# **Engineering** Annual Report 2018–2019





# **Undergraduate demographics**

As of Fall 2017

Data on our 324 graduate students is on page 38







# The future of engineering is right here

A wealth of diversity among our students, research interests, cultures and contexts make an atmosphere that not only welcomes, but promotes thinking differently.

Why do I think we epitomize the future of engineering? Of the 150 top-ranked U.S. doctoral colleges of engineering we have the greatest diversity, the only one with both 20 percent African-American and 20 percent Hispanic undergraduates. Our racial and ethnic diversity is close to that of the U.S. population, not found in most engineering schools, but typical of the real-world environment where engineers work. We are also proud that our undergraduate female population exceeds 25 percent.

FAMU-FSU engineering students in senior design classes gain a unique opportunity to work in cross-cultural teams while experiencing the stimulating research environment and leading faculty of a top research university.

While sharing a powerful engineering education, students also take advantage of the unique environments at either Florida A&M University or Florida State University, depending on their choice of enrollment. (Students study engineering together at the college with shared classes and academic standards,

two partner universities).

universities.

I have just completed my second year as Dean of our remarkable and exciting college and am eager to share with you our progress and plans. Among our successes this year, we hired 11 new tenure-line faculty (of whom 10 are assistant professors) and another eight dedicated teaching faculty. This brings our total faculty size to 123. We also completed renovations on our existing buildings and received the State of Florida's approval for a needed expansion which we hope to begin in the coming years. We saw an increase in our annual



but get their degree from either of our

The U.S. Census Bureau estimates that by 2045 over half of the U.S. population will be today's minority groups. We are living the future of engineering at the FAMU-FSU College of Engineering, training people with hard and soft skills that will make them-and their companies—successful. All this comes as the result of our partnership, the only shared college of engineering in the nation, connecting two powerful external research expenditures in 2017 to \$25.5 million.

This book is organized to give you a snapshot of activities in each of our five departments, learn about our new faculty, and glimpse the success of our students and alums. And you can see some of the accomplishments of our outstanding people. For a quick summary of our research funding and productivity, see the inside back cover.

From Professor Tarik Dickens' additive manufacturing and 3D printing "for the masses" (page 25) to the varied contributions to the military and civilian aerospace industry that our faculty across disciplines provide (page 33), we are at the cutting edge of engineering innovation.

If you are interested in collaborating, attending, or visiting with us, please contact me.

J. MURRAY GIBSON, PH.D. Dean, College of Engineering dean@eng.famu.fsu.edu





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Biomedical imaging Cellular and tissue engineering Multi-scale theory, modeling and simulations Nanoscale science and engineering Plasma reaction engineering Polymers and complex fluids Renewable and advanced power production

# DEPARTMENT OF Chemical & Biomedical Engineering







# Diversity and advanced research power success of polymer team

Polymers are ubiquitous in our lives, but few realize they play a critical role in the batteries of the future and in the pressing global need for clean water. Assistant Professor of Chemical Engineering, Daniel Hallinan, Ph.D., at the FAMU-FSU College of Engineering is using nanostructured polymers to tailor material properties such as permeability and toughness to address these needs.

Nanostructure has dimensions on a scale that is a thousand times smaller than the width of a human hair. Because this scale is comparable to the size of large molecules or the motion of defects under stress, tailoring nanostructure can change important properties and make very useful materials. However, controlling the fixed structure of nanomaterials is not enough. We must also understand and control their dynamics—how their structure evolves in time—which is important for many of the relevant

Hallinan's work has focused on the structure and dynamics of materials for lithium batteries.

Performance of portable technologies from mobile phones to electric vehicles is currently limited by the energy density and lifetime of lithium batteries. Batteries experience a slow fade in the amount of energy they can store, which dictates the time between charges. Barring a catastrophic failure, their lifetime is defined as the point at which they reach 80 percent of initial capacity. This fade is dictated almost exclusively by undesirable side reactions occurring at the electrodeelectrolyte interfaces. Over time, the side reactions consume some of the capacity of the battery and form a thin layer of byproducts. The rate at which this occurs is determined by the properties of the thin layer. Therefore, expanding the limits of battery

technology requires *in-situ* detection of trace components at electrode-electrolyte interfaces.

By using gold nanoparticles ordered in monolayers, Hallinan's team realized they could provide a robust and reproducible substrate to enhance the detection of these trace components via Raman spectroscopy.

Batteries experience a slow fade ... this fade is dictated almost exclusively by undesirable side reactions at the electrode-electrolyte interfaces.

In a 2017 ACS Applied Materials & Interfaces article, entitled "Self-Assembly of Large Gold Nanoparticles for Surface-Enhanced Raman Spectroscopy," Hallinan and his coauthors outlined a simple and effective method for creating gold nanoparticle monolayers. This work was conducted at the FAMU-FSU College of Engineering, the National High Magnetic Field Laboratory, the Florida Center for Advanced Aero-Propulsion and with colleagues from Oak Ridge National Laboratory.

The applications of this work reach beyond gold nanoparticles. Hallinan expects the method to be insensitive to the nanoparticle material and size, meaning it could most likely be applied to nanostructural assembly of other 2D functional thin films. This study is expected to open a new avenue for designing and fabricating the next generation of optical sensors with unsurpassed sensitivity and specificity.

Hallinan's team recently won LG Chem's Battery Innovation Contest.

# Breaking Through Strokes



Samuel Grant, Ph.D. and Teng Ma. Ph.D. have received a \$1.7 million grant from the National Institutes of Health to find new treatments for stroke.

Grant is associate professor of Chemical and Biomedical Engineering and director of the MRI User program at the National High Magnetic Field Laboratory, and Ma is professor and chair of the Department of Chemical and **Biomedical Engineering.** They will investigate how to use cells from bone marrow and fat tissue as a way to treat what's called an ischemic stroke.

"Our long-term goal is to develop cell therapy technology for stroke treatment," Ma said. "Specifically, we will develop technology that allows us to produce therapeutically competent cells as well as the ability to monitor their fate in the brain. The knowledge gained will help establish cell therapy as a viable technology in stroke treatment."

Researchers will look at a type of cell called human mesenchymal stem cells that are found in both marrow and fat tissue. Grant and Ma believe that they can pre-treat these cells and deliver them into the brain of patients who have experienced a stroke.

"Use of these pre-conditioned cells should increase their therapeutic effect and viability once transplanted in the stroked brain," Ma said.

**Chemical & Biomedical Engineering** 



Gold nanoparticles (NP) are assembled in a monolayer at the electrode-electrolyte interface of a Li-ion battery, to reveal fading mechanisms by surface-enhanced Raman spectroscopy (SERS).

ACS Appl. Mater. Interfaces 9, 15, 13457-13470



The competition sought unconventional ideas that redefined the landscape of rechargeable batteries and addressed limitations related to power, energy, cost and safety. Hallinan's research team was selected to advance their efforts studying "Lithium Reactions in Solid Electrolytes that Resist Dendrites" and received an award of \$150,000. The prize-winning research could lead to improved materials that are useful in areas of energy sustainability for batteries, water treatment and other applications.

Research involving solid polymer electrolytes offers possible solutions for the lithium-ion batteries currently widely used in devices. Your cellphone or laptop batteries contain electrolytes composed of flammable, organic liquids. YouTube has numerous videos showing batteries catching fire and exploding after being abused. There are engineering controls to prevent these hazards but it would be preferable if batteries were inherently safe. One goal of this research is to make a safer, longer-lasting battery, by replacing the flammable liquids with nonflammable solids.

Hallinan's research efforts are enriched with a strong educational component that focuses on increasing diversity in long-term STEM careers.

"We are focused on training a diverse team of graduate and undergraduate students through their participation in advanced research and educational outreach," Hallinan said. "The project's educational goal of increasing diversity in polymer and engineering communities will begin on a local level but be designed for implementation nationally. Right now, we are working with several rising sophomores who design and perform hands-on demonstrations of our research, targeting middle school students. Educational research shows this kind of intervention helps middle schoolers not get lost in the STEM curriculum."

Hallinan has recently received two major awards totaling more than \$800,000 from the National Science Foundation to support his research. He received the NSF CAREER award which supports outstanding earlycareer faculty who have the potential to serve as academic role models in research and education.



# Tara Palin discovered engineering and a passion for change-making

Tara Palin was always interested in the medical field, and she began her college career as a biochemical major on the pre-medical route. However, throughout her time at FSU, she found herself excelling in and more drawn to her math classes. So, she decided to change her major to chemical and biomedical engineering.

"This major allowed me to continue enhancing my math skills, while still being able to make an impact in the field of medicine," the senior said.

Recently, Palin and her research partner, Scott Boebinger, were awarded the Mark and Nancy Casper

# Cordell Hardy leads innovation

neering

polymer processing.

When he first joined 3M, he worked in the Consumer Business Group, first as a product developer for consumer adhesives and tapes, then in various management roles within the company.

An active participant and national speaker in STEM encouragement programs, Hardy deeply enjoys mentoring relationships and participates in many, both formally and informally. He has been involved with Jason Learning, North Star STEM Alliance, National Society of Black Engineers, The Discovery Education/3M Young Scientist Challenge, and most recently FIRST Tech Challenge, a robotics competition.

Hillis Endowment for Undergraduate Research to conduct research on Alzheimer's Disease at the National High Magnetic Field Laboratory.

Working under Samuel C. Grant, Ph.D., Palin worked to find a relationship between the decrease of connectivity and the increased presence of plaques in the brain. The loss of connectivity could be used as an early biomarker for Alzheimer's Disease. They also studied the suitability of Diffusion Tensor Imaging scans as a diagnostic tool for Alzheimer's. "Tara was very enthusiastic in the lab, and she had no qualms about putting in the long hours needed to perform research," Grant said. "She demonstrated not only excitement for the work but also is skilled in both the acquisitions and data processing needed in research."

Palin's diverse experiences gave her confidence to know what she wants to do with her future and begin the next chapter in her life.

