

FALL 2020

# ELECTRICAL AND COMPUTER ENGINEERING

Mississippi State University

**The ECE  
Department  
would like to  
welcome our  
new  
Department  
Head, Dr.  
Samee Khan.**



It is with great pleasure that I welcome you to the revived ECE e-newsletter. We hope to keep the e-newsletter as a regular once a semester feature to showcase the superb achievements of our ECE alumni, students, staff, and faculty. But this can only be done through your strong support, which I have no doubt that you will be extending to the Department. As a Department, we are in superb shape with over 700 students (including 80+ PhD students and 40+ MS students) currently enrolled in ECE degree programs. Our alumni are shining brighter than ever and are well represented by the Advisory Board. Our faculty has received several accolades recently and continue to lead the way at the national level through the National Wireless Testbed and the High Voltage Laboratory to name a few. I am so excited to call Mississippi State University as my new home after 4 years in Washington, DC, serving our Nation at the National Science Foundation. I am grateful to all the support I received from the alumni, students, staff, and faculty of the North Dakota State University, where I started my career in 2008. I look forward to your guidance, advice, and support.

**Hail State!**

*Sincerely,*

*Samee U. Khan, PhD*

*Head and James W. Bagley Chair Professor  
Department of Electrical and Computer Engineering  
Mississippi State University*

# Electrical and Computer Engineering Mentor Program

ECE Mentors welcome new students into the department and serve as a resource for navigating ECE courses, understanding how first-year topics relate to senior year ECE topics and more! ECE Mentors are undergraduate students that have a passion for ECE and want to connect with and teach younger ECE students to help them be successful. ECE Mentors spend time in first year labs associated with Intro to ECE Design I and II and the Digital Devices courses. ECE Mentors teach students how to solder, how to connect components on a breadboard, and provide advice or guidance on anything first-year ECE students may ask. Most of the mentors are in their Junior or Senior level classes so that they can talk about what new students need to do to prepare themselves for the future. In the Intro to ECE Design courses, mentors can explain how first-year design concepts and assignments relate to the concepts and assignments students will tackle in Senior Design courses. But it is not all about the mentees; mentors see benefits too! ECE Mentors learn how to serve in leadership roles, they are able to make a lot of new connections with new people, and they get to practice their public speaking each week in lab. Once selected, nearly all mentors have chosen to remain in the mentoring program until graduation. One mentor, Lauren Noller, who has served as a mentor since Fall 2019 summarizes her reason for staying: "As a mentor myself, I truly just enjoy helping newer students and motivating them to never give up on their undergraduate degree. Becoming a mentor has been an amazing experience and a lot of fun. I have enjoyed teaching all my students, and I hope they do their very best here at Mississippi State University."

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*I truly just enjoy helping newer students and motivating them to never give up.*

*- Lauren Noller, ECE  
Undergraduate Student and  
Mentor*



# Emphasis Areas

The Electrical and Computer Engineering Department consists of four emphasis area groups: Communication and Electromagnetics; Computer Systems and Microelectronics; Power, Controls, and High Voltage; and Signal Processing and Machine Learning.



## Communication and Electromagnetics

The faculty of the Communication and Electromagnetics emphasis area are actively involved in research to develop enabling technologies for next generation wireless communication, security, and sensing systems. Both our coursework and research addresses smart-city communication, the Internet of Things, innovative antennas, medical telemetry, wireless communication and networking, physical layer security, cyber-physical systems, microwave remote sensing, radar systems, spectrum sharing, software defined radios, 5G New Radio, 6G, vehicle to vehicle communications, and massive multiple-input and multiple-output technology. Specifically, Dr. Pat Donohoe's research interests include computational electromagnetics (EM), EM compatibility, EM properties of composite materials, and lightning protection. Dr. Mehmet Kurum focuses on low technology readiness level (TRL) microwave remote sensing problems via signals of opportunity (SoOp) through small unmanned aircraft systems (UAS) to small satellite platforms, high fidelity electromagnetic modeling & simulations for forward and inverse problems with applications to environmental monitoring and sustainability. Dr. Ryan Green's research focuses where Smart City Technology, Wireless Medical Telemetry, and Optically Transparent Communication devices intersect. In particular, his research focuses on the challenges of thin film antennas for both transparent and implantable technologies, Internet of Things applications in wearable medical monitoring devices, wireless medical telemetry, and environmental/medical sensor integration into wireless sensor systems. Dr. Vuk Marojevic's research group collaborates on advanced wireless access and mobile communications solutions. Improved heterogeneous interference models, flexible protocols, and dynamic resource management mechanisms are needed for better radio frequency coexistence and higher spectral and energy-efficiencies across heterogeneous systems and devices, active and passive. His group studies the application of artificial intelligence to spectrum access, reliability, security and mobility, and build testbeds and develop experiments with ground and aerial nodes using software radios. Dr. Chung-Hung Liu's research interests are in modeling and analysis for next generation mobile network, machine learning for wireless networking, signal processing, and wireless cyber-physical systems. For wireless networking and signal processing, he focuses on the study of network coverage and capacity, network security, mobile edge computing and distributed learning. For cyber-physical systems, he focuses on the study of distributed machine learning in optimal control and security for large-scale networked systems.

