ANANTH SARAN YALAMARTHY

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PARTICULARS

EDUCATION

Stanford University — Stanford, CA
M. S. & Ph.D. in Mechanical Engineering — *2014-2019*
GPA: *4.037/4.00 (Current). Advisor: Prof. Debbie G. Senesky, Co - Prof. Kenneth Goodson*

Indian Institute of Technology (I. I. T.), Madras — Chennai, India
B. Tech. in Mechanical Engineering — *2010-2014*
GPA: *9.36/10.00*

RESEARCH INTERESTS

I am a graduate student at Stanford University working in GaN-based MEMS design. In particular, my current research is based on nano and micro-scale energy transport & conversion applied to MEMS/NEMS based semiconductor devices. Addtional areas include thermo-electrics, III-V semiconductor based piezoelectric sensors and energy harvesters and issues relating to energy in electronic devices. I have a very wide range of interests, having worked briefly in theoretical plasma physics, experimental high energy physics & satellite instrumentation as part of research in my undergraduate.

SELECTED ACADEMIC ACHIEVEMENTS AND HONORS

- Qualcomm Roberto-Padovani Scholarship Award (2016) (5 awarded worldwide)
- Baker-Hughes Stanford FMA, Stanford University, 2015 - 2016.
- WISE Fellowship, German Academic Exchange Service, 2013 (120 awarded across India)
- Top 4% (Rank 6/160) of Mechanical Engineering Class (157 students) at I.I.T. Madras, 2010 - 2014.
- 99.3 percentile, I.I.T. Joint Entrance Examinations, 2010 (out of approx. 450,000 candidates).
- Indian National Talent Search Examinations, Silver Medallist, 2007 & 2008.
- Awarded for outstanding academic performance in classes VI - X at Indian School Muscat (ISM), Oman.

ARTICLES, CONFERENCES, POSTERS & BOOK CHAPTERS

JOURNAL ARTICLES

1. **Ananth Saran Yalamarthy** et al., "Strain and temperature-induced effects in AlGaN/GaN high electron mobility transistors", *2016 Semicond. Sci. Technol. 31 035024* [**Selected for top 20 highlights of 2016**]
2. Ateeq J. Suria, **Ananth Saran Yalamarthy** et al., "DC characteristics of ALD-grown Al_2O_3/AlGaN/GaN MIS-HEMTs and HEMTs at 600 °C in air", *2016 Semicond. Sci. Technol. 31 115017*
3. Minmin Hou, Hongyun So, Ateeq J. Suria, **Ananth Saran Yalamarthy** et al., "Suppression of Persistent Photoconductivity in AlGaN/GaN Ultraviolet Photodetectors Using In-situ Heating", *2016 IEEE. Electron Dev. Lett. 38 (1), 56-59* [**Highlighed in Semiconductor Today Magazine**]
4. **Ananth Saran Yalamarthy** et al., "Large enhancement of thermoelectric characteristics in AlGaN/GaN films deposited on inverted pyramidal Si surfaces ", *Appl. Phys. Lett., under review*
5. Ateeq J. Suria, **Ananth Saran Yalamarthy** et al., "Using Atomic Layer Deposited Al_2O_3 Films to Suppress Interfacial Reaction and Diffusion of MetalSemiconductor in GaN/AlGaN/GaN HEMTs up to 600 °C in air", *Appl. Phys. Lett., under review*
6. **Ananth Saran Yalamarthy** et al., "Polarization field engineering of thermoelectric properties in III-V Nitrides", *in preparation*

CONFERENCE PAPERS (PEER REVIEWED)

7. Minmin Hou, Ateeq J. Suria, **Ananth Saran Yalamarthy** et al., "2DEG-heated AlGaN/GaN Micro-Hotplates for High-Temperature Chemical Sensing Microsystems", *Solid-State Sensors, Actuators and Microsystems Workshop, Hilton Head, SC 2016*.
8. Athreya Shankar, **Ananth Saran Yalamarthy** et al., "Design of a Large Aperture Space-based Proton and Electron Energy Detector as Payload of IITMSAT", *IEEE International Conference on Space Science and Communication (IconSpace) 2015*, Aug. 2015.
9. Nithin Sivadas, **Ananth Saran Yalamarthy** et al., "A Nano-satellite Mission to Study Charged Particle Precipitation from the Van Allen Radiation Belts caused due to Seismo-Electromagnetic Emissions", *5th Japan Nano-satellite Symposium, Tokyo, Japan*, Nov. 2013.