Cordell Hardy, Ph.D. is the Technical Director for 3M Commercial Solutions Division (CSD), a group responsible for products enhancing some of the world's leading brands. He earned a B.S. at the FAMU-FSU College of Engineering through FAMU in 1998, and a Ph.D. from the University of Minnesota in 2003, both in chemical engi-

At 3M, Hardy and his team develop graphic and architectural films for advertising and decoration, as well as cleaning and surface finish solutions for floors, glass, and food service. He is responsible for leading a large organization of researchers in the U.S., Japan, Germany, Brazil, Singapore, and numerous other countries to offer compelling brand, sustainability and productivity solutions to commercial markets. Owing to the diversity of products offered by CSD, his work involves an appropriate technical grasp of adhesives, films, optics, imaging, abrasives, surface chemistry and advanced

Hardy points to the college as a springboard for his career and his passion for enriching others. "My time at the college was an inflection point in many ways, both personally and professionally," he said. "Not only did I get a top-notch education-which I can confidently assert with years of experience as a successful R&D manager-I did so in a social and cultural landscape like none other in the world. My years as a student at the "E-building" were a precious gift, and an education platform supporting many aspects of my life even today."



# student profile

# Department Awards

YAN LI, PH.D., Associate Professor, has been awarded a five-year NSF grant "CAREER: Engineering Brainregion-specific Organoids Derived from Human Stem Cells," for a total of \$501,345.

DANIEL HALLINAN, PH.D., Assistant Professor. has been awarded a five-year NSF grant entitled "CAREER: Dynamics in Nanostructured Polymer Materials," for a total of \$540,704.

The NSF Faculty Early Career Development (CAREER) Program offers the National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations.

BRUCE R. LOCKE, PH.D., Distinguished Research Professor, earned a Fulbright U.S. Scholar Program grant to the Czech Republic for the 2017-2018 academic year. Locke conducted research at the Institute of Plasma Physics in Prague. His goal is to advance the science and engineering of plasma processes used in a range of chemical, environmental and biomedical fields.

**Chemical & Biomedical Engineering** 

# Investing in the future through new chemical and biomedical engineering faculty hires



Jamel Ali, Ph.D. Assistant Professor

Ph.D., Mechanical Engineering Drexel University

PREVIOUSLY: Chief Technology Officer, *Acrogenic* Technologies Inc., Postdoctoral Fellow, Southern Methodist University/Drexel University

**RESEARCH INTERESTS:** Micro/nanobiorobotics and biomaterials for bio/biomedical applications.

"My research is focused on harnessing biological nanomaterials for actuation, sensing and transport applications. The facilities, personnel and equipment within the FAMU-FSU College of Engineering and National High Magnetic Field Laboratory present a unique environment to develop an interdisciplinary research program. I look forward to working with a diverse group of students and faculty."



**Christina Holmes, Ph.D. Assistant Professor** 

MASc, Ph.D., Biomedical Engineering McGill University

PREVIOUSLY: Postdoctoral Research Fellow, Johns Hopkins University School of Medicine, Department of Neurosurgery

**BESEARCH INTERESTS:** Biomaterials, tissue engineering, regenerative medicine, nanocarriers for drug and gene delivery.

"My research aims to control the delivery of nanotherapeutics carrying a range of bioactive factors (proteins, nucleic acids, drugs) through materials-based approaches, with an emphasis on surface modification strategies. I am excited to be joining the Department of Chemical and Biomedical Engineering at FAMU-FSU as it expands its programs. I look forward to being part of such a diverse and vibrant academic community and helping it continue to grow."





# 'Super practical' research advances innovations in concrete bridge design

n her 12 years at the FAMU-FSU College of Engineering, Associate Professor and Associate Dean for Student Services and Undergraduate Affairs Michelle Rambo-Roddenberry, Ph.D., P.E. has served as the principal investigator on 20 contracts and grants totaling about \$2.25 million. Her work is primarily funded by the Florida Department of Transportation (FDOT), through their Research Center or from flow-through funds from the Federal Highway Administration (FHWA).

Roddenberry's research focuses on concrete and bridge engineeringparticularly analysis, design, testing, and construction of prestressed concrete bridges. Her current projects are related to accelerated bridge construction and the use of innovative materials and construction methods.

Over the years, her research has resulted in the development and implementation of standards and practices that are new to Florida and, often, to the industry nationwide.

"New materials and methods need to be proven through construction and testing," she said, so that challenges can be overcome before adopting new standards for widespread use. "FDOT has a strong research program, and they are prudent to rigorously investigate before implementation.

"It is rewarding to see my research get implemented to help designers and improve infrastructure," Roddenberry said. Ultimately, her research serves the public because it's about designing and building bridges better. Her work helps bridges have longer service life with less maintenance required. This reduces life-cycle costs.

For example, Florida's demanding natural environment means that bridges reinforced with steel rebar and prestressing strands are susceptible to corrosion and deterioration, especially when exposed to salt water, Roddenberry said.

One of her research projects, the West Halls River Road bridge replacement—located in Citrus County on Florida's west coast—is being constructed completely with noncorrosive materials and is the first of its kind in the state and perhaps the nation. The replacement bridge is being built using several novel materials, including beams made in a similar fashion as fiberglass boats, and concrete piles and walls prestressed with carbon fiber reinforced polymer strands.

Roddenberry's collaboration with FDOT has resulted in the acceptance of standards and practices that are new to Florida and to the industry nationwide.

Roddenberry and her team are tasked with documenting and analyzing methods and structural behavior at the off-site precast yard and at the bridge construction site. The \$6.2 million construction project will be completed soon.

of girders in the future.

"The goal is for bridges to last longer," she said. In a side study, some

Roddenberry's most recentlyawarded FDOT project is to test the use of stainless-steel strands as prestressing for precast concrete bridge girders. The girders also will be reinforced with stainless-steel or glass fiber polymer reinforcing bars, and her team will compare their behavior to girders reinforced with conventional steel. Her research team will design the girders, instrument them, and test them at the precast yard and in the lab. They will provide guidelines for the design and construction of these types

of the girders will be constructed with lightweight concrete, which, "once proven as a viable material for use by FDOT, will help to extend the span ranges of beam types—in other words, we will be able to achieve longer spans with the same volume of concrete."

Roddenberry also is involved in an FDOT project to replace four bridges in Northwest Florida's Gadsden County as part of FHWA's Accelerated Bridge Construction initiative. The bridge incorporates prefabricated precast deck panels and bent caps, neither of which is used in typical bridge construction. The goal is to improve quality and constructibility, while reducing onsite construction time, risk to construction workers, and impact on the traveling public.

She has monitored construction of the bridges, as well as precast activities, noting the processes and challenges encountered. Her team, alongside FDOT, also performed load tests on the constructed bridges, and analyzed the data to check for structural deterioration. In addition, they performed several crack inspections.

"It has been a learning process for everyone—FDOT, designers, builders, and researchers-which will help with future projects.

"I enjoy the field work," she said, "especially when it is coupled with analysis and design aspects."

And for good reason. For seven years before joining the faculty at the FAMU-FSU College of Engineering in 2006, Roddenberry was a bridge engineer for two major bridge design firms, Figg Engineering Group, Inc. and Corven Engineering. She worked on the design or load rating of complex bridges including the Sunshine Skyway cable-stayed bridge in Tampa, Florida; the Seven-Mile Bridge in the Florida Keys; the \$930-million, 8.7 miles of bridge structures that connect the JFK Airport to expressways in New York

#### **Civil & Environmental Engineering**



# Predicting climate change adaptability

Gang Chen, Ph.D., P.E., professor of civil and environmental engineering, is exploring how changes people make to the land through farming and development affect the planet's climate. He received a \$1.18 million grant from the U.S. Department of Agriculture to examine this larger question of how to keep the Earth sustainable for generations to come.

"For example, how does deforestation affect the amount of rain in an area? How can you adapt areas that are prone to flood? These are major challenges," Chen said.

Researchers hope answering questions like these may also aid a long-term goal of the project, which is to enhance the resilience of the food supply chain, while minimizing negative environmental, social and economic impacts.

To tackle this problem, Chen will lead a team of experts throughout the country, including Aavudai Anandhi Swamy, Ph.D., an assistant professor of agricultural and biological systems engineering at Florida A&M University. He also will work with environmental engineers, agricultural and biological system engineers, chemists, economists and forestry experts to collectively address this complex issue.

The results of his work will serve as input for Swamy's vulnerability model. The USDA plans to use the model to guide federal and local decision-making with regard to urban and agricultural areas.

City; and over five miles of bridge structures constructed in the median of the Lee Roy Selmon Expressway in Tampa, Florida.

As a designer, she worked alongside other bridge designers, drafters and site inspectors, and "I learned a lot from their perspectives," she said. "As a professor, I try to translate that experience to my teaching and research."

Roddenberry teaches undergraduate- and graduate-level structural engineering courses

including concrete design, bridge engineering, advanced structural analysis, and prestressed concrete.

She is recipient of several local, state, and national awards. For example, she received the Distinguished Service Award from the National Council of Examiners for Engineering and Surveying (NCEES) Southern Zone, was Engineering Faculty Member of the Year for the Florida Engineering Society (FES) in 2010 and 2017, and was Engineer of the Year for the American Society of

"New materials and methods need to be proven through construction and testing. FDOT has a strong research program, and they are prudent to rigorously investigate before implementation."

-MICHELLE RAMBO-RODDENBERRY, PH.D., P.E.

Civil Engineers (ASCE) Tallahassee branch in 2010 and 2013.

She also contributes to the engineering profession in a variety of ways, particularly on licensure issues and connecting professional practice with education. She is active in NCEES, the Order of the Engineer, ASCE and the ABET Boards of Delegates. She recently finished over six years of service to the Florida Board of Professional Engineers, to which she was appointed by Gov. Rick Scott in 2012.

Roddenberry's interest in engineering began in high school.

"It was really math that I loved" and, ever practical, she decided to apply it to engineering.

She earned her bachelor's and master's degrees in Civil Engineering from Florida State University, and holds a doctorate from Virginia Tech.

Roddenberry said she was sometimes the only female-or one of very few—in her engineering classes. Today, she is delighted to see women represent up to 40 percent of students in the classes she teaches.

As a faculty member, Roddenberry takes to heart her responsibilities in teaching, research, and service, and she strives to balance all three. "I want the triad," she said.

