



CLEVELAND STATE UNIVERSITY

# WASHKEWICZ

COLLEGE OF ENGINEERING

2019 - 2020 ISSUE

## — INSPIRED — SPACES

NEW LABORATORIES PROVIDE STATE-OF-THE-ART  
OPPORTUNITIES FOR STUDENTS



INSIDE: STUDENTS | ALUMNI | COLLEGE NEWS | FACULTY | PROGRAM

— Message —  
**FROM**  
 — the —  
**DEAN**



Dear Alumni and Friends,

Welcome to the 2019-2020 edition of the Washkewicz College of Engineering magazine! I am honored to have been selected to lead the College as interim dean. My major goals are to continue the College's upward trajectory in creating "ready-to-go" engineers, with a special emphasis on increasing the number of students who co-op, and continually improving the engineering design experience, from the freshman lab to senior capstone projects. In fact, last year the College has set a new record with 42 industry-sponsored senior design projects, with 100% of mechanical engineering students working on these projects. This "ready-to-go" spirit is exemplified by our student team's first-place award in the 2018-19 National Fluid Power Vehicle Challenge held in Littleton, Colorado. Additionally, I'm proud to announce that the Mechanical Engineering Technology program is now ABET-accredited.

Last year also marked the completion of Phase II of Washkewicz Hall, with research and teaching labs moving into the new building. Inside these pages, you'll read some of the exciting research being conducted in our new, state-of-the-art labs in areas such as Advanced Manufacturing and Materials Processing, Soft Materials, Tissue Engineering and 3D Bioprinting and Human-Machine Systems. The space has allowed us to teach more classes in computer-equipped labs and in collaboration-enhancing classrooms.

Sincerely,

**JOANNE M. BELOVICH, PH.D.**

Interim Dean, Washkewicz College of Engineering



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LEADERSHIP



# NEW LEADERSHIP

*The Washkewicz College of Engineering welcomes a new interim dean*

**THE WASHKEWICZ COLLEGE OF ENGINEERING** welcomed a new interim dean this fall as Dr. Joanne M. Belovich took over leadership of the institution. Dr. Belovich, who previously served as the chair of CSU's Department of Chemical and Biomedical Engineering, will oversee all academic and administrative operations, while seeking to continue advancement of Washkewicz' enrollment, research, fundraising and outreach goals.

"Dean Anette Karlsson provided tremendous leadership and vision for our College and I am honored to have the opportunity to build on her efforts to enhance support for our students and advance the mission of the College of Engineering," Dr. Belovich says.

Dr. Belovich joined the Department of Chemical and Biomedical Engineering at CSU in 1991 and was appointed chair of the department in 2014. During her tenure, she worked to enhance industrial and community partnerships and overall research opportunities for faculty and students. This included the creation of a Current Good Manufacturing Practices (CGMP) design certification program in partnership with Xellia Pharmaceuticals. The course, offered on campus to CSU students and taught by Xellia engineers and managers, directly prepares students to work in pharmaceutical manufacturing, a growing field in the region and across the nation.

Prior to becoming chair, Dr. Belovich also directed the department's partnership in biomedical engineering with the Cleveland Clinic, which includes internship opportunities for students and research advisors for CSU graduate students, as well as joint research projects involving multiple faculty members.

"One of our goals moving forward will be to further enhance the ability of our engineering degree programs to meet the needs of

society," Dr. Belovich adds. "Partnerships like the ones with Xellia and the Cleveland Clinic enhance education, faculty scholarship and CSU's overall ability to contribute value to our community."

During her time at CSU, Dr. Belovich has also served as assistant dean and associate dean of engineering, led the creation of the college-wide engineering design course for freshmen and expanded Washkewicz' outreach programs to bring more than 500 high school students into its engineering labs each year.

She also conducts research in biomedical systems transport and in algae processes for biofuel production. Through this work, she has brought in \$2.4 million in external funding to CSU and mentored the research of 46 graduate students and 17 undergraduates.

"I have loved my time at CSU and am grateful that my efforts have made a difference for the College and our students," Dr. Belovich says. "I am looking forward to working with everyone in Washkewicz, as well as colleagues across campus, to further meet our mission to produce 'Ready-to-Go Engineers.'"

Dr. Belovich received her Ph.D. in chemical engineering from the University of Michigan and her bachelor of science in chemical engineering and biomedical engineering from Carnegie Mellon University. She has taught classes at both the undergraduate and graduate levels in chemical, biochemical and biomedical engineering. She is a member of the American Institute of Chemical Engineers, the American Chemical Society, the Biomedical Engineering Society and the American Society for Engineering Education.



