Sumanta BOSE

Contact Information

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Research Interests

- Mathematical modeling and simulation of semiconductor quantum nanostructures
- Algorithms in machine learning, robotics, embedded systems and image processing

Education

Nanyang Technological University (NTU) Singapore 2013 – ongoing
Ph.D., Electrical and Electronic Engineering CGPA: 4.63/5.00
Advisor: Assoc. Prof. Weijun FAN, and Prof. Dao Hua ZHANG
Thesis: Modeling & simulation of semiconductor quantum nanocrystals for optoelectronics
My Ph.D. work involves quantum mechanical modeling and numerical simulation of semiconductor nanocrystals for optoelectronic applications in LEDs, lasers and solar cells.

National Institute of Technology (NIT) Trichy, India 2009 – 2013
Bachelor of Technology, Electronics and Communication Engineering CGPA: 8.36/10.0
Advisor: Prof. S. Raghavan
Thesis: Mathematical modeling of a metamaterial regular polygon split ring resonator
Graduated with First Class honors

Research Experience

KdotP Soft., Singapore Aug 2016 – Jan 2017
Software Engineering Intern *Advisor*: Assoc. Prof. Weijun Fan
Worked on the simulation engine, database creation and development of a GUI for KdotP Soft, a scientific software for semiconductor physics and device physics simulation.

Indian Institute of Science (IISc) Bangalore, India May 2012 – Oct 2012
Research Intern, Microwave R&D Lab *Advisor*: Prof. K. J. Vinoy
Worked on delay engineering using cascaded microwave all-pass filters for acoustic imaging by chirp waveforms for application in transmission lines acting as dispersive structures.

Qualcomm Inc., Bangalore, India (Offer Declined) Summer 2012
Interim Engineering Intern, Corporate R&D Lab
Selected among top 6 students from NIT Trichy. Not pursued due to difference in the field of research offered.

National Institute of Technology (NIT) Trichy, India Dec 2011 – Feb 2012
Research Intern, Antennas Lab *Advisor*: Assoc. Prof. D. S. Kumar
Worked on smart-fractal concepts employing combinational algorithms for rapid beamforming in smart antennas.

Intl. Institute of Information Technology (IIIT) Hyderabad May 2011 – June 2011
Research Intern, VLSI and Embeded Systems Lab *Advisor*: Asst. Prof. S. R. Chowdhury
Built a hardware model of an intelligent health security system for automated real-time breath rate tracking by exploiting the periodicity of the exhaled air temperature.

Oil India Limited (OIL), Duliajan, India Dec 2010
Industry Trainee *Advisor*: Mr. T. N. Madhavan
Worked on various electronic/pneumatic instruments and developed a control system model.

Skillset

Programming: C, C++, Embedded C, Python, Fortran, Perl, Verilog HDL.
Engineering tools/libraries: MATLAB, Origin, COMSOL, OpenCV, NumPy, SciPy.
Web technologies: HTML, PHP, CSS, JavaScript.
Operating systems: Linux, Unix, RTOS, ROS, Windows, DOS.
Firmware development: BLE, NFC, RFID Zigbee, I2C, SPI and UART.
Development platforms: Arduino, Raspberry Pi, Beagleboard, TI Launchpad, FPGA.
Materials characterization: Atomic-force microscopy, Scanning electron microscopy, Thin-film measurement, Transmission electron microscopy, X-ray powder diffraction , Photoluminescence, Photoluminescence excitation, Raman spectroscopy.

Mentoring

Nanyang Technological University (NTU) Singapore
Mentor — Aug 2015 – ongoing
Mentored 2 students in their Final Year Projects (FYPs) on semiconductor simulation.

Teaching

Nanyang Technological University (NTU) Singapore
Language consultant, HG4045 Structure of a Language — Spring 2016 – 2017
Recording, transcription, phonemic analysis and documentation of Assamese as a language.

Laboratory assistant, E2004L Digital Electronics — Fall 2016 – 2017
Combinational logic circuits, counter and shift registers, logic circuit simulation.

Teaching assistant, EE1003 Introduction to Materials for Electronics — Spring 2015 – 2016
Characteristics of semiconductors, biomaterials, smart materials and nanomaterials.

