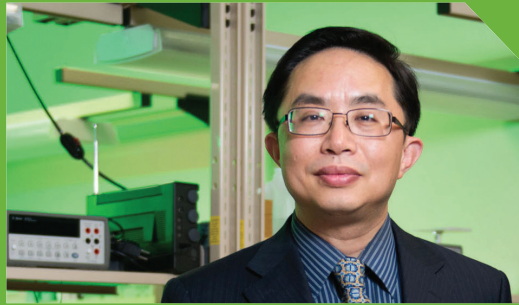
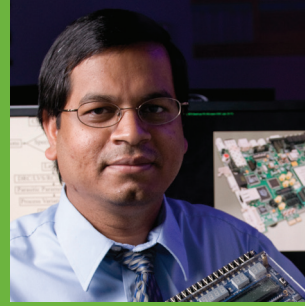


COLLEGE  
OF  
ENGINEERING

2016 ANNUAL REPORT



EST. 1890

**UNT**<sup>®</sup>  
UNIVERSITY  
OF NORTH TEXAS<sup>®</sup>

# MESSAGE FROM THE DEAN



## DEAR FRIENDS OF THE COLLEGE OF ENGINEERING,

It's through this publication that I hope you gain insight into all the fun and fascinating research and activities we're doing at this college. In addition to the great research you'll soon read about, this year marked the first year the University of North Texas was designated a Carnegie Tier One Research Institution – an honor that both recognizes who we are and also challenges us to keep moving forward.

In this edition, you'll read about our current expansion in computer science and engineering and the forthcoming biomedical engineering building. You'll see stories about how our labs in biomedical are giving students hands-on experience with state-of-the-art technology; how funding from the National Science Foundation has propelled the university and its graduate students as leaders in cybersecurity; how research in drone-carried communication is reshaping emergency response; and how our faculty are tackling real-world problems in nuclear engineering. You'll also have the opportunity to learn how science and art can come together in interesting ways to uncover past mysteries, and you'll get to know some of our new faculty, including Dr. Weihuan Zhao and the research she's doing in Texas's only Zero Energy Research Laboratory.

Finally, you'll see how some of our generous alumni have given back to the college by providing scholarships to help support future engineers.

This year has been a truly exciting one thanks to all the great work from our students, faculty and staff.

Dr. Costas Tsatsoulis

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# BY THE NUMBERS

2

## ENROLLMENT

SINCE 2012

INCREASE IN UNDERGRADUATE STUDENT ENROLLMENT	66%
INCREASE IN STUDENT ENROLLMENT IN MASTER'S PROGRAMS	62%
INCREASE IN STUDENT ENROLLMENT IN DOCTORAL PROGRAMS	31%

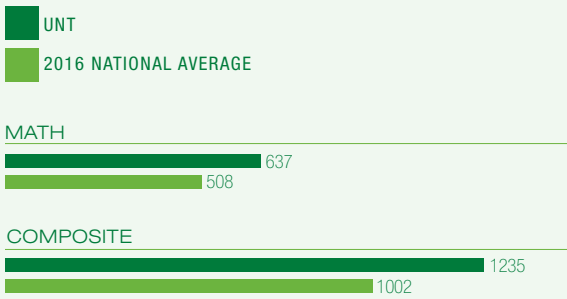
## DEGREES AWARDED

(2011-2015)

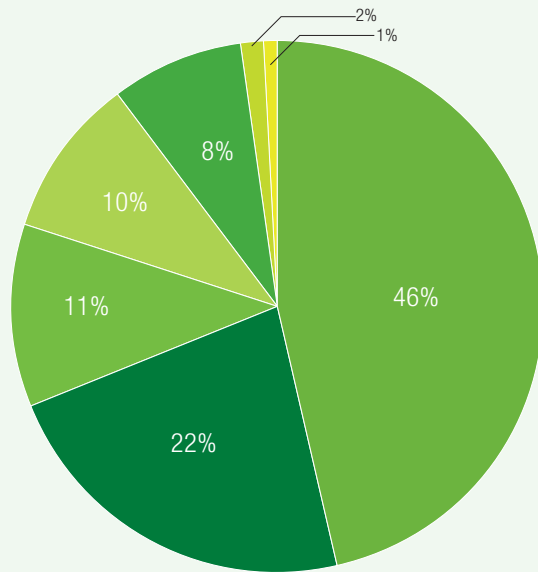
UNDERGRADUATE DEGREES	1,316
MASTER'S DEGREES	798
DOCTORAL DEGREES	95

## FALL 2016 SAT SCORES

CLASS OF 2020



## COLLEGE OF ENGINEERING DIVERSITY



## OTHER STATISTICS

PROGRAMS ADDED IN 5 YEARS	4
INCREASE IN COMPETITIVE RESEARCH EXPEDITURES SINCE 2007	353%
INCREASE IN COMPETITIVE RESEARCH EXPEDITURES PER FACULTY MEMBER SINCE 2007	181%

## UNDERGRADUATE ETHNICITY





**4,000+**

COLLEGE OF ENGINEERING ALUMNI  
IN THE DFW REGION

**150+**

COMPANIES PER YEAR RECRUIT UNT'S  
COLLEGE OF ENGINEERING GRADUATES

**300**

DIFFERENT COMPANIES HAVE RECRUITED  
UNT'S COLLEGE OF ENGINEERING  
GRADUATES AND INTERNS

**40%**

INCREASE IN JOURNAL PUBLICATIONS  
SINCE 2011

**CARNEGIE**

CLASSIFICATION RANKS UNT AS  
A TIER ONE RESEARCH UNIVERSITY

**6 DEPARTMENTS**

- BIOMEDICAL ENGINEERING
- COMPUTER SCIENCE AND ENGINEERING
- ELECTRICAL ENGINEERING
- ENGINEERING TECHNOLOGY
- MATERIALS SCIENCE AND ENGINEERING
- MECHANICAL AND ENERGY ENGINEERING