LEADERSHIP



# KARLSSON NAMED CHANCELLOR

*Dr. Karlsson leaves CSU after seven transformative years*

**WASHKEWICZ COLLEGE OF ENGINEERING'S** former dean, Dr. Anette Karlsson, was selected as chancellor of Embry-Riddle Aeronautical University – Prescott Campus in Arizona. In that role, she will manage all administrative and academic operations and continue Embry-Riddle's mission to advance education and research in aviation and aeronautics.

"During Anette's tenure at CSU, the College of Engineering has undergone a significant positive transformation, including almost doubling the number of undergraduate students and successfully securing funding for and completing construction of a new, state-of-the-art engineering building," notes Jianping Zhu, provost and vice president of academic affairs at Cleveland State. "We are sad to see her go but excited that she will be taking on this new opportunity."

Dr. Karlsson was appointed dean of the College of Engineering in 2012 and previously served as chair of the Department of Mechanical Engineering at the University of Delaware. She earned her bachelor's

and master's in mechanical and aerospace engineering from the University of Linköping in Sweden and her doctorate in engineering from Rutgers University.

Embry-Riddle Aeronautical University was founded in 1931 and is the largest accredited university system specializing in aviation, aerospace engineering and aeronautics.

"Even though I am extremely excited about taking on this new role as chancellor for Embry-Riddle Aeronautical University – Prescott, I will miss Cleveland and all my friends and colleagues at the Washkewicz College of Engineering and CSU. The transformation of the College would not have been possible without the hard work and dedication of faculty, students, staff and friends," says Dr. Karlsson.

We would like to thank Dr. Karlsson for her great service and leadership as the dean of the College for the past seven years and we wish her the best in her new position.



## SOME OF DR. KARLSSON'S ACCOMPLISHMENTS:

- Led and implemented the strategic planning effort for the College, including updating mission, vision and value statements summarized by:
  - Education: "Ready-to-Go Engineers"
  - Research and Teaching: Sustainable Urban Living
  - Values: Diversity and Community Engagement
- Increased the number of undergraduate students by more than 80% from Fall 2012 to Fall 2018.
- Grew the faculty from 49 in Fall 2012 to 67 in Fall 2018.
- Grew the staff from 14 in Fall 2012 to 22 in Fall 2018.
- Enabled the move of the computer science program to the College of Engineering in Fall 2015.
- Increased research expenditures by 40% from FY13 to FY18.
- Together with former University President Ronald Berkman, secured funding for a new engineering building via a public-private partnership. The \$60-million, 100,000-square-foot building is the first constructed for the College of Engineering.
- Grew philanthropic giving to the College by 50% from FY 2013 to FY 2018 (excluding funding for the new building).
- Initiated significant revisions of the engineering curriculum, including freshmen introduction to engineering and senior design.
- Successfully led the College's programs through ABET Accreditation, including new accreditation of two existing programs (computer science and mechanical engineering technology).
- Initiated a new program, the Engineering Student Success Scholars Program, to assist first-generation college students and minority students to succeed in college with funding from local industry.
- Co-chaired the University-wide "Deans Academic Equity Steering Committee," which strives to eliminate the gap between graduation rates among underrepresented minorities and their peers.
- Served as a lead for the Path to 2020 Program; a University-wide long-term budget planning effort.
- CSU was listed as among the "Top 50 Universities Fostering Diversity & Inclusion" published in November 2018 in *Minority Engineer Magazine*.



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# Brian L. Davis

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## INTERIM ASSOCIATE DEAN OF ACADEMIC AFFAIRS AND PROFESSOR

Department of Mechanical Engineering

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**DR. BRIAN DAVIS** joined the Washkewicz College of Engineering last spring — first as a chair of the Department of Mechanical Engineering and now as an interim associate dean of academic affairs.

We asked him a few questions about his career path and academic passions.

**Q:** Can you provide a short summary of your career path?

**A:** For the past 27 years or so, I have been fortunate enough to call Northeast Ohio my home. I joined the Department of Biomedical Engineering at the Cleveland Clinic in 1992, and fully expected to retire from the Clinic. However, after 18 years, I connected with Dr. Frank Douglas at the Austen Biolnnovation Institute in Akron and five days later had a job offer to be the vice president for their Medical Device Development Center. This led to an exciting two-year stint in which I became very familiar with the medical institutions in Akron, as well as NEOMED and the University of Akron. In 2012, the latter institution offered me a position as chair of biomedical engineering, and that is where my interest in engaging with student initiatives blossomed to new levels. Completing my circuit around Northeast Ohio, this year I was extraordinarily fortunate to become chair of Mechanical Engineering at CSU.