About taking on her new administrative role as the Associate Dean for Student Services and Undergraduate Affairs, Roddenberry is enthusiastic.

"I enjoy helping the next generation of engineers find success at the college and in life," she said. "I guess I'm building bridges of a different kind."



# Computing a safer world

While working toward his Ph.D. at the FAMU-FSU College of Engineering, Cezary Bojanowski served as a research assistant at the Crashworthiness and Impact Analysis Laboratory at the college, where he worked on several government-funded projects that led to the development of a new safety standard adopted by FDOT entitled, "Crash and Safety Testing Standard for Paratransit Buses Acquired by the State of Florida." Since 2009 Bojanowski has been working as an engineer at the Transportation Research and Analysis Computing Center (TRACC), a part of Argonne National Laboratory. He



# David Perez works to clean water for India

David Perez wanted to study a field that was challenging, rewarding and had great job prospects. He found that and more as a civil engineering student.

Perez, a native of Homestead, Florida near Miami, graduated as a civil engineer at the end of the Spring 2018 semester. Immediately, he enrolled as a graduate student, pursuing a Ph.D. in the field that ignited his passion for making the lives of real people better and safer.

His main research interest is water remediation and allocation. As an undergraduate, he worked on a pilot project treating contaminated water for families in an impoverished part of India. The project began as a 10-week partnership with the Indian Social Service Institute in Pudikkottai, where he aimed to bring safe drinking water to the families of the children at the institute.

"Civil and environmental engineering gave me a unique perspective on how nature and infrastructure co-exist," he says. "I always wanted to have a career that concentrated on sustainability." As an undergraduate, Perez was part of the Undergraduate Research Opportunity Program. This helped form his

participated in and led many projects that use a computational mechanics approach to analyze transportation-related problems. Most recently Bojanowski has been a contributor to the work on conversion of U.S. High Performance Research Reactors using Highly Enriched Uranium (HEU) to Low Enriched Uranium (LEU) fuel.

He believes his time at the college prepared him well for a future in high-impact research. "Studying engineering is not about obtaining a list of step-by-step recipes for solving engineering problems," he explains. "It's about acquiring a set of skills that will allow you to approach even the most challenging problems with confidence and curiosity at the same time. I think that these skills are what the college offers its students."

> future aspirations. After his Ph.D. study, he hopes to continue his research at a university or national lab.

Perez was recently awarded the McKnight Doctoral Fellowship and was selected as an Associate GEM Fellow. He is recipient of a FAMU-FSU Engineering Dean's Fellows award, which provides an additional \$8,000 in funding for four years and a departmental graduate assistantship.

"At FAMU-FSU Engineering, I was able to participate in research projects that took me abroad and allowed me to conduct research at national labsand to present those results across the country," he explains. "It's the partnership between the two universities that makes it a special place."

# Department Awards

#### REN MOSES, PH.D., P.E.,

received the Best Paper Presentation Award for his paper "Clustering Traffic Congestion Using Mixture of Regression: Exploring the Traffic Occupancy and Speed Relationship" (co-authored by Emmanuel Kidando, Ph.D., Yassir Abdelrazig, Ph.D., and Eren Ozguven, Ph.D.), published in the International Journal of Civil and Environmental Engineering. The award was presented at the 19th International Conference on Innovative Urban Design and Traffic Management in Dubai, United Arab Emirates.

#### **CLAYTON CLARK, PH.D.,**

**P.E.** was honored with the 2017-2018 Research Excellence Award by Florida A&M University.

#### **MICHELLE RAMBO-RODDENBERRY, PH.D.,**

P.E., was elected Fellow of the American Society of Civil Engineers and given the 2017 Distinguished Service Award by the National Council of Examiners for Engineering and Surveying.

#### **MAXIM DULEBENETS,**

PH.D., P.E., received the 2018 Emerald Literati Highly Commended Award for the article entitled "A Novel Continuous Berth Scheduling Model at Multiple Marine Container Terminals with Tidal Considerations," published in Maritime Business Review with co-authors Ali Dadashi, Mihalis Golias, and Abdolreza Sheikholeslami.

**Civil & Environmental Engineering** 

# Investing in the future through new civil and environmental engineering faculty hires



#### Juyeong Choi, Ph.D., Assistant Professor

Ph.D., Civil Engineering Purdue University

#### **RESEARCH INTERESTS:** Capital rehabilitation planning, project management, infrastructure planning for sustainability and resiliency.

"My research focuses on community resilience to natural disasters through infrastructure planning. The Department of Civil & Environmental Engineering at the FAMU-FSU College of Engineering provides a vibrant and interdisciplinary research environment to address urgent urban issues, while the state of Florida is a perfect place for studying infrastructure resiliency. I am thrilled to work with my new colleagues and students."



Sean Martin, M.S. **Professor of Practice** 

M.S., Civil Engineering Florida State University

#### **RESEARCH INTERESTS:** Professional engineering practice, ethics, structural and wind engineering.

Mr. Martin has more than 24 years of experience in private industry. He is a registered professional engineer in Florida, Georgia, Mississippi, Louisiana, Arkansas, Kentucky, Pennsylvania, and Virginia and is a Special Inspector of Threshold Buildings. Martin is certified by the Structural Engineering Certification Board and is certified as LEED AP BD+C.

"I'm so excited to teach here and to have this opportunity to bring my professional experience into the classroom to help today's students transition into tomorrow's design professionals."





# Beyond the traditional battery, research pushes the limits of what's possible

C cientists would study electricity  $\bigcirc$  for 100 years before discovering in the mid-18th century how to actually store a charge in a Leyden Jar-what Ben Franklin came to describe in his experimentations as a "battery." Battery technology has been improving steadily in the 250 years since, but has seen a surge of new research activity in the last few decades because of the limitations of batteries for 21st century needs. The rate of improvement has been relatively slow, at least when compared with the electronics revolution, not just because of the relative lack of research until recently, but also because of the need to overcome some fundamental physical challenges. Jim Zheng, Ph.D., and his colleagues have deployed some revolutionary materials technologies to innovate smaller, lighter, safer, longerlasting and more powerful batteries. The Sprint Eminent Scholar Chair in Electrical and Computer Engineering at the FAMU-FSU College of Engineering has focused on moving the research beyond just the theoretical to the marketable. He has created companies and patented elements of batteries and capacitors that are revolutionizing energy storage now and will continue to in the future. "Energy storage has been around for a long, long time-for our flashlight, and later the vehicle with one battery for the starter," Zheng explained. "People didn't pay much attention to storage until the personal computer came out, and later the cell phone. There's not enough energy for those to last for even one day, so you have to carry the charge cable." With practical applications in mind, he has to have deep knowledge of all the aspects of many different

In a computer, for example, the goal is to create batteries that are more

lightweight while reducing their size. However, the high energy density storage also brings new problems safety and flammability have become serious challenges.

The size of a battery for energy storage isn't really a concern for, say, a utility generating power using windmills. "They don't care how big the device is because they have plenty of land. The footprint is not important," he said. "What they are most sensitive to is the price."

And then there are vehicles.

The rate of improvement in battery technology has been relatively slow, at least when compared with the electronics revolution, not just because of the relative lack of research until recently, but because of the need to overcome some fundamental physical challenges.

"The future direction for transportation will be electric vehicles ... our future depends on renewable energy," he predicted. "Electric vehicles can reduce air pollution, CO<sub>2</sub> emissions, and have better performance than internal combustion engines (the world's fastest acceleration record is held by electric vehicles)."

With limitations on weight and size, current vehicle batteries, "are not so good yet," he said.

Today, cost is not as much of a factor since some consumers are willing to pay a premium with the cachet of,



# Considering cyber-physical vulnerability

The Internet of Things, or IoT, is auickly becoming one of the least understood yet ubiquitous ideas in modern life.

From public utilities to refrigerators, the world of "smart devices" is upon us. But in the digital age, how do you keep any of these systems-from activity trackers to satellites-secure?

Cyber-physical systems include any physical device or equipment "connected" to a computer, be it on the same table or hundreds of thousands of miles away.

And while creating these systems happened very, very fast, they were envisioned, designed and deployed without much regard to security.

In 2015-2016, an electric utility system in Ukraine was attacked with malware and the result was an hours-long blackout. Hackers and malicious insiders are always on the lookout for ways to leverage and exploit these "smart systems," that may be very functional yet protected so fragilely.

Researchers at the FAMU-FSU College of Engineering are working to secure critical infrastructure. Their projects touch most every part of our daily lives, including electric transmission, transportation, medicine, personal devices and more.

In 2018, Lichun Li, Ph.D., and Harrys Konstantinou, Ph.D., joined our faculty to continue this important work alongside Ming Yu, Ph.D.

**Electrical & Computer Engineering** 

say, a Tesla. But power density—how fast the battery can be recharged—and cycle lifetime—how many times the battery can be recharged—are key.

Zheng said he is "a little bit different from other researchers because I place more emphasis on entrepreneurship ... to make a device that you sell on the market."

He is founder of a Tallahasseebased company that makes lithium-ion capacitors, a technology developed at the FAMU-FSU College of Engineering. The company, General Capacitor, secured an exclusive license from Florida State University to manufacture the product. "Basically, it is a faster-charging battery," he said.

Normally, a battery recharges over a period of several tens of minutes to an hour. "With the lithium-ion capacitor, you can charge it within seconds," Zheng said, "Right now it is mostly used for military and space applications."

Such capacitors have made the new generation of hand-held radios safer and easier for soldiers in the field. When transmitting data over long distances, "you need tremendous power," he said. "The battery cannot provide this kind of power, but a capacitor can give more than 10 times the power of a battery, so they are able to transmit the signal to their colleague or commander to get supplies or report their location." Recently, Zheng's group has further explored a new technology: an ultra-high density hybrid energy storage device which integrates the strengths of the lithium-ion battery and the lithium-ion capacitor into a single unit, that could have multiple uses for the military. Such a new hybrid device could be employed on a number of different platforms (for example, in micro-grids for the Army; on ships for the Navy; and on aircraft and spacecraft for the Air Force). Zheng further believes development of a new hybrid energy storage module would also provide the benefits of this new, unique system—lighter, more powerful, longer life, and with less weight and wider temperature rangesto many others in critical new and



advanced technological areas.