**22**

UNDERGRADUATE AND GRADUATE DEGREE PROGRAMS  
IN THE UNT COLLEGE OF ENGINEERING

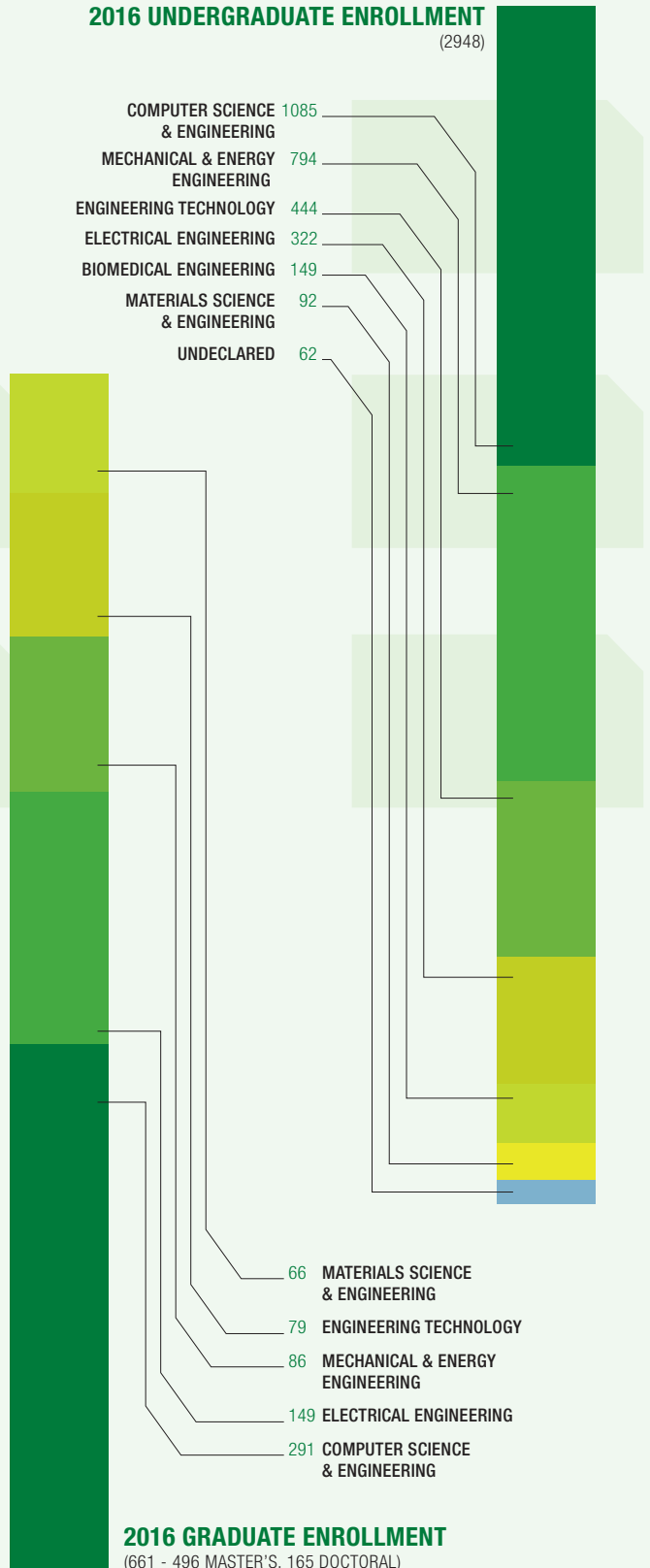
**1,014**

UNDERGRADUATE AND GRADUATE FIRST-GENERATION  
STUDENTS WITHIN THE COLLEGE OF ENGINEERING.

**2016 UNDERGRADUATE ENROLLMENT**

(2948)

- COMPUTER SCIENCE & ENGINEERING 1085
- MECHANICAL & ENERGY ENGINEERING 794
- ENGINEERING TECHNOLOGY 444
- ELECTRICAL ENGINEERING 322
- BIOMEDICAL ENGINEERING 149
- MATERIALS SCIENCE & ENGINEERING 92
- UNDECLARED 62



- 66 MATERIALS SCIENCE & ENGINEERING
- 79 ENGINEERING TECHNOLOGY
- 86 MECHANICAL & ENERGY ENGINEERING
- 149 ELECTRICAL ENGINEERING
- 291 COMPUTER SCIENCE & ENGINEERING

**2016 GRADUATE ENROLLMENT**

(661 - 496 MASTER'S, 165 DOCTORAL)

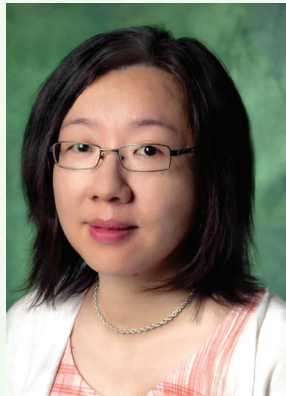
## NEW FACULTY



### **Dr. Diana Berman**

*Assistant Professor*  
Department of Materials Science  
and Engineering

Dr. Berman's research interests focus on the synthesis and processing of nanostructured carbon materials, including nanocrystalline diamond, diamond-like carbon, and graphene, as well as understanding mechanical properties of nanocarbons, from nano to macroscale tribology, and their impact on the performance of carbon-based systems, ranging in scale from MEMS/NEMS devices up to wind turbines.



### **Dr. Wei Jin**

*Associate Professor*  
Department of Computer Science  
and Engineering

Dr. Jin's research focuses on text and web mining, information retrieval and extraction, social network analysis and applied biomedical and healthcare applications.



### **Dr. Stephanie Ludi**

*Professor*  
Department of Computer Science  
and Engineering

Dr. Ludi's research focuses on software engineering and human-computer interaction, with a focus on requirements engineering and accessibility for visually impaired users. Current research includes supporting visually impaired students and professionals pursuing computer science.



### **Dr. Pradhugna Shrestha**

*Lecturer*  
Department of Computer Science  
and Engineering

Dr. Shrestha's research areas include wireless communications and networks, sensor networks, security and forensics.

**Dr. Mark Wasikowski**

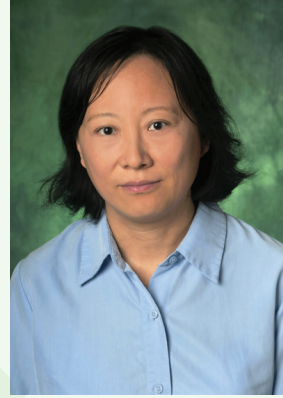
*Clinical Associate Professor*  
Department of Mechanical and  
Energy Engineering

Dr. Wasikowski's teaching and research interests include mechanical systems, robotics, mechatronics, aerospace and automated manufacturing.

**Dr. Tao Yang**

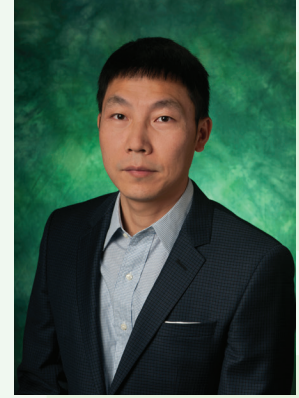
*Assistant Professor*  
Department of Electrical  
Engineering

Dr. Yang's research focuses on developing distributed control and optimization algorithms for networked systems with application to engineering systems, such as power networks and intelligent transportation systems.

**Dr. Hui Zhao**

*Assistant Professor*  
Department of Computer Science  
and Engineering

Dr. Zhao's research area focuses on Network-on-Chip (NoC) and energy efficient multi-core systems.