CONFERENCE POSTERS (PEER REVIEWED)

10. **Ananth Saran Yalamarthy** et al., "Space-based Proton Electron Detector (SPEED) to Measure Fluctuations in the Energy Spectra of Protons and Electrons in the Upper Ionosphere", *Coupling Energetics and Dynamics of Atmospheric Regions (CEDAR), Boulder, USA*, Jun. 2013.
11. Nithin Sivadas, **Ananth Saran Yalamarthy** et al., "Particle Detector for Measurement of Fluctuations in the, Energy Spectra of High Energy Protons and Electrons in the Upper Ionosphere", *National Symposium on Particles, Detectors and Instrumentation, TIFR, India,* Mar. 2012.

BOOK CHAPTERS

12. Debbie G. Senesky, Hongyun So, Ateeq J. Suria, **Ananth Saran Yalamarthy** et al., "Gallium Nitride Micro-electronics for High-Temperature Environments", Semiconductor-Based Sensors, 395-433, 2017

MAJOR RESEARCH & WORK EXPERIENCE

- **Research Assistant, XLab (Prof. Debbie G. Senesky), Stanford University**, Nov. 2014 - Present.
  Strain and temperature induced effects in AlGaN/GaN HEMTs, (February 2015 - June 2015): This work relates to article [1]. We present a semi-empirical simulation model for the study of 2D electron gap in AlGaN/GaN high electron mobility transistors (HEMTs) considering strain and temperature effects. We then use the model to present a novel way to use HEMTs for strain sensing across a wide temperature range from about 300 K - 800 K.

  Demonstration of AlGaN/GaN transistors operating at temperatures upto 600 C, (May 2015 - Dec 2015): This work relates to article [2]. We successfully demonstrate record high temperature operation of an AlGaN/GaN MIS-HEMT using an ALD alumina di-electric layer. We analyze the performance of the 2D sheet of electron gas in the AlGaN layer at high temperatures from analysis of the threshold voltage characteristics. Our performance metrics indicate that operation upto 600 C is possible, but reliability, low power and trans-conductance are an issue.

  Thermo-electric architectures using 2D-gases in III-V Nitrides, (April 2015 - Present): This relates to current work (articles [4] & [6]). We are trying to analytically calculate and optimize the thermoelectric properties of 2D sheets of gas in stacked III-V nitride systems via simple semi-empirical models. We also focus on clever geometries and integration schemes to successfully integrate this system into a larger framework so that it can be used for harvesting and sensing applications.

  Power Optimization of Electro-Thermal Systems (POETS) NSF Collaboration, (Sept. 2015 - Present: 7 year long grant worth $\approx$ 20 mil. $ grant to reach record-power densities in next-generation electronic hardware, lead by multiple research groups at Stanford and UIUC. I am involved in developing next-generation thermo-electric materials and utilizing them to build on-chip harvesting and sensing solutions for this platform.

- **Hardware Engineering Intern, Qualcomm Research, San Diego**, Jun-Sept 2016.
  Areas: Inertial navigation algorithms using MEMS IMUs, Kalman filters, signal processing using machine learning techniques (RNNs). Specifically geared in the context of VR/Head Mounted Display applications.
  Special Mention: Qualcomm Roberto Padovani Fellowship Award, for demonstrating superior technical ability among interns within Qualcomm Research (QR), 5 awarded in 2016 out of several 100 interns worldwide.

- **ME 218 sequence, Smart Product Design Lab, Stanford University**, Autumn 2014 & Winter 2016.
  ME 218A: The first of the 3 quarter Mechatronics sequence at Stanford University. We built a simple

multi-player arcade game (2 people, about 60 seconds) using a TIVA ARM Micro-contoller via a simple event-driven software architecture. I was involved in designing and building the analog and digital circuitry and the implementation of the state machine into the event-driven framework. More details on this webpage.