- *Dr. Mehmet Kurum, Chair of the Communication and Electromagnetics Group*



Dr. Pat Donohoe



Dr. Ryan Green



Dr. Mehmet  
Kurum



Dr. Chung-Hung  
Liu



Dr. Vuk Marojevic



# Computer Systems and Microelectronics

From smart phones to the smart grid, computing systems and microelectronics help us understand and improve our daily lives. Research in our emphasis area seeks ways to better harness these incredible possibilities. Specifically, Dr. Bryan Jones' research into literate programming provides a conceptual framework and a set of software tools which enable collaboration and ease the maintenance burden by enabling the programmer to intermingle their design and discoveries in the programs they write. Dr. Yaroslav Koshka's most recent research area is quantum computing and quantum information, their application to a variety of optimization problems, machine learning, electronic materials and devices. He also continues research in the field of his traditional interests - semiconductor materials and device characterization, defect engineering, synthesis of wide-band-gap semiconductor materials and nano-structures, physics of semiconductor devices, and nano-electronics. Dr. Jean Mohammadi-Aragh believes that learning is fun and that we should leverage computing to improve learning. Those two principles drive her research agenda that examines writing as a support mechanism for learning to program, pedagogical uses of computers and virtual reality systems, and fundamental concerns related to engineering education, such as how community and messaging impact the recruitment and retention of engineers. Dr. Yu Luo's research mainly focuses on sustainable, efficient, and secure cyber physical systems. An energy harvesting powered wireless device is one example of a solution to support semi-perpetual operation in smart home/city applications. His research also includes designing environment-friendly underwater IoT that can coexist with marine animals. Dr. Chaomin Luo's research interests include embedded systems, optimization for very large-scale integration and computer-aided design, robotics, autonomous vehicle systems and control, applied machine learning for robotics, computational intelligence, and intelligent systems. Currently, his main focuses are on embedded systems and sensors for robotics design, and applied machine learning for autonomous systems.