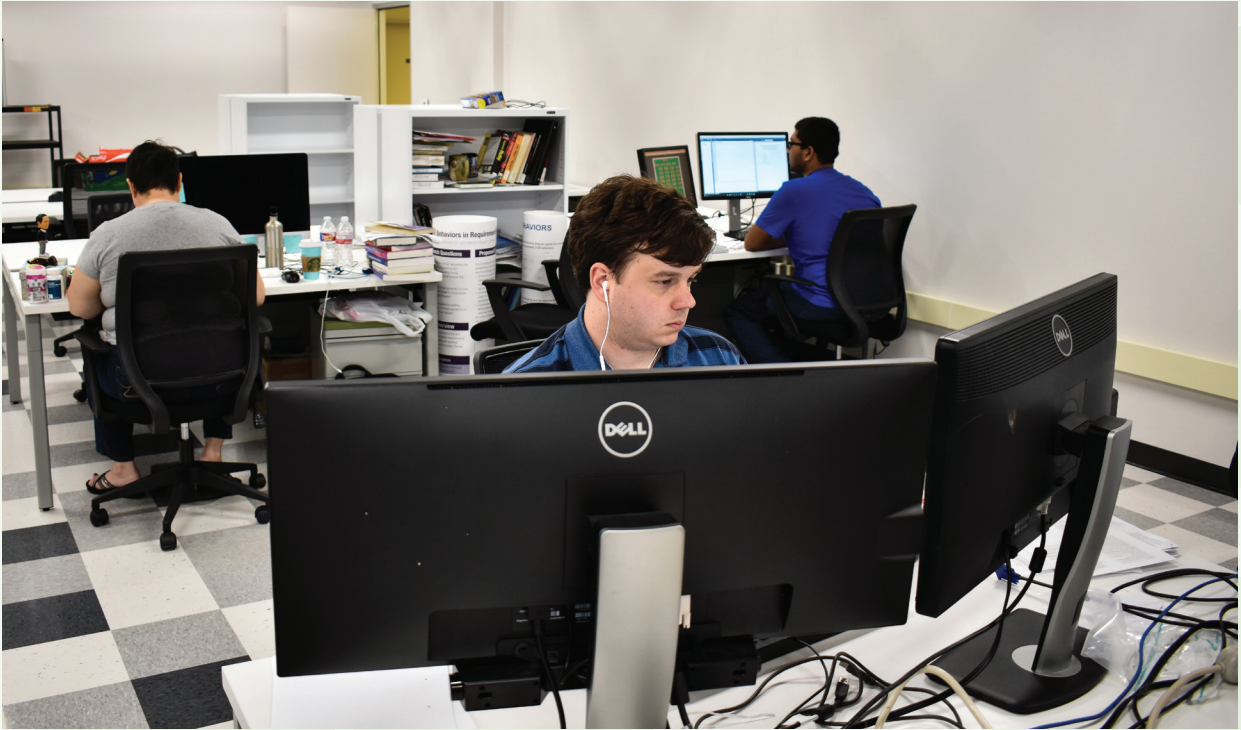
**Dr. Don Zhu**

*Associate Professor*  
Department of Biomedical  
Engineering

Dr. Zhu's research interests include novel biodegradable implants for medical applications, including orthopedic devices and cardiovascular applications, and neurovascular engineering in aging and in neurological diseases.



## EXPANDING ENGINEERING



### New Construction Leads To Growth And Collaboration

The College of Engineering is growing in students, faculty, research expenditures, and, yes, space. With the Department of Computer Science and Engineering's renovations completing soon and the new Department of Biomedical Engineering Building about to kick off, there's no doubt the College of Engineering is developing its own mark on UNT's history.

"It's a truly exciting time for the College of Engineering," said Dean Costas Tsatsoulis. "We've been growing exponentially since we became a college 14 years ago, and both the expansion in computer science and the new biomedical building are helping us not only meet our goals as a college but also as a Carnegie Tier One research university."

The college's Department of Computer Science and Engineering is undergoing a 10,000-plus-square-foot expansion, creating additional space for two new university research centers, building three new labs, and adding new faculty offices.

The space allocated to the research centers will go towards expanding the Net-Centric Software and Systems Center (NCSS) and the Center for Computational Epidemiology and Response Analysis (CECERA), which comes complete with a new visualization wall.

CECERA, which focuses on activities related to population health with projects on outbreak modeling, visualization of complex data, geospatial analysis, and response plan design. A visualization wall will allow the exploration of high-resolution data from multiple sources, such as geographical data from Google Earth and U.S. census information.

"The new laboratory facility will attract faculty and students with interest in Computational Life Science, which will expand the center's expertise and lead to new potential funding opportunities," said Armin Mikler, professor and center director for CECERA.

NCSS, however, focuses on emerging processing technologies, memory technologies, system-level security, reliability and resource management areas of networked and cloud computing systems.

"The new facility allows the students of three faculty members to share the space and collaborate," said Krishna Kavi, professor and center director for UNT's NCSS. "It also allows us to demonstrate projects and technologies to our sponsors."

Two of the new department lab spaces will be dedicated to Research Innovation in Software Engineering (RISE) and Information Management and Knowledge Discovery. RISE explores advances in software engineering through the areas of compiler design, domain-specific programming languages, human-computer interaction, logic programming, model-driven engineering

and software testing. Information Management and Knowledge Discovery focuses on data and text mining and the management of large data sources.

The new faculty office space also creates the opportunity for the department to expand its faculty and research, allowing doctoral candidates more opportunities to get involved.

“The added space makes it possible for us to hire more faculty and to attract more PH.D. students, both of which support our Tier One research measures,” said Barrett Bryant, chair of the Department of Computer Science and Engineering.

Several of the new lab and center spaces come with demo rooms and an adjacent director office to allow for enhanced collaboration and research analyzation. The expansion is set to be finished in May 2017.

“When I came here, what really attracted me to UNT’s College of Engineering was their plan for expanding the department,” said Bryant. “We’re going to be in pretty good shape – it’s fantastic for us!”

#### **BUILDING BIOMEDICAL**

For the Department of Biomedical Engineering, however, gaining a new building is the cornerstone of fostering the two-year-old

program to a successful and maturing program.

The new building will feature new technology, classrooms and labs for research and teaching – not only expanding the department’s research areas, but also assisting in its recruitment and retention efforts.

“My goal is to expand the program, to add research strength in biomaterials, cancer research, and biomanufacturing,” said Vijay Vaidyanathan, founding chair of the Department of Biomedical Engineering. “Doing so, will help attract good faculty and graduate/undergraduate students, furthering the growth and progress of the department and college.”

Vaidyanathan says careers in biomedical engineering are expected to grow 23% by 2024, and it’s important to ensure the curriculum keeps pace with the field.

“The new building will have innovative research and teaching labs for the department,” said Vaidyanathan. “Biomedical engineering is a growing field and the new building will help us reach our goals. I’m really excited.”

The \$18 million project kicks off this year, and is expected to be finished in 2019.

## **UNT Ranked Among Nation’s 115 Top-Tier Research Universities**

Last year, the Carnegie Classification of Institutions of Higher Education ranked the University of North Texas among the nation’s 115 top-tier research universities.

Tier One status is defined, in part, by how a university ranks in the Carnegie Classification, which is a leading framework for measuring institutional characteristics.

This achievement is commonly considered the most significant step in the evolution of a research university and marks a key milestone in UNT’s commitment toward national prominence, UNT President Neal Smatresk said.

“We moved up in the Carnegie classifications by staying true to our roots as an institution focused on creativity as expressed through our research, scholarship and educational activities,” Smatresk said. “All along, we’ve paid attention to what matters most, providing our students a great education and helping to build tomorrow’s workforce and the next generation of globally relevant scholars.”

Tom McCoy, UNT’s vice president for research and economic

development, said being ranked in Carnegie’s top tier is a result of UNT’s comprehensive focus on its level of research activity and helping doctoral students succeed.

“UNT’s official Carnegie Classification as a Doctoral University: Highest Research Activity (R1) matters for many reasons,” McCoy said. “Tier One universities attract top students and faculty, drive innovation and technology through high-level research and scholarship and contribute significantly to the region and state through intellectual capital and economic development.”