ME 218B: This course extends on the background in 218A with a much deeper look into embedded systems. The final project was a mobile autonomous competition level robot. Our team won ME218-2016 edition, **ranking 1 out of the 18** robots built for the class. Detailed explanations of all the subsystems and videos are available at this webpage.

- **EE 323, Energy & Electronics, Stanford University**, Oct. 2015 - Dec. 2015
  Thermal conductivity studies for defect characterization in 4H-Silicon Carbide (SiC): This in on-going work that started out of a class project in EE 323 (Energy & Electronics) taught by Prof. Eric Pop at Stanford University. We experimentally measure the thermal conductivities of SiC samples processed on earth and micro-gravity environments at cryogenic temperatures and use this data to extract out the concentration of defects (0D, 1D & higher order) using analytical thermal conductivities models based on phonon scattering.

- **CS 229, Machine Learning, Stanford University**, Sept. 2016 - Dec. 2016
  Encoding the Natural Response of Primate Retina: Developing encoding models that estimate the functionality of a retina are immensely valuable, not only to get insight into complex visual pathways in the human brain but also to enable brain-machine-interfaces of the future such as a retinal prosthesis. We harness approaches from machine learning and neural networks to better model the natural encoding that takes place in the retina. In this project, we implement two models: a Linear Nonlinear Poisson (LNP) model and deep learning models (Convolutional Neural Networks or CNNs) to predict spike trains given visual stimuli composed of white noise images. We find that our LNP baseline model shows a baseline correlation of 30 % given the model's relative simplicity and that CNNs achieve comparable performance 20 %, which we believe is limited by the time we had (two weeks) to experiment with different architectures and to train the network. We believe experimenting with different number of CNN layers, using combinations of CNNs and RNNs and usig a different dataset may increase model performance.

- **Undergraduate Thesis, I.I.T. Madras**, Aug. 2013 - May 2014.
  Optimization of the Thrust Produced by a Plasma flow in a Magnetic Nozzle: This was my undergraduate thesis at I.I.T Madras, guided by Prof. Harishankar Ramachandran Prof. K. Ramamurthi. Magnetic Nozzles are used in high-power plasma thrusters to produce directed axial kinetic energy. Unlike conventional gas-dynamic nozzles, magnetic nozzles expand a very low density, low pressure, highly ionized plasma into vacuum by means of a strong, divergent magnetic field created by electromagnets. In order to be viable for space propulsion, plasma needs to detach itself from the applied magnetic field downstream of the magnetic nozzle throat. In this project, first, a preliminary model of a magnetic nozzle is demonstrated using single particle simulations. A more realistic model of the magnetic nozzle is created using ATHENA, a Magneto-hydrodynamic simulation code. Using a two-dimensional ideal MHD model, the performance and detachment of plasma from the magnetic nozzle for various applied field strengths is examined. This is used to derive conclusions on the regimes of operation in which the magnetic nozzle can be used as a space propulsion device. Thesis copy and additional details on this webpage.

- **I.I.T. Madras Satellite Project**, Mar. 2011 - May 2014.
  IITMSAT is a student satellite initiative to design and build a Nano satellite which will study the features of plasma in the upper ionosphere to characterize its relation with earth-based phenomena like seismic activity. This unique study is made through a Space Based Proton- Electron Energy Detector (SPEED) payload on-board the satellite capable of measuring the energy spectrum of plasma. The satellite is currently in its engineering phase and is expected to launch in 2016. I was involved in many aspects of SPEED, including detector systems engineering, detector physics, electronics, thermal & mechanical design. An extensive description of my work is available in this webpage.