Zheng is working to create batteries for different commercial applications. In the medical field, for example, there is a focus on creating portable medical devices such as MRI or CT scanners that could be taken to a patient's room.

"You cannot have the huge power needed reach the hospital room, so we need an energy storage device to power the portable scanners," Zheng said. "A lot of companies work on the scanner but they have problems on energy. They may use our technology to implement their designs for the next-generation medical devices."

Robots are another application for increased energy storage, currently mostly for industrial production lines, but the innovator envisions them in homes in the future. "Robots will be dominating our life sooner or later," he said.

Before joining the College faculty 21 years ago, Zheng worked for the U.S. Army Research Laboratory for five years. He has been awarded 18 patents, including breakthrough technology using carbon nanotubes that created a more commercially viable fuel cell by reducing the need for expensive platinum.

He also has been awarded numerous research grants from governmental agencies such as the National Science Foundation, NASA, the Department of Energy and the Department of Defense totaling more than \$10 million as principal investigator and \$50 million as co-principal investigator. His impact has been recognized by his election as a fellow of the National Academy of Inventors.



Newly-developed hybrid cell technology: (left) Jim Zheng, Ph.D., developed a highenergy battery and high-power capacitor that are integrated internally into a single device (internal hybrid).



# Engineering better education

In some engineering courses, students struggle with basic, fundamental from government. Pamidi will concepts that impact their understanding and success rate in subsequent represent academia. classes. These "foundational knowledge gaps" (i.e. prerequisite knowledge gaps) may negatively impact a student's development as a professional engineer. In one of her engineering education research projects, associate professor Shonda Bernadin, Ph.D., investigated a way to accurately measure foundational knowledge and identify knowledge gaps in the learning process using the Evidence-Centered Design (ECD) approach. ECD is a structured method based on Bayesian inference networks which is used to develop assessment tasks that accurately measure student proficiency or understanding based on "inference-by-observation." Professor Bernadin has applied ECD successfully to a signal processing course. She uses research like this to optimize engineering education and design a better learning experience for students - and better outcomes for academic engineering institutions.

# Department Awards

#### HUI "HELEN" LI, PH.D.,

was elevated to the prestigious Institute of Electrical & Electromagnetic Engineers (IEEE) Fellow in 2018. She was elected for her contributions to bidirectional converters for utility applications and high efficiency photovoltaic converters.

#### SHONDA BERNADIN,

PH.D., received the 2017 Insight Into Diversity Inspiring Leader in STEM award from Insight into Diversity magazine.

## The research group of SASTRY PAMIDI,

**PH.D.**, won the "Best Superconducting Materials Paper" award at the 2017 Cryogenic Engineering Conference and International Cryogenic Materials Conference for their research on "Temperature dependence of critical current and transport current losses of 4 mm YBCO coated conductors manufactured using nonmagnetic substrate."

PAMIDI also was elected to the Cryogenic Engineering Conference (CEC) Board. The conference attendees elect one member from academia. one from industry and one

# Dallas Perkins, Ph.D. heads to **General Atomics**

Dallas Perkins' family owns an electrical contracting business in Tallahassee, and he spent a lot of time around that environment growing up.

His Ph.D. in electrical engineering, though, wasn't something he pursued to carry on the family business.

"I spent most of my summers and school breaks on job sites...," he explained. "We always worked off plans developed by engineers and I gravitated more towards that skill set."

Perkins recently accepted a position at General Atomics in California as a software controls engineer in the Electromagnetic Systems division.

"The college provided me with the resources and support to pursue my goal of becoming an electrical engineer

and ultimately completing my Ph.D.," he said. "As a doctoral candidate I had the opportunity to work with some of the best and brightest current and future engineers in the Electrical and Computer Engineering Department and the Center for Advanced Power Systems."

His dissertation on distributed adaptive droop control for power management in DC distribution systems was an intense area of interest for him with significant application potential.

"I was able to take basic mathematical algorithms and apply them to an actual system that could be used in both terrestrial and naval applications," Perkins explained. "This is applicable in a variety of industries for controlling the integration of renewable energy sources into a microgrid or meeting the advanced load demands presented on future naval ship power systems."



# Hubie Payne is a man on fire

Hubert (Hubie) Payne is the vice president and manager of Analog Engineering Operations for Texas Instruments (TI) Incorporated. He earned a B.S. at the FAMU-FSU College of Engineering through FSU in 1997. As an executive and leader driving innovation and effective technical solutions, he heads a global team responsible for providing engineering support and for driving down production costs across tens of thousands of integrated circuits.

Payne is a popular speaker, frequently discussing STEM, diversity and the importance of corporate culture. He travels around the globe, leading teams in Germany, Malaysia, the Philippines, Taiwan, India, China, and the U.S.

Payne's passion for inspiring young people into STEM careers was ignited during his time at FAMU-FSU College of Engineering.

"An excellent technical education was made more meaningful by the culture at the college," he said. "With two great universities invested in creating diverse teams focused on solving complex problems, I was able to transition quickly when I began working. I have the pleasure of working with great engineers from all over the world, and was able to jump in and make an impact early because of my experience at FAMU-FSU Engineering."

His dedication in mentoring and diversity is reflected in his work with the next generation of engineers. He serves as the executive sponsor of FAMU-FSU Engineering recruiting, board member of the college's Electrical and Computer Engineering Department, and sits on the board of SMU's Mechanical Engineering department. Within TI, he is the executive sponsor of BEST Robotics, executive sponsor of two diversity initiative teams: the Veterans Initiative and the Black Employee Initiative, is a board member of TI's Political Action Committee and visits college campuses regularly as a TI university recruiting and steering team member.

## **NEW FACULTY**

#### **Olugbenga Moses** Anubi, Ph.D. Assistant Professor

Ph.D., Electrical Engineering University of Florida

PREVIOUSLY: Control Systems Engineer, GE Global Research; Postdoctoral Scholar, UC Davis

**RESEARCH INTERESTS: Resilient.** robust and adaptive control systems, vehicle dynamics and control, real-time optimization, robotics

"I love to improve/maintain performance, robustness and resiliency of systems through controls. The Department of Electrical & Computer Engineering at the FAMU-FSU College of Engineering is an excellent, fertile environment to root and grow my research. I am very excited to work with my new colleagues and students!"

#### Harrys Konstantinou. Ph.D. Assistant Professor

Ph.D., Electrical Engineering New York University

PREVIOUSLY: Distribution Engineer, Consolidated Edison

**RESEARCH INTERESTS: Cyber**physical systems security and resilience, smart grid and industrial control systems

"The electric power grid is unique in that it supports all other critical infrastructure and key resource sectors. As the backbone of critical infrastructure domains, it is imperative that we find effective ways of securing existing systems and develop new methods for building secure systems able to increase operational efficiency and reliability. The Department of Electrical & Computer Engineering at the FAMU-FSU College of Engineering is an excellent environment to support my research. I cannot

imagine a better place to continue growing as an engineer and educator. I'm really excited for this new chapter!"

Yuan Li, Ph.D. **Assistant Professor** 

Ph.D., Electrical Engineering Wuhan University, China

University

**RESEARCH INTERESTS: Photovoltaic** inverter, impedance converter, solar power generation forecast

"My research pursues clean power so that we can make the world a better place to live. I am excited to work in the 'Sunshine State' and study smart ways of using renewable energy sources. I am looking forward to working with my new colleagues and students at the Center for Advanced Power Systems and in the Department of Electrical & Computer Engineering."

## Jinyeong Moon, Ph.D. Assistant Professor

Ph.D., Electrical Engineering and Computer Science Massachusetts Institute of Technology

PREVIOUSLY: Technical Engineer, Maxim Integrated; Postdoctoral Associate, Massachusetts Institute of Technology; Senior Research Engineer, SK Hynix Semiconductor

**RESEARCH INTERESTS: Modeling**, design, analysis and measurement in the fields of power conversion, energy harvesting, electromagnetics

"I would like to contribute to a more energy/power-efficient environment with finer sensing and control. The Department of Electrical & Computer Engineering at the FAMU-FSU College of Engineering and the Center for Advanced Power Systems have excellent resources to support my research. I'm truly excited to collaborate with colleagues."

alumn

profile

PREVIOUSLY: Visiting Associate Professor, Northeastern University; Associate Professor, Sichuan University; Visiting Scholar, Michigan State









#### **Electrical & Computer Engineering**



Distinguished Professor of Engineering

## Fang Peng, Ph.D. POWER ELECTRONICS

Joined the faculty of the FAMU-FSU College of Engineering Fall 2018

## Fang Z. Peng, Ph.D. is an

expert in power conversion technology for electric utility applications as well as hybrid electric vehicles. Most recently he was the director of the Power Electronics and Motor Drives Laboratory at Michigan State University (MSU), which boasted a low-voltage (three-phase 480 V) lab and a medium-voltage (three-phase 13,800 V) lab for conducting research, development and testing of power converters, inverters and motor drives.

Peng joins the FAMU-FSU College of Engineering, Department of Electrical and Computer Engineering as a Distinguished Professor of Engineering. His main research lab will

#### be at the Center for Advanced Power Systems (CAPS).

"FAMU-FSU College of Engineering is a rising star and the Center for Advanced Power Systems is the strongest research group in my field," he said. "I am excited to be a part of the family and look forward to working with my new colleagues."

Peng received a bachelor's degree from Wuhan University in China (1983), and M.S. (1987) and Ph.D. (1990) degrees from Nagaoka University of Technology in Japan, all in electrical engineering. Before his post at MSU, he was the lead scientist for the Power Electronics and Electric Machinery Research Center at Oak Ridge National Laboratory in Tennessee.

Peng is a fellow of the Institute of Electrical and Electronics Engineers (IEEE) and an IEEE Distinguished Lecturer, traveling the U.S. and internationally to speak on power electronics, motor drives, hybrid electric vehicles, and renewable energy interface systems.