Costas Tsatsoulis, dean of the College of Engineering, said the college’s research, scholarship and graduate studies directly contributed to this achievement, including the opening of 30,000 square feet of state-of-the-art research laboratory and teaching space and the creation of two new doctoral programs in the Departments of Electrical Engineering and Mechanical and Energy Engineering.

“The Carnegie Classification ranking is the first step—an important step, a real milestone—but it’s not a destination,” Tsatsoulis said. “We need to continue to excel, and we will do so the same way we have operated so far, by focusing on the things that matter and which make us excellent: our students, our scholarly pursuits, our teaching and our outreach to the community.”

# BIOMEDICAL ENGINEERING



## Biomedical Labs Provide Real-Life Research

The College of Engineering's Department of Biomedical Engineering may be just over two years old, but it's grown a lot. The new department, currently boasting both a bachelor's and master's program, has 150 enrolled students, access to four teaching and research labs, and is graduating its first class in May 2018.

"It's exciting to see where we've come," said Vijay Vaidyanathan, department chair. "Of course, we still have a long way to go."

With access to four labs, and a new building in 2019, students are given the opportunity to put their classroom instruction to the test.

The B3 Lab – short for biomedical modelling, biomechanics and biomaterials – allows students to use new technology like the BioBot, a 3-D printer that can print artificial tissue through the use of specialized inks and cell cultures.

Another technology students have access to in the B3 Lab is in the realm of biomechanics and biomedical modelling. Through the use of software and biomechanical sensors, students are able to measure forces and analyze motion, by attaching sensors to a person's body and monitoring them via the computer software.

"I could be playing tennis, for example, and when I swing the racket, the sensors would display the force and the motion of the swing on the computer," said Vaidyanathan.

Tabletop tensile testers, too, are available for students to use. "With tabletop tensile testers, students and researchers are able to test the material properties of biological tissue," said Vaidyanathan.

In another lab, under Donghui Zhu, students and research fellows conduct biomaterials research and focus on areas like bioresorbable stents and bone screws, and improving drug delivery for those suffering from Alzheimer's disease.

"It is very exciting to develop the new generation of biodegradable medical implants which will eliminate the second surgery and long-term clinical complications associated with permanent implants," said Zhu.

The Biomedical Instrumentation Lab, shared with the Department of Computer Science, also gives students the opportunity to design different instruments like biomedical circuits.

"The biomedical instrumentation lab is used by students to understand data acquisition in biomedical systems and also to design and implement microprocessor based, stand-alone biomedical devices," said Vaidyanathan.

The fourth lab, the Biomedical Research and Innovation Lab is devoted to graduate research and senior design projects. It's a lab that will no doubt be very popular next year when the department has its first senior class.



**Madison Hardage**  
**Biomedical Engineering major**  
**Freshman**

**WHAT INTERESTS YOU ABOUT BIOMEDICAL ENGINEERING?**

Biomedical engineering is one of the most versatile engineering fields, and it is an engineering area that focuses on people. Biomed is where people invent and build machines to directly help other people. There are so many applications: you can build prosthetics for missing limbs, an exoskeleton that could let people who can't walk walk again, an exoskeleton for the military to enhance the endurance of soldiers, or build medical equipment to detect disease or injury.

**CAN YOU TELL US A LITTLE BIT ABOUT UNT'S BIOMEDICAL ENGINEERING PROGRAM?**

Biomed is the jack-of-all-trades of engineering. Dr. Vijay created specific tracks – something unique about UNT – that gives us a little depth into an area of our choice. I'm on the bioinformatics track that focuses on computer science, so I don't have to take a lot of extra science courses.

**WHAT INTERESTS YOU ABOUT RESEARCH?**

It's a very unique opportunity. I hadn't considered the possibility of doing research until I was at least a junior, but when I got the chance I couldn't turn it down; I thought the experience would help me in the future. When the concept of printable circuitry was brought up, I wanted to learn more and now I'm on the research team trying to make it happen.

I think doing research as a freshman is something that everybody should try, if only to learn something new. Being on the research team has been a great experience; I've learned so many things I didn't even know I wanted to know. I'm really glad I've had this opportunity.

**WHAT'S IT LIKE HAVING ACCESS TO NEW TECHNOLOGY AS A STUDENT?**

I never expected to be able to use any of the new technology that Discovery Park has to offer as a freshman, especially after learning from my tour of Discovery that typically only upperclassman get access to its finest resources since they're on the campus more often.

Last semester, we were cleaning out the Biomedical Research and Innovation Lab, where the research team does most of our



testing, and we found a lot of things Dr. Vijay had left there and said we were free to use. It was neat to go through all of the stuff: we found lasers, circuit boards, soldering equipment and a drone.

It's been a lot of fun having access to so much, because it's nothing like I imagined.

**WHY DID YOU CHOOSE UNT?**

I chose UNT because it was the school that fit me the best. When I visited, I got a tour of Discovery Park and I loved the engineering college. UNT was fun to visit, it's close to home, and I got into the honors college, which lead to more opportunities for me.

**WHAT MAKES YOU BLEED GREEN?**

I like the band; they were the reason I went to as many football games as I did.

**WHAT WOULD YOU LIKE TO DO WHEN YOU GRADUATE?**

I want to get my master's and possibly my Ph.D. I don't know exactly what I want to do career-wise, but I have time to figure it out. Right now, I'm considering software engineering. I'm in the intro computer science course learning C++, and I love it so much. I'm glad I'm on the bioinformatics track.

# COMPUTER SCIENCE AND ENGINEERING

10



## UNT Doctoral Students Tackle the Newest Threats in Cybersecurity

The University of North Texas is the only university in the country to receive National Science Foundation funding of more than \$1 million for a Scholarship for Service program exclusive to Ph.D. students studying cybersecurity.

UNT's team of six Scholarship for Service students research topics including cyber physical security, insider threats, intrusion detection, data breaches, health information technology, big data security analysis and more. Those involved are Suliman Hawamdeh, Ram Dantu, Dan Kim, Victor R. Prybutok, Quentin Mayo, Yassir Hashem, Logan Widick, Obi Ogbanufe, Josh Talkington and Michael Jaynes.

The program provides funding for students to complete their doctoral degrees in exchange for an agreement to work for a federal organization where their cybersecurity expertise can benefit the U.S., such as the CIA, FBI or Department of Homeland Security.

The program, led by UNT Professor of Computer Science and Engineering Ram Dantu, is building UNT's reputation as a leader in cybersecurity research. Dantu also serves as director of UNT's Center for Information and Computer Security, a hub for interdisciplinary programs and research from business, criminal justice and engineering that focuses on network security and human behavior in relation to cybersecurity.

### CYBERCRIME AND THREATS

Obi Ogbanufe is a student in the Information Technology and Decision Sciences department in UNT's College of Business with a concentration on information assurance. Her background is in computer science and systems engineering. Cybersecurity research piqued her interest because it is an ever changing challenge.

"Computer science, information technology, these fields keep changing," she said. "We need security in everything we do or have: our jobs, our homes, our cars. Everything is connected in one way or another, mostly through the internet, and with that comes questions about privacy. How are we protecting ourselves?"

Ogbanufe's research focuses on cybersecurity risk management and traceability of cybercrimes. On the risk management side, she is looking into what options are available for organizations and individuals to manage risks that come from being a casual internet user or an attack. On the cybercrime side, she is building frameworks to better understand how organizations can trace information and be better prepared.