- **Institute for Space Systems, TU Dresden, Dresden, Germany**, May. 2013 - July 2013.
  Devlopment of a Serial Communication Interface for Satellite Sun Sensor and Magnetometer Calibration: I spent 10 weeks in the Institute for Space Systems at TU Dresden, Germany as part of the DAAD (German Academic Exchange Service) scholarship program, advised by Prof. Tino Schmiel. I was involved in the initial development phase of the SOMP-II satellite, working on the Attitude Determination and Control subsystem.The main objective of this project was to mimic the orbital motion of a satellite using a dual-axis turntable, current carrying coils and an artificial lamp, which together could create the magnetic field and illumination that the satellite would have experienced in orbit. I was involved in developing the control software which could send the rotation commands to the turntables and the micro-controller which varied currents in the magnetic field coils. The software can also receive sun angle data from the satellite

placed on the 2-axis calibration testbed and magnetometer data via the micro-controller, and this can be used to verify the functioning of the sun sensors and the magnetometer. The control software was coded into a GUI so that all the user had to do was to set his orbital parameters and a complete simulation of the orbit can be achieved. Additional details on this webpage.

- **Student Intern, Amadasoft Inc.**, Dec. 2012 - Jan 2013.
  Tool-path Optimization for an CNC Turret Punching Machine: Amadasoft Inc. is the software division of the Japanese manufacturing automation company Amada. A CNC punching machine consists of a turret with about 30 tools that can be used to punch specific patterns onto sheet metal. When moving from one punch location to another punch location, the table must move in the X and Y directions, whereas the turret must rotate such that the correct tool gets aligned with the sheet. Our project objective was to find the optimum sequence of punch co-ordinates to minimize the time wasted in moving from one punch location to another. I co-developed a C++ algorithm modeled on a travelling salesman problem to solve this problem. In a departure from the traditional approach, we solved a clustered TSP taking into account all possible motions of the punch. The algorithm showed almost 30% improvement over Amada's current punching sequence algorithm.

TEACHING & MENTORING EXPERIENCE

- **Mentor, High School Student, XLab, Stanford University**: I worked with a 11th grade student from Prospect High School, California from July - Dec '15. We worked on the basics of electro-thermo-mechanical modeling using COMSOL Multiphysics. We created and analyzed a wide range of simulation models appropriate for high-school students.
- **Mentor, I.I.T. Madras Student Satellite Project**: I co-worked (guided) with 2 sophomore students on the design of the structural system of the satellite payload in May - July '13, in association with the Space Astronomy Group (SAG) at the Indian Space Research Organization (ISRO) in Bangalore, India.

Major Extra-Curricular

- **Event Manager, Digital Shapers at Stanford**: Core member involved in organization of events for the Stanford Digital Shapers Club. Our club aims to increase awareness of the impacts of technology on society. In addition, our aim seeks to educate the Stanford community about the future of privacy, digital rights, social systems and employment in the digital age.
- **Co-ordinator, Student Leadership Council, POETS ERC**: Organized and supported various activities as part of the Power Optimization of Electro-Thermal Systems ERC across multiple schools, from 2016-2017.
- **Science and Technology correspondent, The Fifth Estate, I.I.T. Madras**: The official news body of I.I.T. Madras. Involved in the coverage of events around the campus as well as scientific pieces, from 2012-2014.
- **Co-ordinator & organizer, Ig Nobel, Mechanica, I.I.T. Madras (2012)**: From the official website: "The Ig Nobel Prizes honor achievements that make people LAUGH, and then THINK. The prizes are intended to celebrate the unusual, honor the imaginative and spur people's interest in science, medicine, and technology". I co-organized a similar event in the context of the mechanical engineering discipline for the first time in 2012 at Mechanica, the annual department showcase of the Mechanical Engineering department at I.I.T. Madras.
- **Western Classical Electronic Keyboard, Trinity College of Music, London**: Grade certificates in levels 0-3, from 2005 - 2007.
- **Black Belt Certificate, Karate Budokan International**: Earned a karate black belt over the course of 4 years, 2004 - 2008.
- **GAMA Abacus Academy**: Mental math training using techniques from abacus. First in class in all 7 levels, from 2005-2007. Can perform complex math operations at extremely high speeds without the use of calculators.

SKILLS

- Programming: C—Python—Matlab—SciPy—NumPy—LaTeX
- Design & Analysis: Sentaurus—COMSOL—Abaqus (novice)—ANYSYS Parametric—SolidWorks—L-Edit