His awards include the IEEE Industry Applications Society's Gerald Kliman Innovator Award (2013), which recognizes noted innovators for their technical contributions. Other honors include best papers for the IEEE Industry Applications Society in 2011 and 2010.

At MSU, he was recognized with the University Distinguished Faculty Award and the Withrow Distinguished Junior Scholar Award.

"We are very excited to have Dr. Peng at our college and at CAPS," said Sastry Pamidi, Ph.D., chair of electrical and computer engineering and associate director of CAPS. "Peng's innovative research and significant collaborative relationships with the electrical power industry complement the strengths of existing faculty and the outstanding power systems research facilities we have at CAPS. This will allow the college to produce groundbreaking science, expand external funding, and strengthen our undergraduate and graduate programs."



# DEPARTMENT OF Industrial & Manufacturing Engineering



Applied optimization

Healthcare engineering

Materials development

Materials manufacturing & applications

Systems engineering



# Engineering the ultra-personalized products of the future

Professor Tarik Dickens' proprietary DeXter<sup>™</sup> robot is an additive manufacturing (AM) prototype utilizing multiple Selective Compliance Assembly Robot Arms (SCARA) in a compact and modular environment in order to print materials simultaneously. What it boils down to is actually very simple: Two is better than one. Currently, the standard for 3D printing is one arm laying down material layer by layer to build a product. DeXter<sup>™</sup> has two robotic arms—its name comes from "ambidextrous"—working simultaneously which, at the very least, can halve the time it would take to construct a part. Dickens sees other possibilities, however, including integrating two or more different materials in a build or having one arm picking and placing components while the other builds the matrix that will

"The market for 3D printing is ever expanding," said Dickens, an assistant professor at the FAMU-FSU College of Engineering. "A couple of years ago it was only a billion dollars. This year it's going to reach \$5 billion, over the next five or 10 years we're talking about approaching \$20 billion, so many companies are investing a lot of

"The next market of the future is personalization. Basically, everybody's going to want their own personalized everything. From their shoes to maybe even their car," he continued. "We've already seen it for prosthetics (another area of research for FAMU-FSU Engineering). Everybody has a different body shape, different body conditions, so we need to be able to meet their

Dickens has an entrepreneurial bent that dates back to his doctoral days in the college's High-Performance Materials Institute/Industrial

and Manufacturing Engineering department, when he developed novel techniques currently under patent protection. He has also secured awards for his research from the NSF and NASA totaling more than \$3 million.

His vision for DeXter<sup>™</sup> doesn't go to infinity and beyond. Mars, however, is a distinct possibility.

"The market for 3D printing is ever expanding. This year it's going to reach \$5 billion, over the next five or 10 years we're talking about approaching \$20 billion" - TARIK DICKENS, PH.D.

"We want to go to Mars in 20 or 30 years, so that means we're going to have to send manufacturing elements ahead of time to build some of the habitats before we send human beings,' he predicted. "Maybe ... you will send a manufacturing robot that's able to move on its own and able to think on its own so all you do is say 'Hey, here's the design for XYZ habitat, go mine in the field on Mars and start producing it.' We're kind of building the initial infrastructure and exploring best options to make this possible."

More down-to-earth, he also sees opportunities for advancement in medicine.

"Bioprinting is seen as potentially having tremendous benefits to human health while also being very lucrative. Say we're printing out a heart to transplant into your body," he said. "With the second printer we can start





In search of the next dimension: (Clockwise from top): Graduate student Arriana Nwodu works with the DeXter<sup>™</sup> platform in the High Performance Materials laboratory that houses Professor Tarik Dickens' team; This Spring 2018 undergraduate senior design team designed an autonomous platform for DeXter<sup>™</sup> that allows for manufacturing capabilities with the system even with strict constraints; Dickens and two of his graduate students, Jolie Frketic and Marguese Pollard, discuss the science behind the apparatus.



to integrate some circuitry with other biocompatible materials and place the cells where they need to be."

Dickens' industrial-sized lab was originally funded by grants from the Department of Defense and previous research focused on creating carbon fiber structures used in drone technology. He envisions uses for additive manufacturing in the military.

Dickens gives one example:

"The Department of Defense aims to use additive manufacturing as an agile strategy to make products in the field," he said. "Say you wanted to have a wrench and ship it from here to an overseas base. The part could be designed digitally and the 'e-blueprint' sent over where it can be manufactured on-site. It not only saves money and time, but the need to store and transport parts."

These are exciting but still early days for Dickens and his graduate researchers, Jolie Frketic and Arriana Nwodu, who are on the cusp of taking 3D printers from a hobbyist novelty to a scaled-up manufacturing process.

One of DeXter<sup>™</sup>'s challenges is discovering ways to keep the two arms from colliding as they work together. Another is developing the precision required when the nozzles are extruding material. Current commercial printers can get as low as 100 microns, but Dickens said, "we were actually able to get to about 1 micron."

An optimal process would include multiple arms working on one project, with the use of Artificial Intelligence so DeXter<sup>™</sup> can decide what functions each arm would perform and in what order.

"We come at it from two different perspectives," he continued. "One is a pure materials perspective because we're trying to synthesize new materials to put into the 3D printing. That would be for the future. The other thing is ... how do we take 3D printing and integrate it into the manufacturing system so any small or medium enterprise can come in and utilize it to create products and services?"

Last year, Dickens and a group of co-principal investigators and faculty garnered a prestigious Centers of Research Excellence in Science and

Technology (CREST) grant from the National Science Foundation (NSF) to support a new Center for Complex Materials Design for Multidimensional Additive Processing (CoManD) Center, specifically to advance this research and fund graduate students in underrepresented minority groups interested in this technology. This award followed a complementary NSF Research Infrastructure in Science and Technology (RISE) grant led by Dickens in 2017.

The research group also has received grants from NSF and the Air Force Research Laboratory for internships to train the next generation of industrial engineers. Many of the students in the 2018 class of 15 minority students focused on additive manufacturing during their 10-weeklong NSF Research Experience for Undergraduates (REU) program. While REUs are a way to introduce potential graduate students to additive manufacturing research, Dickens has secured competitive grants to extend the reach all the way down to middle and high school students by "gamifying" DeXter<sup>™</sup>. In 2017, REU students helped create a scaleddown, simple SCARA that requires players to cooperate using controllers to manipulate two robotic arms at the same time to build a pyramid. The takeaway? "Two can get the job done faster than one, while it also teaches the students about DeXter<sup>™</sup>'s algorithms—like which combination of space can this arm take that will also optimize the amount of space that the other arm can take," explained Nwodu. "They're developing intuition without

even knowing it and that's the way you want it."

In the summer of 2018, Nwodu and Frketic spent several weeks working to explain the game and teach the concepts of additive manufacturing to a group of local teachers in an NSF RET (Research Experience for Teachers) program. It is expected they will bring the game—and the scientific concepts behind it—to their classrooms during the next school year.

# U.S. Navy propels new master's degree program

In early 2018, Dean Murray Gibson announced a new Systems Engineering degree offering for FAMU-FSU Engineering. Systems engineering (SE) is an interdisciplinary field of engineering that focuses on how to design and manage complex engineering systems over their life cycles. The new engineering program integrates engineering disciplines with industrial and management practices.

Through the program students will develop highly-valued skills required in the national workforce and the technology-driven global economy.

Because of the college's unique association to Florida State University, we are able to offer this program at both our Tallahassee campus and at the FSU-Panama City campus in Northwest Florida.

"This new program came to FSU Panama City because of the strong demand from local industry and support from the FAMU-FSU College of Engineering," FSU Panama City Dean Randy Hanna said. "With community partners, such as the Navy base, Tyndall Air Force Base and GKN Aerospace, our students will have unlimited options."

FSU Panama City and the FAMU-FSU College of Engineering developed the program with support from the Naval Surface Warfare Center Panama City Division.

# Rebekah Sweat, **Research Scientist** at Solvay

Rebekah (Downes) Sweat received her Ph.D. through FSU at the FAMU-FSU Engineering Department of Industrial and Manufacturing Engineering. Her graduate work, sponsored by Solvay (formerly known as Cytec) and the close relationship with their scientists culminated in the development of a scalable process for aligning carbon nanotube sheets for incorporation

in structural and multifunctional composites—and a job at the company.

Her role as a research scientist at Solvay in the Composite Materials Global Business Unit includes experimental and computational micromechanics. The materials that she advances have applications in the aerospace, automotive and the oil and gas industries. She is a passionate STEM mentor and trainer for industry and academic researchers. She credits her time at the college and her many mentors, including Richard Liang, Ph.D., Arda Vanli, Ph.D., John Taylor and Ayou Hao, Ph.D., for her passion.

# Sophia Hawkins wants to change her world

"My goal is to work for a company and make processes more efficient to reduce the use of natural resources and the generation of waste.3

Sophia Hawkins has always known she wanted to be an engineer. From an early age, she liked math and science, and the elementary schools she attended had a decidedly engineering-centric bent.

She also knew-from early onthat she wanted to somehow positively affect the environment.

**28** FAMU-FSU ENGINEERING

"I found it very interesting to learn in my materials classes about the structure of metals and plastics and their everyday applications," she said. "One of the more concerning aspects is our growing use of plastics contrasted with our limited resources for recycling them."

The rising senior from Sarasota, Florida is excited about the opportunities-and the challenges-that engineering both creates and attempts to solve.

She was an intern at Northrop Grumman last summer and one thing she realized was, "engineering is a ticket to do almost anything."

While Hawkins is narrowing in this year on her specific career goals, she's already decided that helping the Earth and developing innovative materials

"The team of faculty at the FAMU-FSU College of Engineering does not simply teach the subject matter of engineering; they inspired me to a life of curiosity," Sweat said.



# student profile

based on natural resources excite her.

She's been a peer leader during her time at the college, serving as vice president for the Society of Women Engineers (SWE) chapter. With her help, the young women have worked hard to develop a group truly inclusive for students from both FAMU and FSU.

Hawkins is a recipient of the Southern Scholarship Foundation's housing award, and she is actively involved in her university's spirit, philanthropic and sports groups.

"My time here has been one of tremendous personal and academic growth," she said. "I've grown as a leader and learned what I'm passionate about from students and faculty from diverse backgrounds.'