Ogbanufe recently wrapped up an internship with the U.S. Department of Health and Human Services, where she got hands-on experience with research and handling issues surrounding health care information technology and security.

### HOW SECURE ARE YOUR DEVICES?

Quentin Mayo also likes a challenge. His research is focused on computer network security, or how to monitor and prevent attacks





## Professor Receives Editorial Appointments, Recognition

Saraju P. Mohanty, a Department of Computer Science and Engineering professor, has been appointed as the Editor-in-Chief of IEEE Consumer Electronics Magazine and has been inducted into the Editorial Board of IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (CAD of ICs.)

Additionally, he received the 2016 PROSE (Professional & Scholarly Excellence) Award for the best textbook in Physical Sciences & Mathematics from the Association of American Publishers (AAP). The PROSE Awards recognize achievements in professional and scholarly publishing and are given to distinguished books, journals and electronic content in more than 40 categories. Mohanty's book, "Nanoelectronic Mixed-Signal System Design," was published in February 2015 by McGraw-Hill Education.

Mohanty is the founder and director of the NanoSystem Design Laboratory (NSDL) and is a world-renowned researcher in the areas of low-power high-performance nanoelectronics systems and hardware-assisted digital watermarking. He is the recipient of four patents with applications in digital watermarking, digital rights management and mixed-signal integrated circuit design.

He has served on the editorial board of several peer-reviewed international journals and magazines and is a founding editor-in-chief of Very Large Scale Integration (VLSI) Circuits and Systems Letter. Mohanty also is an author of 200 peer-reviewed research articles and three books.

The IEEE Consumer Electronics Magazine covers topics related to consumer electronics such as video technology, audio technology, home care products, mobile communications, home security and consumer storage technology.

The IEEE Transactions on CAD of ICs publishes papers on the topic of computer-aided design of integrated circuits and systems composed of analog, digital, mixed-signal, optical or microwave components.

on computer networks, and content aware security, building an understanding of how apps use data, such as location, time and identity information, and deciding whether or not that data usage is a threat.

"I want to understand how we can better protect people," he says. "If you are using features on a device, such as a smart phone, how secure are you?"

Mayo and a team of other graduate and PH.D. students from around the country tackled these topics during an internship at the University of Illinois Urbana-Champaign's Coordinated Science Laboratory this summer.

### LEADING CYBERSECURITY RESEARCH

In 2015, UNT was named a Center for Academic Excellence in Cyber Defense Research by the National Security Agency and the U.S. Department of Homeland Security. UNT is one of about 60 such centers in the U.S. and also is one of only a few Texas universities to be named both a Center for Academic Excellence in Cyber Defense Research and a Center for Academic Excellence in Information Assurance Education.

"This type of recognition is very advantageous for UNT researchers, who now will have an extra edge when applying for research funding," Dantu said.

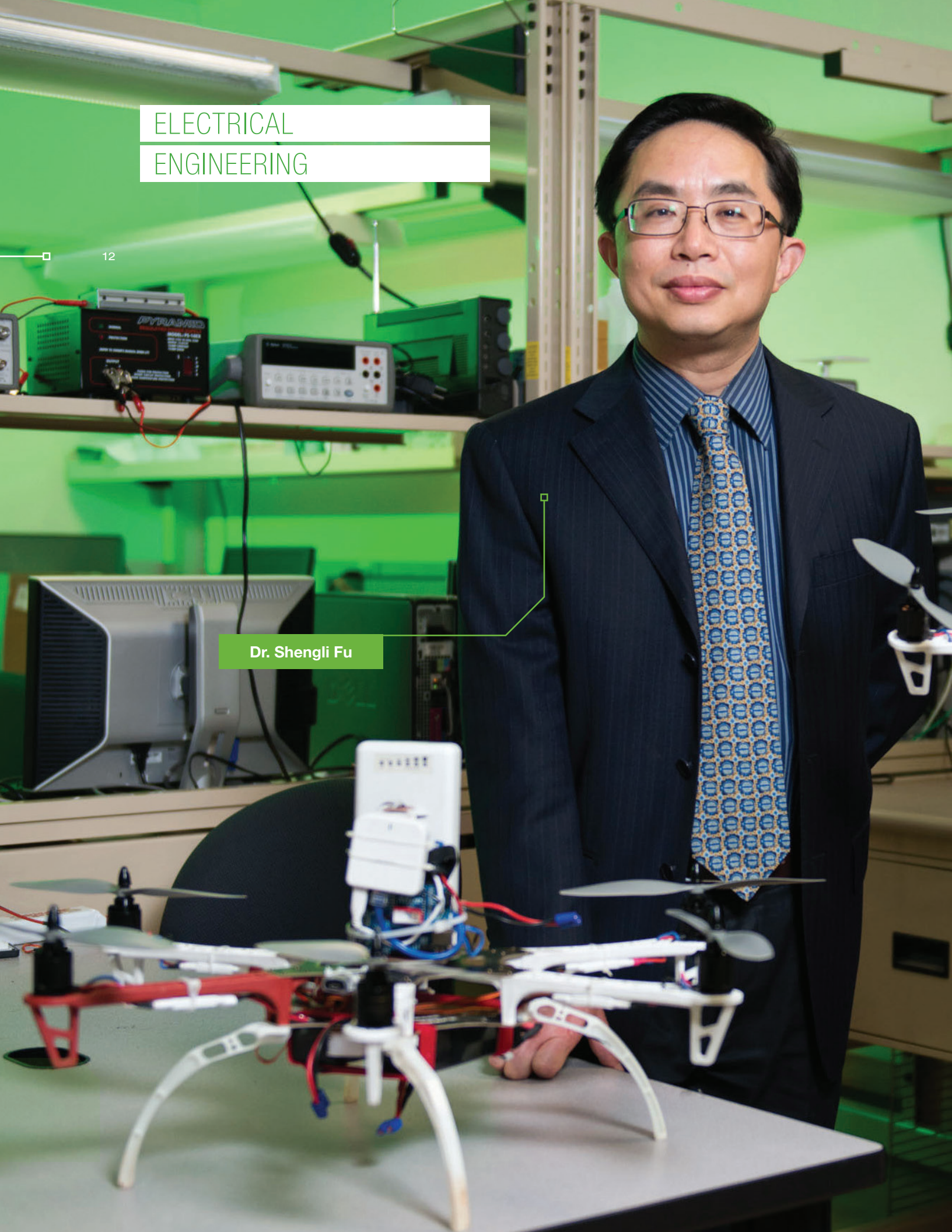
Dantu also is a leader for innovative research using smartphone technology, Voice over Internet Protocol security and cybersecurity to help people and organizations effectively and safely store information. National Science Foundation Director France A. Córdoba recently noted in a speech at the Texas Research Summit that Dantu's research in VoIP security is an example of how cybersecurity research like his has led to products, services, startups and innovative solutions in the marketplace.



ELECTRICAL  
ENGINEERING

12

Dr. Shengli Fu



## Researchers Receive NSF Award for Drone-Carried Communication

On Sept. 14, 2015, at a White House event, the National Science Foundation announced that 12 new projects will be funded to help enable a vision of smart and connected cities and communities including a proposal from researchers of the University of North Texas Department of Electrical Engineering.

