTSE scholarship in 2008
- Selected for the *National Chemistry Camp* in the year 2010 and the *National Junior Science* Camp in the year 2008, and was awarded a *gold medal* and a *Special Merit Certificate* respectively
- Secured *All India third rank* twice in National Science Talent Search Examination conducted by Unified Council, and *first rank in Andhra Pradesh* in State Level Talent Search Examination
- Secured *All India first position* in *Aptitude* test, and *All India first* position in *Achievement* test in the year 2005, and *All India first* position in *Aptitude*, *All India first* position in *Mathematics* and *All India second* position in the year 2008, in the *Academic Aptitude and Achievement test*
- *School topper* in both class 10 ICSE and class 12 IBDP

TEST SCORES

- **GRE**: *Total:* 336/340 (*Quantitative:* 170/170, *Verbal:* 166/170, *Writing:* 4.5/6.0)
- **TOEFL**: *Total:* 117/120 (*Reading:* 30/30, *Listening:* 30/30, *Speaking:* 29/30, *Writing:* 28/30)

AFFILIATIONS

- Student Member of *Association for Computing Machinery* (ACM)

Extracurricular activities and Positions of responsibility

- *Institute Student Mentor* to mentor a batch of 25 freshmen – responsible for their holistic development
- *Department Academic Mentor* to mentor students with a poor academic performance
- *Teaching Associate for Calculus* (MA 105): one among 10 students selected out of a batch of 800
- *Debating Secretary of Hostel 6*: the only one from the hostel for the year 2011-12
- *Editor* of the official institute magazine – InsIghT, and the department magazine – Background Hum
- *Coordinator, Electronics Club* of IIT Bombay

Technical skills

Electronic Design Tools: Sentaurus TCAD, Quartus, NGSpice, Keil, LabView, Eagle
Programming and Web development Languages: Prolog, Haskell, Scala, Fortran, Java, C, C++, Python, Verilog (HDL), Javascript, PHP, SQL
Analysis and Publishing Tools: MATLAB, Scilab, Sage, R, LATEX

Relevant courses

Electrical Engineering:
Compound Semiconductor Materials and Devices, Microelectronics Simulation Lab, VLSI Technology, Introduction to Nanotechnology, Digital Systems, Electromagnetic Waves, Analog Circuits

Computer Science:
Functional and Logic Programming, Discrete Structures, Graph theory, Data Structures and Algorithms, Machine Learning, Database and Information Systems, Computer Networks

Physics:
Photonics, Advanced Photonics, Physics of Nanoscale Devices, Semiconductor Physics, Quantum Information and Computing, Electricity and Magnetism

Mathematics:
Probability & Random Processes, Calculus, Linear Algebra, Data Analysis and Interpretation, Complex Analysis, Differential Equations, Advanced Differential Equations, A first course in Optimization

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References

- **Prof. Rajeev Ram** (Summer Internship Advisor)
  Director, Center for Integrated Photonic Systems,
  Research Laboratory of Electronics,
  MIT, Cambridge, USA.
  Email: rajeev[AT]mit.edu

- **Prof. Udayan Ganguly** (Undergraduate Thesis Advisor)
  Associate Professor,
  Department of Electrical Engineering,
  IIT Bombay, Mumbai, India.
  Email: udayan[AT]ee.iitb.ac.in

- **Prof. Bhaskaran Muralidharan** (Supervised Research Exposition Advisor)
  Associate Professor,
  Department of Electrical Engineering,
  IIT Bombay, Mumbai, India.
  Email: bm[AT]ee.iitb.ac.in

- **Dr. Paul Horwitz** (Google Summer of Code mentor)
  Senior Scientist,
  Concord Consortium,
  Concord, USA.
  Email: phorwitz[AT]concord.org

- **Prof. Brij Mohan Arora** (Course Instructor)
  Visiting Professor,
  Department of Electrical Engineering,
  IIT Bombay, Mumbai, India.
  Email: bmarora[AT]ee.iitb.ac.in