Investing in the future through new industrial and manufacturing engineering faculty hires



PREVIOUSLY:

of Maryland

Lichun Li, Ph.D. Assistant Professor

Ph.D., Electrical Engineering University of Notre Dame

#### PREVIOUSLY:

Postdoctoral Fellow, University of Illinois at Urbana-Champaign and Georgia Institute of Technology

**RESEARCH INTERESTS:** Security of cyber-physical systems, game theory

"My goal is to design secure, resilient, and efficient networked systems mainly using game theory and control theory. The Industrial and Manufacturing Engineering Department at FAMU-FSU Engineering provides me an excellent environment to support my research. I am very excited to work with my colleagues and students."

"My research narrows the gap between the research community and the practitioners' world, through the application of mathematical modeling and optimization methods, to improve the operations and management of complex systems, particularly multi-modal transportation systems. I am amazed by the fantastic research environment at FAMU-FSU Engineering. I hope to facilitate passenger and freight movements through my unique research."



#### Yanshuo Sun, Ph.D. Assistant Professor

Ph.D., Civil Engineering University of Maryland

Research Scientist, National Transportation Center, University

**RESEARCH INTERESTS:** Smart cities, freight and logistics, shared mobility, air transportation, public transit, transportation economics

# Department Awards

AYOU HAO, PH.D., was one of the seven winners of the 2018 Society for the Advancement of Material and Process Engineering (SAMPE) Young Professionals Emerging Leadership Award.

Two graduate students working with **RICHARD** LIANG, PH.D. recently won awards for their research presentations. **JOSHUA DEGRAFF'S** presentation of his work "Low-Profile and Printable Carbon Nanotube Buckypaper Strain Gauges in Structural Health Monitoring" won first place for the best in the University Research Symposium Ph.D. category. Degraff's prize includes an expenses-paid trip to attend the SAMPE Europe Conference in September held in Southampton, UK. **NAM NGUYEN** was awarded third place for his presentation on "In-Situ Curing and Out-Of-Autoclave of Interply Carbon

Fiber/Carbon Nanotube Buckypaper Hybrid **Composites Using Electrical** Current."

#### In the same category, graduate student CHELSEA **ARMBRISTER'S**

presentation on "Characterization of Triboluminescent Enhanced **Glass Fiber Composites** Manufactured via Displaced Foam Dispersion Technique" received an Honorable Mention. Armbrister works with **OKENWA OKOLI**, PH.D.



#### **THE HIGH-PERFORMANCE MATERIALS INSTITUTE (HPMI)**

is a multidisciplinary research institute affiliated with the FAMU-FSU College of Engineering. HPMI occupies one of four Florida State University (FSU) research buildings dedicated to engineering research. The center strives to recruit, develop and retain top-quality faculty and staff who will develop HPMI into a center of excellence for research and education in the field of advanced materials.

Over the last several years, HPMI has proven a number of technology concepts that have the potential to narrow the gap between research and practical applications of nanotube-based materials. These technologies include auxetic foams, alignment of nanotubes, fabrication of nanotube membranes or buckypapers, production of nanotube composites, modeling of nanotube-epoxy interaction at the molecular level, and characterization of single-walled nanotube nanocomposites for mechanical properties, electrical conductivity, thermal management, radiation shielding and electromagnetic

attenuation. HPMI personnel also established Florida's first National Science Foundation (NSF) Industry/University Cooperative Research Center (IUCRC).

HPMI and FAMU-FSU Engineering recently kicked off a project with NASA that is focused on developing material entities to be used in space travel. The project is part of a five-year plan by NASA to establish the first-ever Space Technology Research Institutes (STRI), which includes one on bioengineering and one on materials synthesis.

In addition to conducting numerous projects sponsored by the National Science Foundation over the years, HPMI has worked with most military research centers, including Air Force Research Labs, Air Force Office of Scientific Research, Army Research Lab and Office of Naval Research. HPMI has also worked with other industrial entities including Boeing, General Dynamics, Lockheed Martin, and Ravtheon.

HPMI is located in the 45,000square-foot Materials Research Building, adjacent to the FAMU-FSU College of Engineering.

#### **CREST CREATED BY NSF GRANT**

Engineering professors garnered a prestigious Centers of Research Excellence in Science and Technology (CREST) grant from the National Science Foundation to support the Center for Complex Materials Design for Multidimensional Additive Processing (also known as the CoManD Center). The project has labs at HPMI.

CoManD is led by director Subramanian Ramakrishnan, Ph.D, professor in FAMU-FSU Engineering Department of Chemical and Biomedical Engineering; associate director Tarik J. Dickens, Ph.D., assistant professor in the Department of Industrial and Manufacturing Engineering; and assistant director Mandip Sachdeva, Ph.D., professor and section leader for pharmaceutics activity at Florida A&M College of Pharmacy. Co-principal investigators and faculty involved in the center's diverse projects include FAMU professors Nelly Mateeva, Ph.D. (chemistry), Satyanrayanan Dev, Ph.D. (biological systems engineering), Daniel Hallinan, Ph.D. (FAMU-FSU chemical engineering), Charles Weatherford, Ph.D. (physics), and Komalavalli Thirunavukuarasu, Ph.D. (physics).

The \$5 million, five-year grant promotes research and graduate education in manufacturing at the micrometer scale. These developments will be important to a number of applications such as in vitro 3D tumor models for biological applications, electromagnetic radiation shielding materials for aerospace applications and nanostructured photovoltaic devices for energy applications. Project collaborators include Florida State University, Harvard University, MIT, Army Research Labs and Air Force Research Labs.

(Below, left to right): Co-principal investigators Ramakrishnan, Dickens, Sachdeva.







As the federal space shuttle program was winding down, Florida movers and shakers sought a way to continue to develop cutting-edge technology in aerospace and aviation. Florida aimed to maintain its leadership role in space exploration—that it held for decades through NASA Kennedy, while also training the next generation of scientists and engineers at the state's leading universities.

Aeronautical University.

And in its 10-year history, it's mission accomplished-and mission still continuing—at the Florida Center for Advanced Aero-Propulsion (FCAAP). "FCAAP is becoming nationally

Engineering.

# Empowered by space exploration, aerospace research takes off

In 2008, a team led by the researchers at the FAMU-FSU College of Engineering responded to the call by the Florida Legislature to establish Centers of Excellence. Their proposal was ranked second out of 40-plus submissions and provided seed money to establish a multiinstitution Center of Excellence led by and headquartered at the FAMU-FSU College of Engineering. Faculty, scientists and students at this Center collaborate with colleagues based at the University of Florida, the University of Central Florida and Embry-Riddle

and internationally known as an excellent place for research," said Lou Cattafesta, Ph.D., director of the center and an Eminent Scholar and professor at the FAMU-FSU College of

The initial \$11 million investment from the state offered the opportunity to build a 60,000-square-foot facilitythe Aero-propulsion, Mechatronics and Energy Center—from the ground up, "which doesn't usually happen in an academic setting," he said. The facility houses FCAAP, 14 faculty and nearly 50 graduate students from multiple disciplines who work in state-of-the art

testing facilities and labs. You will be hard pressed to find another facility of its caliber in its areas of focus—at any university.

Just in the past year, FCAAP has received 32 new grants and has more than \$7.8 million in annual research awards. The center has 28 collaborations with other institutions and 27 with private industry.

One point of pride is the more than \$6 million Polysonic Wind Tunnel, which can be used for tests with speeds ranging from Mach 0.2 (around 150 mph, the speed of a high-performance car) to Mach 5—five times the speed of sound!

"Thanks to our unique talent and facilities, we have assembled a leading national effort to advance high-speed transport research."

- FARRUKH ALVI, PH.D.

Other research tools found at the Center include an Anechoic High Temperature Jet Facility (which can generate supersonic jets at temperatures over 2000°F), Subsonic and Supersonic Wind Tunnels, a STOVL (Short Take-Off Vertical Landing) Jet Facility and a Computational Physics Laboratory.

The facilities are used by researchers and graduate students, as well as visiting scientists from government agencies, aerospace companies and collaborators from around the nation and the world.

"What we have is people with unique expertise coupled with equally unique facilities," said Farrukh Alvi,

Ph.D., an Eminent Scholar and professor who was director of FCAAP from its genesis until Cattafesta took the helm in 2017. "Thanks to our unique talent and facilities, we have assembled a leading national effort to advance highspeed transport research."

Cattafesta's research focuses on examining the possibility of a return to commercial supersonic flight. Introduced in 1976, the Concorde flew passengers at Mach 2, but the pricean average of \$12,000 round-trip for 100 passengers-the massive amount

of fuel it used, and the limitations imposed because of sonic boom ended the era in 2003.

"The technology is there to build a much more economical and quieter airplane," he said. "A supersonic civil transport would be really cool. Fly to London in a couple of hours—and hopefully at a price that's pretty much what you pay for coach now." The plan, "is to make this viable—you're talking about a 300-passenger airplane-that we all can afford to go on."

Resident researchers cover a



## Quantum computing a new fuel cell?

The Cummins, Inc. Professorship in Engineering, appointed through the FAMU-FSU College of Engineering since 2016, was recently awarded to William Oates, Ph.D., professor in Mechanical Engineering with a lab in the Aeropropulsion, Mechatronics and Energy (AME) center. The endowment is funded through engine manufacturer and energy powerhouse Cummins, Inc.

Engineering dean J. Murray Gibson said Oates' nomination and appointment comes "in recognition of [his] exemplary leadership, outstanding record of research accomplishment with a sustained upward trajectory, and contribution to engineering education and career development." The Dean also noted Oates' success in raising funds from Cummins, Inc. to forward his pioneering work in the field of quantum computing.

Cummins, Inc. is interested in Oates' research to advance the design of new fuel cell technology-which he aims to improve using quantum machine learning and quantum linear algebra. While quantum computing is still in its infancy, Cummins, Inc. granted \$300,000 to support research in this area.

"This is quite an honor and a privilege," Oates said. Referencing the pedigree of Cummins, Inc., he then went on to add: "Growing up with a father who was a diesel mechanic his whole career makes this one particularly special.'

multitude of disciplines. While others are reaching for the sky, Professor Neda Yaghoobian's research pretty much keeps her feet on the ground.