The purpose of the UNT project, Aerial Communication Infrastructure for Smart Emergency Response, is to develop a broadband communication infrastructure that can be quickly deployed for emergency response, improving the efficiency of first responders and saving lives.

This project, led by Shengli Fu and another researcher at the University of Texas Arlington, will build upon a previous concept for a flexible, low-cost, and drone-carried broadband long-distance communication infrastructure and will investigate its capability for immediate smart-city application for emergency response. This effort is to support the Smart Emergency Response System (SERS) cluster as it participates in the Global City Teams Challenge.

“By bringing together various stakeholders in academia, industry and the community, we want to explore state-of-the-art technologies that could help improve emergency response, where even now gadgets like the walkie-talkie are still heavily relied upon,” Fu said. Other partners of the SERS team running for GCTC 2015 include Austin Fire Department, Mathworks, Worcester Polytechnic Institute, Wright State University and Myth Innovations.

This project will have an immediate impact on firefighting and other smart-city emergency response applications by quickly deploying a broadband communication infrastructure, thus improving the efficiency of first responders and saving lives.

This communication infrastructure expands the capability of individual drones, enables broad new multi-drone applications for smart cities, and has the potential to create new businesses and job markets.

This interdisciplinary project addresses the following technology issues:

Development of cyber-physical systems (CPS) technology that enables robust long-range drone-to-drone communication infrastructure;

Practical drone system design and performance evaluation for WiFi provision; and

A systematic investigation of its capability to address smart-city emergency response needs, through both analysis and participation in fire-fighting exercises, as a case study.

The project team includes an academic institution, technology companies and government planners, each of whom provides complementary expertise and perspectives that are crucial to the success of the project. The project also will provide interdisciplinary training opportunities for students and the community to learn about CPS technologies and the efforts of the Global City Teams Challenge.

## Namuduri Chairs New IEEE Working Group

Kamesh Namuduri, an associate professor of the Department of Electrical Engineering, is the chair of the new IEEE Aerial Network Communications Working Group.

On June 29, IEEE and the IEEE Standards Association (IEEE-SA), announced the formation of the IEEE Aerial Network Communications Working Group. Members of the new working group, working under the sponsorship of the IEEE Communications Society Standards Development Board (COM/SDB), will initially launch project IEEE P1920.1TM to develop standards to enhance

the situational awareness of aircraft and enable air-to-air communications in an ad hoc aerial network that includes manned, unmanned, civil and commercial aircraft.

In an IEEE press release, Namuduri said the "growing utilization of Unmanned Aerial Vehicles (UAVs) is driving a need to ensure safety through increased situational awareness and direct air-to-air communications for all types of aircraft. Creating standards for Aerial Network Communications brings many benefits, such as safer and more coordinated use of UAVs in emergency or natural disaster situations, greatly enhanced tracking of commercial and civil aircraft, and overall safer operation with more advanced collision avoidance data being shared directly between all aircraft."





## Zhang to Create Nuclear Monitoring Technology

By TANYA O'NEIL

Haifeng Zhang began a major new project in November that he hopes will help solve a critical problem in nuclear engineering.

Zhang, an associate professor of mechanical engineering technology, was recently awarded a \$1 million research grant from the Department of Energy. He will be working to use an ultrasound through-wall data transmission technique to transmit a large amount of sensor data from inside spent fuel storage canisters to an outside data processing center for monitoring. Nuclear spent fuel rods are typically stored in thick metal shells that normal wireless technology can't penetrate and data cables also cannot be used since those would require undesirable holes to be made in the canister.

"This is an urgent problem that needs a solution," said Zhang. "Right now, it is difficult to tell what is going on inside that nuclear canister. If we are successful, we can monitor conditions of spent fuel rods inside that canister in real time."

Zhang is collaborating with Lei Zuo, an associate professor of mechanical engineering at Virginia Tech; Oak Ridge National Laboratory; and Westinghouse Electric Company on this project. Zhang says they will be using innovative techniques that have rarely been done before and that preliminary tests have already shown promising results.

"This is my expertise," said Zhang. "I've been working on piezoelectric device for almost twenty years. What this project means to us is that we can actually apply our knowledge and solve a major problem in the nuclear field. The technology we are going to develop can also be applied for data communication through hulls of ship and submarine and other applications in future."

Dr. Haifeng Zhang





Leticia Anaya

## Engineering Professor Wins Lifetime Achievement

BY TANYA O'NEIL

A major honor was recently presented to Leticia Anaya, a senior lecturer in the University of North Texas College of Engineering. The Regional Hispanic Contractor Association presented its 2016 Women's Luna Lifetime Achievement Award to Anaya. She

was chosen for her more than 19 years of teaching engineering technology courses at UNT, as well as her experience working in the industry.

"I didn't expect this award," said Anaya. "The other nominees were very high achievers. I really had to take off a day to just really think about it. It's amazing to suddenly realize that industry really does appreciate what I do."

Along with engineering experience, the award was also judged based on leadership experience. Anaya has held several leadership positions in engineering-based organizations in and out of academia. She also focuses her leadership skills on encouraging the next generation. Her biggest goal is finding ways to motivate students, especially women, toward science, technology, engineering and mathematics careers. She hopes this new honor can help with that.

"I've seen such positive feedback over this award, particularly from young women," said Anaya. "I hope this helps inspire them. Engineering is a very good career that can be high paying and even fun. There is just so much you can do within this field."

Anaya's award was presented at the 10TH annual Luna Awards Conference and Expo. It's an event aimed at celebrating the achievements of women in architecture, engineering and construction.

## Barbieri New ASEE Engineering Technology Council Chair-Elect

Engineering Technology Professor and Chair Enrique Barbieri is the 2016–2018 chair-elect for the Engineering Technology Council of the American Society for Engineering Education (ASEE). The Council is the national organization that speaks for engineering technology education and is committed to promoting quality education and creative endeavors in engineering technology.

Barbieri has been UNT's ETBC chair since January 2012, where he has been involved in initiatives to promote the department, engineering technology and engineering in general, such as the 20TH anniversary celebration of the department and the creation of *Invencones de la Inventiva*, the Spanish version of *The Engines of Our Ingenuity*, as part of a partnership with the University of Houston through funding by the United Engineering Foundation 2011–2014.

He has been the PI or Co-PI of research grants, contracts and fundraising projects from federal, state, and private agencies exceeding \$3.7 million, and is the co-recipient of a U.S. patent on a 3-D ultrasonic ranging system with application to motion detection in flexible structures. He has published on the synthesis of sensing and control algorithms for heart arrhythmia and for electromechanical systems and industrial processes such as redundant robots, flexible structures, automatic arc-welding (temperature field sensing and control) and rocket propulsion testing. More recently, he has published on educational and human resource development topics. His teaching interests are



Enrique Barbieri

in the systems control engineering technology area.

Barbieri also is a senior member of the Institute of Electrical and Electronic Engineers (IEEE) Control Systems Society. He was a technical associate editor of IEEE Control Systems Magazine, (92-95), and served at different times in a variety of positions such as finance chair, exhibits chair, program co-chair, publicity chair and associate editor for national and international conferences. He co-directed the Texas Manufacturing Assistance Center-Gulf Coast (TMAC) during the 2005–2006 Center's transition to the College of Technology, was a member of the TMAC Executive Council (2006–2011) and served as chair of the Council (2007–09). He was a board member (2005–08) for ASEE's Engineering Technology Leadership Institute.