- *Dr. Bryan Jones, Chair of the Computer Systems and Microelectronics Group*



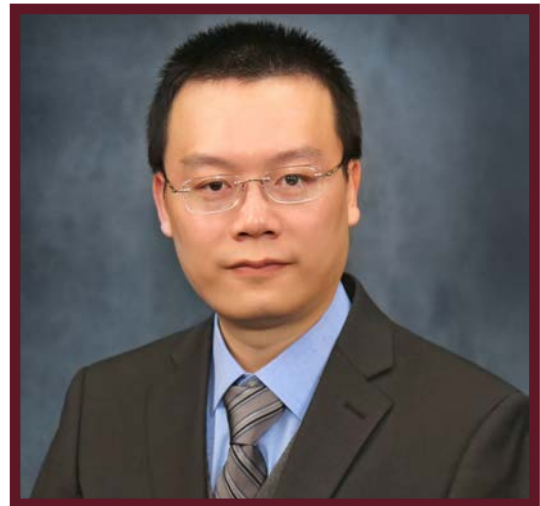
Dr. Bryan Jones



Dr. Yaroslav  
Koshka



Dr. Chaomin Luo



Dr. Yu Luo



Dr. Jean  
Mohammadi-Aragh

# Power, Controls, and High Voltage

The Power, Controls, and High Voltage area of the ECE Department has a wide variety of topics of interest for research and development, as might be expected given the diverse specialties included in this area. In the area of power, Dr. Seungdeog Choi works on power electronics, electric machinery, wireless power transfer systems, battery management and controls, and monitoring and diagnosis of general power electronics and microgrid systems. Dr. Yong Fu is involved in the optimization and economics of power systems, studies of interdependencies between various parts of the energy infrastructure, renewable energy applications, smart grids and power systems for electric ships. Dr. Masoud Karimi works on modeling, analysis, design and control of systems, such as photovoltaics, wind turbine generators and battery energy storage systems, as well as microgrid modeling, controls and hybridization of grids to include both AC and DC components. In order to conduct work in all of these areas, he is also involved in a wide variety of control theory as applied to the power area, as well as advanced signal processing for power. Dr. Junbo Zhao rounds out the power area with his work on power system state and parameter estimation, studies of power system dynamics, stability and cybersecurity, modeling and identification of power systems, and situation awareness and control of power distribution systems with a high penetration of renewable energy. In the general area of control theory, Dr. Randy Follett has been involved in a variety of work digital, optimal, and nonlinear control applications ranging from covert sonar signal processing, to control of airborne weapons systems, to the control of large flexible space structures like the Hubble Space Telescope, but in recent years has been more focused on student team advising, particularly in the areas of unmanned aerial systems and ground vehicle electrification and autonomy. In the area of high voltage engineering, Dr. Chanyeop Park works on a variety of specific areas, including dielectrics, partial discharge, cryogenic power electronics, applied plasma physics, and applied superconductivity.

*- Dr. Randy Follett, Chair of the Power, Controls, and High Voltage Group*



Dr. Seungdeog  
Choi



Dr. Randy Follett



Dr. Yong Fu



Dr. Masoud Karimi



Dr. Chanyeop Park



Dr. Junbo Zhao



# Signal Processing and Machine Learning

The signal processing and machine learning emphasis group performs research in many areas, including athletic performance; sensors, including cameras, radar and lidar; remote sensing; autonomous vehicles, and many other areas. The group specializes in signal and image processing, including advanced deep learning methods, wavelet analysis, sparse and compressive signal processing, and image processing. Members of this research team are recognized worldwide and include two IEEE fellows. Dr. Junbo Zhao's current research efforts include development of new machine learning and deep reinforcement algorithms and tools to extract insightful information from heterogeneous data and make timely optimization and controls of cyber-physical systems for reliability, security, and resiliency. He is currently funded by the Department of Energy to develop advanced hybrid white-box modeling and black-box learning algorithms for power grid optimization with massive uncertainties. Dr. John Ball's research involves sensor processing in remote sensing, automotive autonomy, and wearable devices. He focuses on advanced artificial intelligence, machine learning, and signal processing methods. He is currently funded by the National Science Foundation, National Institute of Justice, the Engineer Research and Development Center, and the Air Force. Dr. Bo Tang's research focuses on machine learning and data mining, and their applications in various cyber-physical systems, including automated aerial/ground/underwater vehicles, smart grid, and communication networks. He is particularly interested in developing advanced statistical machine learning algorithms and building smart and secure embedded systems that are robust, adaptive and fault tolerant to uncertain environments. Dr. Jenny Du's research field is digital image processing and its application to remote sensing problems with an expertise on hyperspectral image exploitation. Dr. Ali Gurbuz's research focuses on both foundations and applications of machine learning. He is studying sparse signal processing, computational imaging and deep learning based inverse problems leading to smart sensing systems. He is developing machine learning based solutions with applications for autonomous vehicles, remote sensing, precision agriculture and human activity recognition. Dr. James Fowler's research is in analysis and coding of hyperspectral imagery, random projections and compressed-sensing of imagery and video, representation and compression of big data, image and video coding.

*- Dr. John Ball, Chair of the Signal Processing and Machine Learning Group*



Dr. John Ball



Dr. Jenny Du



Dr. James Fowler



Dr. Ali Gurbuz



Dr. Bo Tang



Dr. Junbo Zhao

# Electrical and Computer Engineering Graduate Coordinator

I am delighted to serve the ECE community in the capacity of Graduate Coordinator. The ECE graduate program is one of the largest graduate programs in the Bagley College of Engineering in terms of the number of graduate students enrolled and doctoral degrees offered. Fall 2020 enrollment consisted of 44 M.S. students and 82 Ph.D. students. About 40% of ECE graduate enrollment is via distance, and we offer the only distance Ph.D. program in ECE in the nation. Certainly, our graduate program faces the same challenges as many others in these unprecedented times. If you have any suggestions or concerns, please feel free to contact me at [du@ece.msstate.edu](mailto:du@ece.msstate.edu).