"In general, my work studies the thermal-fluid dynamic interactions at the interface of the Earth and the lower atmosphere," said Yaghoobian, who recently joined the faculty as an assistant professor. The "fluid" she usually works with is air—our atmosphere. "The problems that could be studied are pollution dispersion in urban areas, air quality, human health and comfort, energy use and energy harvesting."

A recent analysis discussed how the air flow over the trees and terrain affected the trajectory of a golf ball, but her work and that of her colleague Kourosh Shoele, Ph.D., has other important real-world applications.

For example, with information about the strength and direction of a hurricane's winds and the locations of natural and structural features, the duo could predict where damage is likely to occur and thereby help communities better plan and respond to extreme weather events.

Shoele, another recent addition to the faculty, uses computational techniques to study, among other things, how air interacts with the structure of aircraft wings with a goal of making them lighter and more flexible. While his computer is key, the assistant professor also spends time observing animals, including birds, insects and fish.

"The interesting thing about natural species is that each one uses a particular kind of motion and each one uses its own 'best' way to fly," he explained. "They learn through years and years of evolution how to do things the perfect way."

The goal, he said, is not to create an airplane that recreates the flight of an eagle.

"We need to learn from those biological systems, to see what we need to take and what parts we can ignore in our engineering design," said Shoele. "In many cases people try to mimic what they see in biology,



"A supersonic civil transport would be really cool. Fly to London in a couple hoursand hopefully at a price that's pretty much what you pay for coach now." The plan, "is to make this viable-you're talking about a 300-passenger airplanethat we all can afford."

- LOU CATTAFESTA, PH.D.

but as an engineer you never mimic, you just learn from them and use those principles to design the system according to your needs. That's what I'm looking for."

Nature can inspire revolutionary improvements. In industry, innovation can be stifled by manufacturers limiting already exists.

"Sometimes during this process, you end up with a product that is doing the job, but it doesn't do it efficiently. It doesn't do it with minimal fuel use or just does what people want to see," Schoele said. "I think part of my job is to break this barrier." And if there's resistance to change? "That's the whole point of being in academia. You need to do something that excites people. Show them a better alternative from what they always

practice."

Associate professor Rajan Kumar, Ph.D., focuses on subjects that fly much faster and higher than today's jets. "Right now in the nation, whether it's Air Force, Army or Navy, they all have hypersonic programs—anything which goes above Mach 4-5," he said. "It is happening and that's where the next 10 or 15 years of research will be. We are ready for that. We have the Polysonic Wind Tunnel that can reach

Kourosh Shoele, Ph.D. (left) and Neda Yaghoobian, Ph.D., use computational techniques to study how air interacts with structures and how wind disperses pollutants.

to incremental improvements on what

those speeds, (and) we are building the necessary tools to explore aerodynamics in this flight regime. As an example, we are collaborating with the Air Force, enabling their next-generation hypersonic air vehicles.

"Because we have these unique tools and facilities, a number of major aerospace companies like Lockheed Martin, Boeing and Northrop Grumman come to us for their testing needs on a regular basis and we are working with a number of other commercial companies to build the next generation airplanes," he continued.

While innovation gets attention, educating the next generation of aeroscientists is always on the minds of our faculty. "All those graduate students that work in our facilities, they get trained in the most advanced test and diagnostics," said Kumar. "They find jobs very quickly because they are trained in the right areas with the right skills."

# Ebony Luster innovates for others

Some lucky children discover their career path very early in life. Ebony Luster, a senior in mechanical engineering at the FAMU-FSU College of Engineering, discovered her passion at the age of 11.

"I will never forget the moment that my team at 'Girls Experiencing Engineering Camp' won first place for designing the cheapest and most efficient solar-powered vehicle," Luster remembers. "After that camp, I was certain of what I wanted to becomean engineer."

The Memphis native pursued her dream throughout school and enrolled at Florida A&M University as an engineering major, but she chose her discipline because of its potential to help others.

She chose mechanical engineering "after reading about students who were designing robotic arms to improve the lives of child amputees and children with limb disabilities." Luster savs.

To this day, materials science intrigues her. After her Spring 2019 graduation, Luster plans to pursue a Ph.D. in industrial engineering, with a focus on materials and devices for prosthetics.

During a Diversity in Research and Engineering of Advanced Materials Training (DREAM) internship, Luster worked on a project related to composite materials.

"The study gave me the chance to take all of the skills and knowledge I've learned over the years and apply them to something that could directly impact people's lives," she says.

Transforming materials into something useful, observing the failure behaviors of composite structures, and using that data to come up with new ideas to improve that performanceand people's lives-is what Luster loves.



"This has been the most challenging—and rewarding—journey I've ever taken in my life," she says.

# From here to Guinness and beyond

Asegun Henry, Ph.D. recently joined the Massachusetts Institute of Technology (MIT) as an associate professor in mechanical engineering. He graduated from Florida A&M University in mechanical engineering through our college and then went on to earn both his M.S. and Ph.D. in the same field from MIT. Henry began his academic career as an assistant professor at the Woodruff School of Mechanical Engineering at Georgia Tech in 2012.

Henry's research focused on developing high-thermal conductivity polymers, based on theoretical insights gained from molecular dynamics simulations. Prior to his post at Georgia Tech, he worked as a postdoc in the materials theory group at Oak Ridge National Laboratory (ORNL) developing an approach to predict the thermal conductivity of materials from first principles.

After ORNL, he then went on to work as a postdoc in the materials science department at Northwestern University. After that experience, he was a fellow in the Advanced Research Projects Agency-Energy, where he focused on identifying new program areas such as higher-efficiency and lower-cost energy capture, conversion and storage.

Henry developed the highest temperature pump for a record 1.200°C (1.473 K), which is now in the Guinness Book of World Records. This technological breakthrough opened the door for many new high-temperature energy system concepts, including methane cracking for CO<sub>2</sub>-free hydrogen production and a new cost-competitive approach to grid-level energy storage.

"People used to often ask me if I felt adequately prepared by FAMU to succeed at MIT. My answer was always yes. I would say FAMU did more to prepare me to succeed at MIT than I think MIT could have done."



# Enhancing robotics research with new faculty and equipment

#### **Christian Hubicki,** Ph.D. Assistant Professor

Ph.D., Robotics & Mechanical Engineering Oregon State University

#### PREVIOUSLY: Postdoctoral Fellow, Oregon State University and Georgia Institute

of Technology; Control Design Consultant, SRI International

**RESEARCH INTERESTS:** Robotics, bi-pedal locomotion, optimal control methods, biomechanical modeling.

"I aim to control legged robots to be as fast, maneuverable, and

stable as animals in the wild. The faculty and students here at the FAMU-FSU College of Engineering provide an enthusiasm and breadth of expertise that beautifully complement my robotics work. I am thrilled to start working with all my new colleagues and am excited to see what we will accomplish together."





# Faculty Awards

#### LOU CATTAFESTA, PH.D.,

was named an American Physical Society Fellow, recognizing his exceptional contributions to the physics enterprise. The fellowship is a distinct honor signifying recognition by one's professional peers.

#### WILLIAM OATES, PH.D.,

was named the Cummins, Inc. Professor in Engineering through an endowment to the Florida State University Foundation.

#### KUNIHIKO (SAM) TAIRA,

PH.D., received the 2017-2018 FSU Developing Scholar Award from the Florida State University Office of Research.

#### **STEVEN VAN SCIVER.**

PH.D., won the 2017 Samuel C. Collins Award at the Cryogenic Engineering Conference.

## **CHENGYING (CHERYL)**

XU, PH.D. received the Florida State University Office of Commercialization's GAP Commercialization Grant in 2017 for her proposal of an "In Situ Temperature and Strain Sensor in Ultra-High Temperature and Harsh Environment."



# **Graduate student demographics**

As of Fall 2017

**324** Graduate students









# Investing now to create the graduate students of the future

inding graduate students is an increasingly difficult endeavor for academia. Perhaps not struggling as much as other disciplines, engineering faculty still find it hard to recruit students who are perhaps not aware of the opportunities and earning potential that a graduate degree brings to private and academic research positions.

At the Center for Advanced Power Systems (CAPS), our engineering faculty have created a new way to integrate-and hopefully propelundergraduates' research and future graduate studies.

Sastry Pamidi, Ph.D., chair of the electrical and computer engineering department at the FAMU-FSU College of Engineering envisioned with his

colleagues a new way to immerse promising undergraduates in the work of their center.

undergraduate classes."

The program complements the undergraduate programs already in place, such as NSF's Research Experiences for Undergraduates (REU), but provides a way for promising undergraduates to have an extended research role.

About 10 years ago, the engineering faculty at the college that

"We integrate the students directly into the ongoing faculty research," he explains. "Normally undergraduates don't get this type of experience because these labs are not used in courses and the material isn't necessarily taught in

were affiliated with CAPS designed a valuable opportunity for undergraduate students. Each semester, approximately 10 undergraduate students are selected to undertake research at CAPS, right along with the world-class faculty at the renowned lab.

These students are from the electrical and computer, mechanical and chemical engineering departments, and the majority of them are paid assistantships. For up to 10 paid hours per week, the students are able to work on a variety of research projects in the fields of electric power systems, renewable energy, power electronics, superconducting power systems, high voltage engineering, energy conversion systems, modeling & simulation and cyber-physical security.

"The main thing is although many students have good skills, they think research is beyond their reach," Pamidi explains. "If they work with us, they see it is attainable once they are motivated and willing to work on difficult problems."

The work they do is real. Undergraduates can work on ongoing research projects as part of the established research teams at CAPS consisting of their advising professor, full-time research scientists, postdoctoral researchers and graduate students. Through their work, the students are exposed to advanced research equipment and state-of-the-art simulation platforms. As they contribute to the research project, there is the potential for them to earn co-authorships on research publications.

Getting into a CAPS undergraduate assistantship isn't easy: only about 30 percent of applicants are accepted for a coveted six to 10 slots. But of those, Pamidi has seen 90 percent go on to graduate school. In total, about 100 students have matriculated through the program, with some staying as long as two years at CAPS.