MATERIALS  
SCIENCE  
AND  
ENGINEERING

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## UNT Engineer Looks Beyond Paint, Metals and Ceramics

Materials scientist, Marcus Young, is investigating a secret underneath the final layer of paint on Alessandro Allori's "Portrait of Grand Duchess Bianca Capello de Medici with Her Son." The portrait, which was painted more than 500 years ago, is one piece of a story about a controversial royal family. The painting currently is being treated and studied by Paintings Conservation Fellow Laura Hartman in the Dallas Museum of Art's visible conservation studio.

Young and students from UNT's College of Engineering are using advanced materials characterization research equipment to look underneath the portrait's final layer. They also are exploring how 3-D printing technologies can create reproductions of famous sculptures and are using a scanning electron microscope with a focused ion beam to learn how silver-plated metal objects in the museum's collection were created and can be conserved.

"Working with UNT engineers has been great because they've been able to bring their background into this project and come up with really interesting imaging and analysis techniques," Hartman said.

### 3-D PRINTING, METALS

Young and his students are using a dual beam ultra-high resolution field emission scanning electron microscope with a focused ion beam at UNT's Center for Advanced Research and Technology to create a window – a  $30 \times 30 \times 30$  micron window, smaller than the width of a human hair – to look inside each object and learn about its processing history.

"Using this equipment we can determine what processing and manufacturing techniques the artist used to build the object, what base metals were used and even get details on grain size and plating," Young said. "The ion beam creates such a small hole that no one will ever know that we touched anything."

3-D printing technology has advanced to the point that Young can now print near exact replicas of some of the museum's ceramic objects.

"You could build an exact replica of a ceramic object by hand, but



Dr. Marcus Young



with our equipment, we get the exact dimensions and are able to print them nearly perfectly,” Young said. “We’re able to capture all the characteristics and flaws of the original, and staff from the museum can transport and display the replica without having to worry about damaging an irreplaceable art object.”

### BIANCA CAPELLO DE MEDICI

Bianca was born in Venice in 1548. She eloped at 16 years old and moved to Florence with her husband, where she later fell in love with Grand Duke of Tuscany Francesco I de’ Medici. Francesco, at the time, was married to Joanna of Austria, daughter of Holy Roman Emperor Ferdinand I.

Bianca’s husband was murdered in 1572, and Joanna died a few years later, opening the door for a romance between Bianca and Francesco that spurred questions and conflict.

“The portrait is of Bianca and her son with Francesco; his name was Antonio,” Hartman said. “Antonio’s story is interesting, because there are questions about the legitimacy of his birth – was he born before or after his parents were officially married? Was he a changeling? All of the questions and rumors circled around his right to the throne and the title Grand Duke of Tuscany.”

Bianca and Francesco died on the same day in 1587 from an unknown illness, creating more intrigue and unrest.

“After their deaths, Francesco’s brother made a call to destroy all memory of Bianca – all images of her and her coat of arms,” Hartman said. “So, the fact that this painting survived is incredible.”

Art conservators and historians who have looked at the painting notice something interesting about Antonio’s face. His face appears to have been repainted at some point over an earlier younger face, but no one knows exactly when or by whom the alterations occurred. Young is using advanced materials characterization equipment to find answers.

“It’s of historical interest since the family used the painting to legitimize their son, the heir. What we believe is underneath is a younger version of their child, Antonio, which was later repainted,” Young said.

Young and Hartman are using a combination of X-ray imaging, X-ray fluorescence spectroscopy and scanning electron microscopy as well as synchrotron radiation X-ray fluorescence spectroscopy available at the Advanced Photon Source at Argonne National Laboratory to create a detailed map of the underlying colors and shapes. He also is working to identify chemical differences in the paints used in the top and underlying layers, which will be used to reveal and reconstruct the underlying image of the child.

“There is so much to learn about history through this type of research and collaboration,” Hartman said. “Bianca’s story is such a tangled web, and we’re looking forward to finding out what we can learn about the age of the paint and the portrait beneath.”

## Diving Into Nuclear Waste Disposal

By TANYA O’NEIL

Department of Materials Science and Engineering Associate Professor Jincheng Du is part of a new energy frontier research center, or EFRC, funded by the Department of Energy that will work to make nuclear waste disposal safer for a longer period of time.

“It is very exciting,” said Du. “It will be a great opportunity for UNT and our students working on this project. They will work with researchers and peers from other institutions of the center, and it will be a great learning experience for them.”

The team of researchers from five universities, two national laboratories and one company will receive at least \$8 million from the U.S. Department of Energy over the next four years to establish the Center for Performance and Design of Nuclear Waste Forms and Containers, one of only four centers funded by the Department of Energy for 2016. The team will research the degradation of materials that store nuclear waste, including glass, ceramics and metals. Du and his research assistants will focus on the fundamental mechanisms of glass degradation, especially the long-term corrosion behaviors.

“Glass is very durable, one of the reasons why it is chosen to store nuclear wastes, but we are now looking into the durability over not hundreds or thousands, but hundreds of thousands to millions of years,” said Du. “If nuclear waste is stored underground, at some point far into the future that glass will corrode and it could get into the ground water. We are looking to the fundamental corrosion mechanisms of glass, and the design of glass compositions and their containing environments to make them even more durable for that long-term timeframe in geological storages.”

This project will enable sharing the understanding of the degradation mechanisms of different types of materials in hopes of leading to the design of new materials to solve energy and environmental challenges. Du said it is an honor to have been part of the team to win the project among very tough national competitions.

“It’s very satisfying to know that my research and expertise is being recognized and this is benefiting UNT and our students,” he said.



MECHANICAL  
AND  
ENERGY  
ENGINEERING

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Dr. Weihuan Zhao

## Zhao Zeroes In On Research

Assistant Professor Weihuan Zhao is one of many new faces in the ever-growing Department of Mechanical and Energy Engineering. As one of only two primary researchers at the Zero Energy Lab following former department chair, Yong Tao's departure, Zhao is diving head first into her work.

The Zero Energy Research Laboratory, which is the only building of its kind in Texas, is designed to test and demonstrate various alternative energy generation technologies to achieve a net-zero energy consumption of energy.

It's the perfect place for Zhao to work on her research, which zeroes in on thermal-fluid sciences, including heat transfer, thermodynamics and fluid dynamics.

"The Zero Energy Laboratory allows us to test building energy savings as well as human physiological and psychological responses through modulating room temperatures, lighting conditions, and so on in a specific space. It has a lot of renewable devices – solar panels, geothermal heat pumps, and wind turbines – that allow us to collect data that provides guidelines for how the current renewable energy technologies work, allowing us to compare with our new technologies to seek their improvements on building," said Zhao. "It also helps us integrate a lot of our research elements, such as when we want to integrate a small part of the storage system – like the HVAC with the geo-thermal pump system – the lab and the data already collected help us see the improvements we've made in heat transfer."

Zhao currently has three graduate students working under her. One student is working on improving the HVAC efficiency in the building. The other student is looking into phase-changing





The Zero Energy Research Lab is over 1,200 square feet and has an open flexible work/laboratory space along with an attached work shop area. There is a living quarter with a bathroom and a small kitchen with a refrigerator. Steel columns/ beams were used for building as well as structural insulated panels for the walls and roof. It has a centered utility core for easy operation and remodeling. The sustainability features include: bamboo flooring and millwork, local materials, a recycled glass countertop and backsplash, a rain-harvesting water system, and renewable solar and wind power for energy.

materials embedded in the building envelope and how they improve building energy efficiency. Another student, Caleb Traylor, who studied under Tao and graduates this year, is researching how temperature relates to building energy savings and comfort.