**Q:** Can you describe your research at the interface between medicine and mechanical engineering?

**A:** My early publications focused primarily on foot and ankle mechanics, especially related to total ankle replacements. Even at that time, hip and knee replacements far exceeded ankle replacements largely because arthritis of the hip and knee is a major cause of disability. This is not the case with the ankle — although patients with arthritis of this joint could potentially benefit from a viable total ankle replacement. From an engineering/orthopedic point of view, however, all ankle replacements were (and still are) associated with implant loosening. This is still an active area of research in many laboratories around the world.

During my doctoral studies at Penn State, I focused primarily on the biomechanics of exercise devices used by NASA astronauts in

microgravity. However, I also managed to co-author a textbook, “Dynamics of Human Gait.” This book was accompanied by a software package, “Gait Laboratory,” and is still cited by many biomechanics researchers. The software — written originally in Turbo-Pascal — is probably less useful.

Developing advanced technologies for understanding orthopedic conditions has long been an interest of mine. In this regard, I have participated in numerous federally funded projects that have required designing and commissioning state-of-the-art equipment to probe musculoskeletal function. The most advanced of these — the Universal Musculoskeletal Simulator — is used for conducting orthopedic research across a range of joints — both human and animal. Dr. Ton van den Bogert contributed significantly to this project when we were at the Cleveland Clinic — now we are both at CSU.

Finally, I should add that I have spent the past two decades performing research into stresses applied to the skin of diabetic patients. The overarching theme of this work is to develop an understanding of the etiology of diabetic ulcer formation. My research team has advanced methods for assessing high-resolution pressure and shear distributions at the skin-ground interface. We have presented our findings at national and international conferences and are now receiving requests from multiple scientists asking if they can visit our lab and collaborate on projects of mutual interest.

**Q:** Any additional thoughts?

**A:** In 2020, we will be hosting the “Bridging Engineering Science and Technology in Medicine” engineering fair at CSU. “BEST Medicine” is a venue for students in grades 6 through 12 to present their ideas for new medical inventions. The idea is that middle and high school students become more engaged with STEM once they see that their efforts can result in a better quality of life for uncles, aunts, parents or grandparents. Some of the best students at “BEST Medicine” are those whose GPAs may not be the greatest. However, once they realize they have the ability to make a difference in the world, their interest in math, science and engineering increases dramatically. (See [csuohio.edu/engineering/bestmedicine](http://csuohio.edu/engineering/bestmedicine))

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# Josiah Owusu-Danquah

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## ASSISTANT PROFESSOR

Department of Civil and Environmental Engineering

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**DR. JOSIAH OWUSU-DANQUAH** earned a bachelor's degree in civil engineering from Kwame Nkrumah University of Science and Technology in Ghana. He served as an assistant structural engineer for almost three years in Ghana, where he was part of a team of engineers and architects involved in the design and construction of reinforced concrete and steel structures for both private and government organizations. He later obtained his master's degree from Southern Illinois University in 2013 and his Ph.D. from the University of Akron in 2017. He has served as an assistant professor of civil and environmental engineering at CSU since 2018.

Dr. Owusu-Danquah's research focuses on the application of multifunctional materials in the design of "smart" engineering structures and devices. This involves a comprehensive characterization of the mechanical, thermal and electrical properties of engineering materials through experiments and computational modeling. It also includes the simulation and design of functionally optimized engineering structures using finite element tools and 3D printing technology.