*- Dr. Jenny Du, ECE Graduate Coordinator*



Dr. Jenny Du



Congratulations to Dr. Du, the  
New ECE Graduate  
Coordinator!

# Electrical and Computer Engineering Undergraduate Coordinator

Fall 2020 has brought new challenges to undergraduate students, faculty and staff in the ECE Department, Mississippi State University and in higher education across America. Reduced classroom capacities and space constraints necessitated online learning for our undergraduate programs that previously did not have any online coursework. Motivation in the monotony of staring at a computer screen and connecting with classmates seem to be the biggest difficulties for undergraduate students. However, I'm proud to report that our faculty and students are rising to the occasion to continue their level of scholarship in these unprecedented times. I remain continuously impressed with the ECE faculty as they support undergraduate online learning in new ways, such as development of online laboratory work or checkout systems for lab equipment for students who medically cannot be on campus, recording lectures to be available before and after classes so that class time can be spent problem solving and discussing topics, and providing office hours at non-traditional times for student assistance. I believe that many adjustments that have been made during this time can and will improve programmatic impacts in the future, but I do look forward to a time when the halls of Simrall are filled with the buzz of student activity. If you have any suggestions or concerns, please feel

free to contact me at  
kylie@ece.msstate.edu.

*- Kylie Crosland, ECE Undergraduate  
Coordinator*



Kylie Crosland



# Q. and A. with ECE Undergraduate Student

## **Seth Barger**

### **Q: What made you choose Electrical and Computer Engineering?**

A: I chose ECE because I have a deep fascination with technology, and also because I already had programming experience from middle school and high school. I have been an amateur video game developer/hobbyist since I was 13 years old, and published an arcade game app for Android in my senior year of high school. Computer and electronics have enabled so many more innovations in our daily lives, and I want to be a part of it!

### **Q: Are there any groups and/or organizations that you are involved in?**

A: I am a member of the Engineering Honors Society, Tau Beta Pi.

### **Q: While being at MSU, have you received any awards and recognition?**

A: I am a Provost Scholar with the Shackouls Honor College. Also, I am a nominee for the Simrall Award in the Bagley College of Engineering from the Computer Engineering academic program. I studied abroad in France, during Summer 2017, where I took Engineering Economics.

### **Q: Have you completed any research?**

A: This semester I have not completed any research, since I am focusing on my undergraduate thesis, but the past three semesters I was part of Dr. Ali Gurbuz's team. During my time with them, I developed a software plugin for Blender 3D (an open source 3D software suite) to generate virtual radar data from an animation of a humanoid model. This tool was designed so large amounts of virtual

data could be generated into a deep learning algorithm to learn human motions and how to identify them using only radar signals. Also, with regards to my undergraduate honors research thesis, I am working on a volumetric display technology that I invented. I have made a functional prototype, and as soon as I have finished getting my patent pending filed, I will be sharing more details, and hopefully, I can hand off my design to people far smarter than myself to fully realize.

**Q: Have you completed a Co-Op or an internship?**

A: I did a Co-Op with Campaign Inc. in Starkville, MS. They are a tech company that does government contract work and some financial analysis using AI/ML algorithms. I got to work on Android apps and software libraries, which interact with military field sensors. I have also accepted a full-time position as a Junior Software Engineer, starting in January 2021!

*- Seth Barger, ECE Undergraduate Student*



Seth Barger  
Classification: Senior  
Major: Computer Engineering  
Degree: Bachelor of Science

# Q. and A. with ECE Graduate Student

## **Akansha Jain**

### **Q: What made you choose Electrical and Computer Engineering?**

A: When I was growing up, my dad and I worked on electrical projects at home. This sparked a desire in me to understand how machines work. To add to this, in the 9th grade, I worked on an electrical project at school that involved circuit analysis. I thoroughly enjoyed it! This project encouraged me to try out more science classes in high school and around my senior year, I decided to go into higher education majoring in electrical engineering.