Laboratory assistant, EE1071 Introduction to EEE laboratories — Fall 2015 – 2016
Electronic components, working with AC waveforms, soldering and circuit-building.

National Institute of Technology (NIT) Trichy, India
Teaching assistant, EC204 Transmission Lines and Waveguides — Spring 2012 – 2013
Planar transmission lines, composite substrates and electromagnetic CAD tools.

Teaching assistant, EC307 Antennas and Propagation — Spring 2012 – 2013
Microstrip antennas, CNT antennas, metamaterial loaded antennas and wearable antennas.

Non-affiliated teaching
Maker Faire, Singapore — 2015 – 2016
Introduction to Robotics, Arduino, Raspberry Pi, PCB CAD design and 3D printing.

Organization

TEDxNTU
Lead Curator — Apr 2016 – Mar 2017
Co-Curator — Apr 2015 – Mar 2016
Involved in the planning and organization of TEDx (Technology, Entertainment, Design) chapter of NTU Singapore. Served as the lead organizer of the TEDxNTU 2016 edition.

NTU – World of Wisdom (WOW)
Co-Founder and Vice-Chairman — Apr 2015 – Mar 2017
Involved in the development of a think tank bringing together students and providing them with opportunities to mould their skills in diverse areas of science, economics, arts, etc.

NTU – Graduate Student Council (GSC)
Committee Director — Apr 2015 – Mar 2016
Involved in the planning and organization of academic workshops and talks. The flagship event is the 3-minute-thesis (3MT) in collaboration with NTU library, Student Life Office.

IEEE Young Professionals, Singapore Chapter
Executive Committee Member Nov 2015 – Nov 2016
Involved in facilitating young graduates to become world class professionals, enhancing their skills and establishing a diverse professional network, through workshops and networking.

Robotics and Machine Intelligence (RMI), NIT Trichy
Head, Electronics division July 2011 – June 2013
Involved in robotics project including micromouse, line-follower, PIR motion sensor, accelerometer controller. Other projects involved image processing and PID control systems.

Honors and Awards

- IEEE Region-10 Young Professionals Affinity Group Award in recognition and appreciation of valued services and contributions; Aug 2016.
- NTU Research Scholarship, for the duration of Aug 2013 – July 2017
- University Graduate Scholarship, University of Glasgow, *offered* 2013
- *Grant for Student* of EUR 750 to present a paper at the 6^{th} Intl. Congress on Adv. Electromagnetic Materials in Microwaves & Optics, St. Petersburg,; Sept 2012.
- Govt. of India's University Grant Commission (UGC) Sponsored Fellowship for Summer Research Internship at Indian Institute of Science (IISc), Bangalore; May – July 2012.

Academic Services

Talks (*Invited*)

- "Semiconductor Quantum Nanocrystals for Optoelectronic Applications" at the 4^{th} Annual World Congress of Smart Materials 2018 in Osaka, Japan; 2018
- "Semiconductor Quantum Nanocrystals for Optoelectronic Applications" at the 3^{rd} Annual World Congress of Smart Materials 2017 in Bangkok, Thailand; Mar 2017
- "Semiconductor Quantum Nanocrystals for Optoelectronic Applications" at the EMN Meeting on Optical Communications 2016 in Dubai; Nov 2016

Journal Reviewer

- Institute of Electrical and Electronics Engineers (IEEE): *Journal of Lightwave Technology*
- Institute of Physics (IOP): *Materials Research Express* and *Nanotechnology*
- Springer Open: *Nanoscale Research Letters*
- Multidisciplinary Digital Publishing Institute (MDPI): *Computation* and *Applied Sciences*

Conference Reviewer

- IEEE TENCON 2016 – IEEE Region 10 Conference
- IEEE CRALT 2016 – Conference on Recent Advances in Lightwave Technology

Professional Memberships

- *Student Member*, Institute for Electrical and Electronics Engineers (IEEE)
- *Student Member*, IEEE Photonics Society
- *Life Member*, Society of Electromagnetic Compatibility (EMC) Engineers India, SEMCE(I)