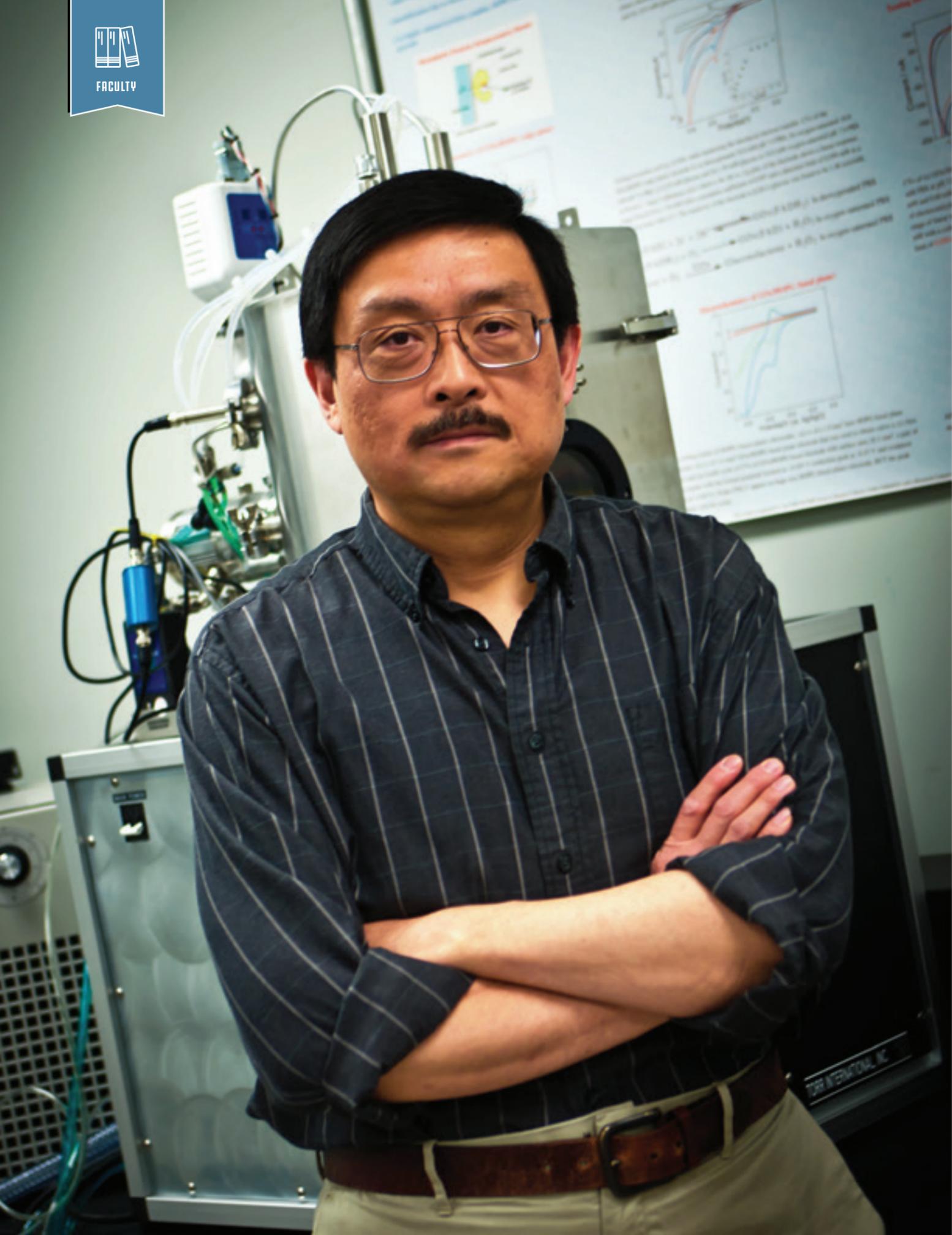
He is currently working to advance development of shape memory alloys (SMA) for use in biomedical and aerospace applications. These types of materials are able to recover large magnitudes of induced deformations upon loading and unloading at a constant high temperature and can also memorize and return to a specific shape. For example, Dr. Owusu-Danquah is working to devise better shape memory training schemes that would allow SMAs to remember specific shapes at both high temperature and low temperature states, while producing dimensionally stable, high actuation strains under zero load. This will further enhance the design of many micro-actuators embedded in robotic fingers, which can open and close as they grasp and release an object for a number of times by heating and cooling of the SMA components.

The laboratories for advanced materials testing, computer simulation and 3D printing housed in the Washkewicz College of Engineering will further grant the ability to incorporate various aspects of his research into the classes he teaches.





FACULTY



# Siu-Tung Yau

## PROFESSOR

Department of Electrical Engineering and Computer Science

**DR. SIU-TUNG YAU** is a professor in the Department of Electrical Engineering and Computer Science at CSU. His research focuses on controlling biological processes using electrical means. He has published more than 40 papers in this area and is the inventor of a bacterial detection platform, which has shown promise for improving the diagnosis of bacterial infections.