“Working in the Zero Energy Lab has been great, because I have been able to see all the technologies up close. I’ve been able to learn what goes into the solar and wind power systems, the rainwater system, the HVAC system, etc.,” said Traylor, a graduate student in the Department of Mechanical and Energy Engineering. “My research in human thermal comfort and finding ways to heat and cool buildings that will save energy has revealed how much goes into analyzing our energy usage. So much goes into researching the things do that use energy and the reasons we do them; it’s

been interesting to be able to contribute in this growing field.”

“The students at UNT are very hard working and smart,” said Zhao. “They’re willing to explore different research activities to advance their knowledge.”

Zhao also teaches three classes: Introduction to Heat Transfer, Conduction and Radiation Heat Transfer, and Computational Heat Transfer and Fluid Flow.

“This department is an excellent fit for my background,” she said. “The department is very new – under 10 years – and has room to grow. As a new faculty, I can get more involved in research activities and have a lot opportunities for advancement.”





## ALUMNI & GIVING

### Engineering Receives Two New Scholarships

Thanks to a generous alumnus, UNT's College of Engineering has received two endowed scholarships that will begin in 2022. Each gift will go toward supporting a student with their education at the college.

"This is a tremendous gift we've received, and it will no doubt help many of our students succeed here at the college," said Angus McColl, College of Engineering director of development.

The two scholarships were created through a five-year pledge agreement with annual payments to be made by the donor and

matching funds also provided annually by the donor's employer.

"Matching gifts are a great way to support the university, because they can double, triple, and in some cases, quadruple the impact of an employee's gift to a university, depending on the match ratio of the company," said McColl. "This generous donor has set an exceptional example for other alumni to emulate, and we hope more UNT engineering alumni will consider giving to the university through their employer's matching gift program."

Engineering students who demonstrate high academic achievement and financial need may qualify for the scholarships. Students may also apply for them as completion scholarships, to be used in their final year of study.

### Denton Family Keeps Ties To UNT

BY TERESA LOVE

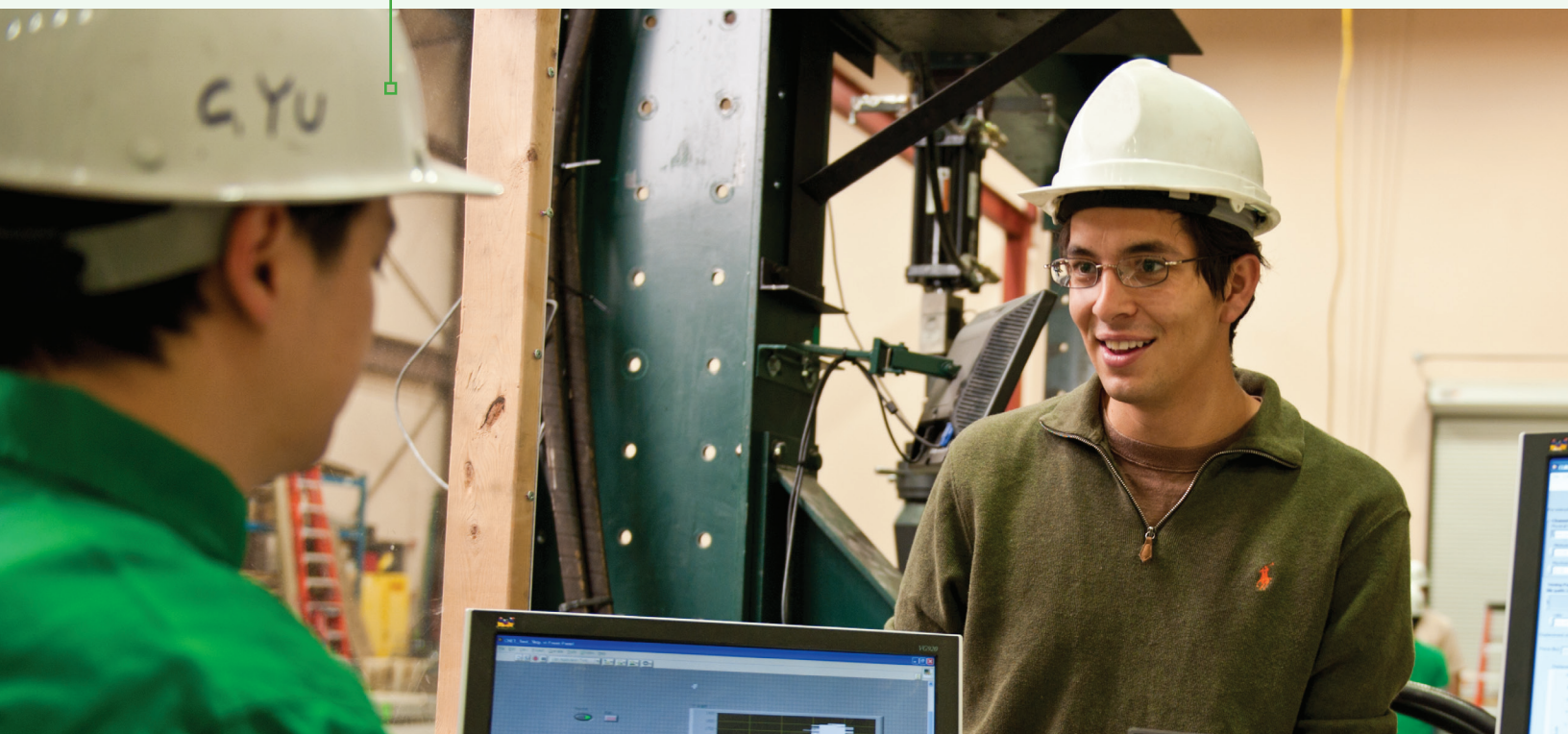
John Pierce donated \$50,000 to create the Wilford E. Pierce Endowed Scholarship to honor his father. Following in his father's footsteps, Pierce studied industrial arts education at UNT. Pierce's brother, Jack, also made a sizable contribution to the endowment. This scholarship is available to students in the construction technology program in UNT's College of Engineering.

Pierce wanted to honor his father and support students in this field of study. His great-grandfather was a Denton County surveyor in the early 1900s. From 1946 to 1978, his father Wil-

ford Pierce and his wife operated Pierce's, where they extended credit to many UNT students for the first time. Wilford studied industrial arts education at UNT, graduating with a B.S. in 1931; he then went on to send all three of his sons to UNT: John ('61, '63 M.ED.), Michael ('63, '65 M.A., '70 PH.D.) and Jack ('67).

Pierce is passionate about the value of an industrial arts education. "Industrial arts education has all but disappeared from public schools," says Pierce. Although Pierce is semi-retired, he still works as a land surveyor. Pierce will partner with his employer to give UNT students the opportunity to work with state-of-the-art equipment. He has plans to visit campus to demonstrate surveying techniques to current UNT students.

### Professor Cheng Yu with a Construction Engineering Technology student.





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