### **Q: Are there any groups and/or organizations that you are involved in?**

A: I was involved with WECE (Women in ECE) and WIE (Women in Engineering). I am also a member of the IEEE group.

### **Q: While being at MSU, have you received any awards and recognition?**

A: I recently received an NSF Inter award. It provided me with an opportunity and funding to work with an organization for hands-on experience and current practical aspects of my research work (Organization: Entergy, Jackson, MS; USD 55000 approx.). Also, I received an ECE 2020 student travel grant. I received a scholarship from the BCoE/ECE at MSU to attend a three-part, instructor led online program with ASEE DELTA Future Faculty Institute.

**Q: Have you completed any research?**

A: I am currently working with Dr. Masoud Karimi-Ghartemani. My field of research is Power and Control Systems. I am currently studying the impact of Plugged in Electric Vehicles on distribution transformers and the possible solution to help reduce this impact. I have so far published a conference paper on this work in the ECCE 2020 (The Energy Conversion Congress and Exposition) conference.

**Q: Have you been to a conference or completed an internship?**

A: I have attended the 2020 ECCE conference. Also, I will be completing a six month internship with Entergy as a part of an NSF intern award. I am expected to start this internship in January 2021.

*- Akansha Jain, ECE Graduate Student*



Akansha Jain

Classification: Graduate

Major: Electrical and Computer  
Engineering

Degree: Doctor of Philosophy



# Electrical and Computer Engineering Alumni Spotlight

## Dr. Nashlie Sephus, Amazon

Dr. Nashlie Sephus, Amazon Applied Science Manager, currently lives in Atlanta, GA. She recently purchased twelve acres and seven buildings in the downtown area of her hometown of Jackson, MS. She “plans to bring a mixed-use development to the downtown district and thrust the city into becoming a tech-hub in the region.” Dr. Sephus has innovative ideas for the development, such as one building being an “...Arts and Innovation Station, which will serve as a hub for offices and coworking space...” In addition to this development, Dr. Sephus previously founded a non-profit organization in Jackson, The Bean Path. It has assisted in developing technical expertise in Mississippi. The ECE department applauds and spotlights the work of our 2007 graduate, Dr. Nashlie Sephus.

Dennis, Angela. "Amazon's Dr. Nashlie Sephus Buys 12 Acres for Black Tech-Hub in Jackson." *blackwithnochaser.com*. 21 Septmeber 2020. Web. 27 October 2020.

[https://blackwithnochaser.com/amazons-dr-nashlie-sephus-buys-12-acres-for-black-tech-hub-in-jackson/?fbclid=IwAR2ULCcYOQoEAWGLUCKcWm9epkScvwlI3wToe2EkIJsTYzcIpx\\_hwAEhLYw](https://blackwithnochaser.com/amazons-dr-nashlie-sephus-buys-12-acres-for-black-tech-hub-in-jackson/?fbclid=IwAR2ULCcYOQoEAWGLUCKcWm9epkScvwlI3wToe2EkIJsTYzcIpx_hwAEhLYw)

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**CONGRATULATIONS**  
to the Electrical and Computer  
Engineering Faculty and Students on all  
of their achievements!

The Fall 2020 semester has been filled with many challenges; however, the ECE Department worked diligently and successfully tackled the obstacles it encountered. Please visit the link:

<https://www.ece.msstate.edu/welcome/> to view all of the awards and achievements that our faculty and staff have received during the Fall 2020 semester!

The ECE Department is delighted to share our Fall 2020 newsletter. The purpose of this newsletter is to showcase student, faculty, and alumni achievements. In addition, we hope to provide updates on our students throughout the semester. Anyone who has something that he/she would like to showcase in the Spring 2020 newsletter, please contact Shelby Chaney, Editor in Chief, at [shelby@ece.msstate.edu](mailto:shelby@ece.msstate.edu).

*- Shelby Chaney, Administrative Assistant and EiC*



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KEEP IN TOUCH WITH THE ECE  
DEPARTMENT



# DONATIONS

Your giving helps the ECE Department to serve our students better. Donations help to enhance the quality of our academic and research programs. Your giving also allows ECE students to receive scholarships. We, the ECE Department, are grateful of your kind and generous support, and every donation is greatly appreciated!



If you would like to donate, please visit the link: <https://www.ece.msstate.edu/donate>



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