The platform is a modified electrochemical immuno-assay that features a voltage-controlled signal amplification. It provides ultrasensitive detection at a low cost and allows for rapid identification of bacteria directly in blood without requiring a culture. The technology could significantly reduce the time it takes to detect and identify bacterial infections and ensure that proper treatment is provided quickly before the infection spreads through the body or to other patients.

Dr. Yau and his doctoral student Xuyang Shi tested the platform on patient blood and urine clinical samples in partnership with St. Vincent Charity Medical Center in Cleveland. These studies, which were conducted at St. Vincent's Microbiology Laboratory, were performed in parallel with two standard bacterial detection technologies: MALDI-TOF and MicroScan. The results indicate that the platform can generate identification 15-27 hours sooner than MALDI-TOF or MicroScan.

The markedly shortened diagnosis time will allow clinicians to use narrow spectrum antibiotics approximately 70 hours sooner than previously administered, treating infections with much greater efficacy and leading to reduced treatment costs and hospital stays. In addition, the platform, in its point-of-care format, will provide early detection in the outpatient setting without the need to transport samples to centralized labs, allowing initiation of antibiotics long before a patient would require hospitalization.

Dr. Yau is currently conducting additional trials as well as working to expand the number of bacteria strains and pathogens the platform can cover.

## CSU Welcomes New Betty L. Gordon Endowed Chair



In July, Professor Yong X. Tao joined CSU and the Washkewicz College of Engineering as the Betty L. Gordon Endowed Chair and Distinguished Professor in the Department of Mechanical Engineering. Dr. Tao's research interests include fundamentals of thermal/fluids sciences; renewable energy and energy efficiency in buildings, including solar, wind and geothermal heat pump systems; and sustainability science.

His research has attracted more than \$19 million in funding from U.S. federal agencies and industry. He is a fellow of ASME, past chair of the ASME Heat Transfer Division, senior vice president and founding board director of the American Society of Thermal & Fluids Engineers, editor-in-chief of *Heat Transfer Research* and a licensed professional engineer.

Dr. Tao comes to CSU from the College of Engineering and Computing at Nova Southeastern University (NSU) in Florida. In 2016, he was the founding dean of that college. Prior to joining NSU, he was the department chair of Mechanical and Energy Engineering at the University of North Texas (UNT). Dr. Tao has also served as associate dean at Florida International University (FIU).

Dr. Tao received his Ph.D. in mechanical engineering from the University of Michigan. He currently serves as interim chair of the Department of Mechanical Engineering at CSU.

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# Maryam Younessi Sinaki

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## ASSISTANT PROFESSOR OF PRACTICE

Department of Mechanical Engineering

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**DR. MARYAM YOUNESSI SINAKI** developed an interest in mechanical engineering due to an early love for mechanics and mathematics. After completing her bachelor's and master's degrees in mechanical engineering, she worked for a number of years in industry. This included conducting projects related to the operation and overhaul of boilers, steam turbines and gas turbines; the design of innovative rotary engines; and the optimization of cooling towers.

She ultimately decided to pursue her passion for working in academia and continued her doctoral studies at the University of Waterloo in Canada. Her Ph.D. research focused on the production of hydrogen using methane. Due to the multidisciplinary nature of this research, she gained experience in the areas of kinetic modeling and combustion, two phase liquid solid flows and fluidization, catalytic processes and numerical modeling.

After completing her Ph.D., she worked as a postdoctoral fellow at the University of Akron before joining the Washkewicz College of Engineering in 2017. Her teaching philosophy is based on the idea that any subject in engineering can be interesting to students if they learn its application. Therefore, her courses include a significant amount of practical problems and group work, so students can see for themselves how engineering concepts and mathematical equations actually operate in the real world. Her efforts led to her earning the Most Outstanding Mechanical Engineering Faculty Member Award in 2018 as voted by CSU students.

Apart from teaching, Dr. Younessi is currently organizing the Thermodynamics Laboratory for use as an educational tool and as a research resource for students and faculty. Her own scholarly interests are mostly in the energy field, including numerical modeling of energy systems for investigating their performance and design.





# THE NEXT CHAPTER

*Dr. Paul Lin retires after 34 years at CSU*

**DR. PAUL LIN** joined Cleveland State University in 1985 as an assistant professor of mechanical engineering. He was promoted to associate professor with tenure in 1991 and professor in 1998. In January 2002, he became the chair in the Department of Mechanical Engineering and, in 2007, he became the associate dean of academic affairs in the College of Engineering until his retirement in 2019.