Pamidi and his colleagues see a clear advantage to investing this way in undergraduates. "We are always seeking good graduate students. We want to increase the number in Ph.D. programs, and this allows us to increase the number in the pool. And, we know from our own experience that they will do very well."

# **Investing in innovative teaching** and a commitment to student success with dedicated teaching faculty hires

We are delighted to welcome four new full-time teaching faculty at FAMU-FSU Engineering in Tallahassee. In recent years our number of full-time dedicated teaching faculty has grown to 17-a trend seen nationwide. These nontraditional faculty are freed of the responsibilities for research and service of tenure-line professors, and are a critical source of teaching, mentoring and educational innovation for our college.

# **NEW TEACHING** FACULTY



Mohd Yousuf Ali, Ph.D. Teaching Faculty

Mechanical Engineering Ph.D., Florida State

University

PREVIOUSLY: Assistant Professor of Practice, Syracuse University; Postdoctoral Research Associate, Ohio State University; Adjunct Assistant Professor, Florida Center for Advanced Aero-Propulsion (FCAAP)



Beth Gray, M.S. Teaching Faculty Industrial & Manufacturing Engineering

M.S., Ohio State University

PREVIOUSLY: Industrial Engineer, Canon Solutions America, Inc., Senior Industrial Engineer, Kyklos Bearing International; Senior Quality Engineer, Delphi; Senior Industrial Engineer, General Motors



**Scott Rowe**, Ph.D. **Teaching Faculty** Chemical & Biomedical Engineering

Ph.D., University of Colorado, Boulder

PREVIOUSLY:

Process Control Instructor, University of Colorado at Boulder; Controls Engineer, University of Colorado; Co-Founder, BigBlueTech.com; Process Engineer, Process Science Technology Center



Oscar Chuy, Jr., Ph.D. **Teaching Faculty** 

Electrical & Computer Engineering

Ph.D., Tohoku University, Japan

#### PREVIOUSLY:

Assistant Professor, University of West Florida; Postdoctoral Research Associate, FAMU-FSU College of Engineering



# Welcome three new faculty at the FSU

Panama City campus

Florida State University has a campus in Panama City, Florida where the FAMU-FSU College of Engineering offers bachelor's degrees in civil and environmental, electrical and computer, and mechanical engineering. This year, we launched a master's in Systems Engineering degree program, developed in partnership with the Naval Surface Warfare Center in Panama City. Three new faculty hires add to the existing six.



**NEW FACULTY** 

#### Azize Akcayoglu, Ph.D. Teaching Faculty Mechanical Engineering

Ph.D., Cukurova University Turkey

#### PREVIOUSLY:

Associate Professor, Mersin University, Turkey; Adjunct Faculty, Penn State University; Adjunct Faculty, University of North Texas





**Damion Dunlap.** Ph.D. Teaching Faculty Mechanical Engineering

Ph.D., Florida State University

PREVIOUSLY: Program Executive Office Unmanned & Small Combatants (PEO USC) Science & Technology Lead for Mine Warfare, Naval Surface Warfare Center Panama City Division



Daniel Georgiadis, Ph.D. **Teaching Faculty** Systems Engineering

Ph.D., George Washington University

PREVIOUSLY: Professor of Systems Engineering, George Washington University; Chief Technology Officer, Hepburn and Sons LLC; Supervisory Acquisition Manager, Program Executive Office Submarines, Undersea Defensive Warfare Systems

Contributing to the advancement of science and engineering **Selected Faculty Publications** 

Here is a sampling of our published research. Overall, faculty published more than 300 papers in peerreviewed journals last year. Almost all are co-authored with students.



Sangroniz, L., Cabvallo, D., Santamaria, A., Muller, A. J., & Alamo, R. G. (2017). Thermorheologically complex selfseeded melts of propylene-ethylene copolymers. Macromolecules. 50 (2), 642-651.



Dadashi, A., Dulebenets, M. A., Golias, M. M., & Sheikholeslami, A. (2017). A novel continuous berth scheduling model at multiple marine container terminals with tidal considerations. Maritime Business Review. 2 (2), 142-157. INDUSTRIAL ELECTRONICS





Tsai, A.C., Liu, Y., Yuan, X., Chella, R., & Ma, T. (2017). Aggregation kinetics of human mesenchymal stem cells under wave motion. Biotechnology Journal. 12(5), 1600448.



Tang, Y. and Liu, H. (2017). Modeling multidimensional and multispecies biofilms in porous media. Biotechnology and Bioengineering. 114 (8), 1679-1687.



Zhang, Q., Bahadur, D., Dufresne, E. M., Grybos, P., Kmon, P., Leheny, R., Maj, P., Narayanan, S., Szczygiel, R., Ramakrishnan, S., & Sandy, A. (2017). Universal scaling of quench-dependent dynamics in intermediate concentration colloidal gels. Physical Review Letters. 119 (17), 178006.



Cao, W. J., Warfield, M., Lu, J. F., Yan, J., Chen, X. J., Brandt, W., Lewis, D., Yturriage, S. R., Moye, D. G., & Zheng, J. (2017). High performance Li-ion capacitor laminate cells with hard carbon/lithium stripes negative electrodes. Journal of The Electrochemical Society. 164, A93-A98.



Chou, S. Y., Ma, R., Li, Y., Zhao, F., Kwing, T., Yu, Z., & Pei, Q. (2017). **Transparent** perovskite light-emitting touchresponsive device. ACS Nano. 11 (11), 11368-11375.



Parent, L. R., Bakalis, E., Ramírez-Hernández, A., Kammeyer, J. K., Park, C., Pablo, J. D., Zerbetto, F., Patterson, J. P., & Gianneschi, N. C. (2017). Directly observing micelle fusion and growth in solution by liquid-cell transmission electron microscopy. Journal of the American Chemical Society. 139 (47), 17140-17151.





DeGraff, J., Liang, Z., Le, M. Q., Capsal, J.F., Ganet, F., Cottinet, & P. J. (2017). Printable low-cost and flexible carbon nanotube buckypaper motion sensors. Materials and Design. 133, 47-53.



Kim, S. (Nat. High Magn. Field Lab., Florida State Univ., Tallahassee, FL, United States), Hahn, S., Kim, K., & Larbalestier, D. (2017). Method for generating linear current-field characteristics and eliminating charging delay in no-insulation superconducting magnets. Superconductor Science and

Technology. 30 (3), 035020.



Worden, T.J., Singh, C. & Alvi, F.S. (2017). Supersonic jet impingement on a model-scale jet blast deflector. AIAA Journal. 55 (8), 2522-2536.

# Research, innovation and graduate recruitment on a fast upward trajectory



his summer marked the first anniversary of the establishment of a dedicated Office of Research and Graduate Studies as well as my first year as Associate Dean. We have made substantial gains increasing our research productivity and planted the seeds for even greater growth. With these gains, we are positioned to be the leading doctoral institution for the diverse engineering workforce of the future.

We are deploying an enhanced online delivery of graduate courses as part of our overall strategy for offering robust online Master of Science and certificate programs. These build upon the strengths of our education programs and unique research capabilities and aim to better address the need for a highly trained workforce—regionally in the Florida Panhandle with its concentration of military installations—as well as nationally and globally. As an example, this year we launched our MS in Systems Engineering, in collaboration with the Panama City campus, because our industry partners were hungry for this program. Enrollment has already exceeded our optimistic projections.

Research productivity has increased

'We've made considerable qualified students with an emphasis on recruiting and graduating minority students and the results are very promising."

notably and our annual external expenditures have grown to more than \$25 million. This represents a nearly 15 percent increase over last year. Growth was fueled by important successes of our faculty who have landed multi-million-dollar research programs in advanced power systems, environmental engineering and land use, human health, advanced composites for space exploration and aerospace and aviation, to name a few.

In the area of additive manufacturing, our NSF CREST grant brings opportunities for innovation and more graduate student funding for underrepresented minorities—an important area that will greatly benefit from this boost.

The strategic research initiatives our faculty collectively identified for future growth are now in the next phase. Advanced, distributed power systems and cyber-physical systems security are two related strategic areas where we have hired five of the 11 new faculty: four in

electrical and computer engineering and one in our industrial and manufacturing engineering department. We are making similar investments in additive multiscale manufacturing, including biomaterials and in next generation of air and transport systems. Two faculty have already been hired in the former and two to three are planned for the latter. We look forward as our investments in people and facilities in these areas lead to strong, nationally recognized programs and hopefully a national center such as an NSF Engineering Research Center in the near future.

The immersion of our graduate students in the study of challenging fundamental and applied problems is a critical part of graduate education. The relationship is highly symbioticchallenging research problems attract curious and motivated students who help find answers, which in turn leads to resources for the study of even more challenging problems AND result in insights and advances to society's benefit.

In terms of graduate productivity, this has been a banner year: we graduated a total of 32 Ph.Ds, out of which 31 percent were women and minority. Recruiting highly qualified and motivated graduate students is an integral part of our growth strategy where we have made substantive investments. This spring, the College of Engineering Graduate Weekend was a resounding success where nearly 50 percent of the attendees enrolled in our graduate program. Efforts like these resulted in a nearly 30 percent increase in minority student Ph.D. enrollment. We will continue to refine and expand upon the success of our recruitment efforts.

As you flipped through these pages, you saw stories that represent some of these accomplishments. We hope they encourage you to learn about and engage more with the FAMU-FSU College of Engineering, whether you are a proud alumnus, a prospective student, a research collaborator, a member of the community or in industry.

# 2018 Engineering research by the numbers



\*Numbers are approximate as of July 31, 2018; FY 2018: July 1, 2017 - June 30, 2018



**Sponsored Research** Expenditures



FY 2018 Proposals Submitted by university



Faculty earned nearly \$2 million in awards for advanced instrumentation (DURIP)



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One college, two universities, unlimited opportunity.

The FAMU-FSU College of Engineering is the joint engineering institution for Florida A&M and Florida State universities, the only such shared college in the nation. We are located less than three miles from each campus. After satisfying prerequisites at their home university, students learn together at the central engineering campus with its eight adjacent, associated research centers and a national laboratory.