Media coverage

- 'NIT-T student gets grant to attend conference on metamaterials', The Hindu, Aug 2012
- 'Young India', a mass broadcast radio program by All India Radio (AIR), Oct 2012

Citation indices

- Citations: 138
- h-index: 6
- i10-index: 5

Journal Publications

- S. Bose, S. Shendre, Z. Song, V. K. Sharma, D. H. Zhang, C. Dang, W. J. Fan, H. V. Demir, "Temperature-dependent Optoelectronic Properties of Quasi-2D Colloidal Cadmium Selenide Nanoplatelets", *Nanoscale*, **9**, 6595-6605, 2017.
- S. Bose, W. J. Fan, D. H. Zhang, "Optoelectronics of Inverted Type-I CdS/CdSe Core/Crown Quantum Ring", *Journal of Applied Physics*, **122** (16), 163102, 2017.
- Z. Song, S. Bose, W. J. Fan, D. H. Zhang, Y. Y. Zhang, S. S. Li, "Quantum Spin Hall Effect and Topological Phase Transition in $InN_xBi_ySb_{1-x-y}$/InSb Quantum Wells", *New Journal of Physics*, **19** (7), 073031, 2017.
- S. Bose, Z. Song, W. J. Fan, D. H. Zhang, "Effect of lateral size and thickness on the electronic structure and optical properties of quasi two-dimensional CdSe and CdS nanoplatelets", *Journal of Applied Physics*, **119** (14), 143107, 2016.
- Z. G. Song, S. Bose, W. J. Fan, S. S. Li, "Electronic band structure and optical gain of $GaN_xBi_yAs_{1-x-y}$/GaAs pyramidal quantum dots", *Journal of Applied Physics*, **119** (14), 143103, 2016.
- W. J. Fan, S. Bose, D. H. Zhang, "Electronic bandstructure and optical gain of lattice matched III-V dilute nitride bismide quantum wells for 1.55μm optical communication systems", *Journal of Applied Physics*, **120** (9), 093111, 2016.
- K. Prabu, S. Bose, D. S. Kumar, "BPSK based subcarrier intensity modulated free space optical system in combined strong atmospheric turbulence", *Optics Communications*, **305**, 185-189, 2013.
- M. Levy, S. Bose, D. S. Kumar, A. V. Dinh, "Rapid beam forming in smart antennas using smart-fractal concepts employing combinational approach algorithms", *International Journal of Antennas and Propagation*, vol. 2012, ID **467492**, 2012.
- M. Levy, S. Bose, A. V. Dinh, D. S. Kumar, "A novelistic fractal antenna for ultra wideband (UWB) applications", *Progress In Electromagnetics Research B*, **45**, 369, 2012.
- S. Bose, M. Ramaraj, S. Raghavan, S. Kumar, "Mathematical modeling, equivalent circuit analysis and genetic algorithm optimization of an N-sided regular polygon split ring resonator (NRPSRR)", *Elsevier Procedia Technology* **6**, 763-770, 2012.
- Y. Liu, S. Bose, W. J. Fan, "Effect of size and shape on electronic and optical properties of CdSe quantum dots", *Optik – International Journal for Light and Electron Optics*, **155**, 242-250, 2018
- S. Bose, W. J. Fan, D. H. Zhang, "Optoelectronics of Quasi Two-dimensional CdS_xSe_{1-x} Nanoplatelets", *Journal of Physics D: Applied Physics*. [under review]
- S. Bose, S. Delikanli, V. K. Sharma, C. Dang, W. J. Fan, D. H. Zhang, H. V. Demir, "Electronic Bandstructure and Excitonic Absorption in CdSe Nanoplatelets", *Nanoscale*. [under review]

Conference Publications

- S. Bose, S. Delikanli, A. Yeltik, M. Sharma, O. Erdem, C. Dang, W. J. Fan, D. H. Zhang, H. V. Demir, "Anomalous Spectral Characteristics of Ultrathin sub-nm Colloidal CdSe Nanoplatelets", *Conference on Lasers and Electro-Optics (CLEO)*, 2017.
- S. Bose, S. Delikanli, M. Z. Akgul, Y. Gao, W. J. Fan, D. H. Zhang, H. V. Demir, "Inverted Type-I CdS/CdSe Core/Crown Colloidal Quantum Ring", *Conference on Lasers and Electro-Optics (CLEO)/Europe and the European Quantum Electronics Conference (EQEC)*, 2017.
- S. Bose, W. J. Fan, D. H. Zhang, "Theoretical Investigations of Excitonic Absorption in Quasi Two-dimensional CdSe Nanoplatelets", *12^{th} Conference on Lasers and Electro-Optics Pacific Rim (CLEO-PR)*, 2017.
- S. Bose, W. J. Fan, D. H. Zhang, "Strain Profile and Size Dependent Electronic Bandstructure of Type-I CdS/CdSe Quantum Ring", *12^{th} Conference on Lasers and Electro-Optics Pacific Rim (CLEO-PR)*, 2017.

- S. Bose, Z. Song, W. J. Fan, D. H. Zhang, "KdotPsoft: Modelling and Simulation of Semiconductors and Device Physics", *9^{th} International Conference on Materials for Advanced Technologies*, 2017.
- Z. Song, S. Bose, W. J. Fan, X. H. Tang, D. H. Zhang, S. S. Li, "Electronic structure and optical gain of $InAs_{1-x-y}N_xB_y$/InP pyramidal quantum dots", *9^{th} International Conference on Materials for Advanced Technologies*, 2017.
- T. Chaudhuri, Y. C. Soh, S. Bose, L. Xie, H. Li, "On assuming Mean Radiant Temperature equal to air temperature during PMV-based thermal comfort study in air-conditioned buildings", *42^{nd} Annual Conf. of the IEEE Industrial Electronics Society, (IECON)*, 2016.
- S. Bose, W. J. Fan, J. Chen, D. H. Zhang, C. S. Tan, "Strain Profile and Size Dependent Electronic Band Structure of GeSn/SiSn Quantum Dots for Optoelectronic Application", *International Conference on Fibre Optics and Photonics*, 2014.
- S. Bose, W. J. Fan, C. Jian, D. H. Zhang, C. S. Tan, "Strain profile, electronic band structure and optical gain of self-assembled Ge quantum dots on SiGe virtual substrate", *7^{th} International Silicon-Germanium Technology and Device Meeting (ISTDM)*, 2014.
- S. Bose, K. J. Vinoy, "Group delay engineering using cascaded all pass filters for wideband chirp waveform generation", *IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT)*, 2013.
- K. Prabu, S. Bose, D. S. Kumar, "Analysis of optical modulators for Radio over Free Space Optical Communication systems and Radio over Fiber systems", *Annual IEEE India Conference (INDICON)*, 2012.
- S. Bose, M. Ramraj, S. Raghavan, "Design, analysis and verification of Hexagon Split Ring Resonator based Negative Index Metamaterial", *Annual IEEE India Conference (INDICON)*, 2012.
- S. Bose, S. Raghavan, "Theoretical Investigations of a N-sided Regular Polygon Split Ring Resonator with Skew Rotation", *The 6^{th} International Congress on Advanced Electromagnetic Materials in Microwaves and Optics*, 2012 [accepted, but not presented]
  – Awarded 'Grant for Students' - registration fee waiver and travel allowance (EUR 750)
- M. Ramraj, S. Raghavan, S. Bose, S. Kumar, "Elliptical Split Ring Resonator: Mathematical Analysis, HFSS Modeling and Genetic Algorithm Optimization", *Progress In Electromagnetics Research Symposium (PIERS)*, 2012.
- M. Levy, D. S. Kumar, A. Dinh, S. Bose, "A novelistic approach for rapid beam forming in smart antennas for wireless applications using smart-fractal concepts and new algorithm", *International Conference on Advances in Mobile Network, Communication and its Applications (MNCAPPS)*, 2012.
- S. Bose, K. Prabu, D. S. Kumar, "Real-time breath rate monitor based health security system using non-invasive biosensor", *3^{rd} International Conference on Computing Communication & Networking Technologies (ICCCNT)*, 2012.
- S. Bose, K. Prabu, D. S. Kumar, "Array Signal Processing & Optimization using Algorithms in Nature", *International Proceedings of Computer Science & Information Technology*, 2012.

References

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