He has been in administration for half of his 34-year academic career, and still managed to become an ASME Fellow in 2008 based on his accomplishments in research and development. Dr. Lin also provided service as editor-in-chief, associate editor and reviewer for refereed journals. His research has resulted in becoming the keynote speaker for seven international conferences.

Dr. Lin's academic career started through collaborations with the Advanced Manufacturing Center (AMC), the Wright-Patterson Air Force Base and the NASA-Lewis Research Center (renamed later as the NASA Glenn Research Center). Through his 10-year research work at NASA, Dr. Lin developed a non-conventional optimization technique for aircraft engine design. He also developed an intelligent system to monitor the microgravity environment onboard the International Space Station. Dr. Lin worked with the Wright-Patterson Air Force Base in Dayton to develop a 3D optical measurement technique to quantify aircraft tire deformation subject to high-speed take-off and landing. As a result, his work was introduced by Aerospace Engineering magazine in its July 1994 issue as an innovative technology.

Gregg Schoof spoke with Dr. Lin in May 2019 about his career and plans for retirement.

**GREGG SCHOOF (GS):** What are a few of the significant changes you've seen at Cleveland State University and the Washkewicz College of Engineering since you started working here in 1985?

**PAUL LIN (PL):** One of the biggest changes was the unionization of faculty and staff. As a department chair, I learned how to work with the unions and follow the agreements. An additional significant change has been increasing engineering student enrollment, partially thanks to the Fenn Academy. Other positive changes

were the new engineering building (Washkewicz Hall), raising the admission standards and establishing greater expectations for faculty. Overall, we are moving forward with better quality programs, faculty and students, as well as an improved national ranking of our undergraduate programs.

**GS:** What do you feel has been your positive contribution to CSU or to the Washkewicz College of Engineering?

**PL:** I have helped promote the image of the University whenever I traveled. Serving as a keynote speaker at several conferences is one of many examples. Raising expectations from faculty also helped improve the image and reputation of the College. Developing the College's workload guidelines with the dean and the faculty provided a means to gauge faculty's performance and reward the faculty who performed well in research, teaching and/or service with less teaching load.

**GS:** If you could offer any helpful advice to an incoming associate dean, what would it be?

**PL:** The associate dean of academic affairs works with department chairs almost on a daily basis. Thus, having experience as a department chair is desired. This person, in my opinion, will need to be open-minded, organized and, most importantly, maintain standards and principles, but operate with some flexibility when necessary.

**GS:** What are your plans for the future?

**PL:** First, I want to travel around the world with my wife, my children and my grandchildren, also with my relatives and friends. Second, I hope to have an opportunity to work with young faculty to perform cutting-edge research and development. Working as an endowed scholar overseas would be ideal. I also will move from Cleveland to Columbus and build a new home there soon. It will allow me to spend more time there with my daughter and her family. With 34 years of service with CSU, I am sure that I will miss the College, the University and the people I have worked with.



STUDENTS

# — Head of the — CLASSES

*Learn more about the College of Engineering's valedictorians and salutatorian*



From left to right: Kayli Senedak, Jennifer Wisniewski and Aubrey Lokey

## JENNIFER WISNIEWSKI

### Washkewicz College of Engineering Valedictorian

Jennifer Wisniewski graduated from the Washkewicz College of Engineering with a bachelor's degree in mechanical engineering as a member of the Jack, Joseph and Morton Mandel Honors College. Since her first year at CSU, she has been a member of CSU's student chapter of Engineers Without Borders (EWB), later serving as vice president, president and project manager. Through EWB, Wisniewski volunteered with Habitat for Humanity and completed other projects for the City of Cleveland. In addition, she traveled to Salinas Valley, California, and August Pine Ridge, Belize, to conduct water quality assessments. She was also president of CSU Robotics and co-facilitator of the CSU Lead Program, as well as a member of CSU's Fluid Power Vehicle Team that won first place at the April 2019 competition in Littleton, Colorado. Wisniewski's honors thesis was designed to create a solution for sterilization issues faced abroad. She originally played varsity soccer, but, due to injuries, left the team and later joined fencing. Wisniewski has held internships at Goodyear Tire and Rubber Company, Karpinski Engineering and Sherwin-Williams.

## AUBREY LOKEY

### University Valedictorian and College of Sciences and Health Professions Valedictorian

Aubrey Lokey graduated from Cleveland State University with physics and computer engineering majors and a mathematics minor. She will be pursuing her Ph.D. in experimental nuclear physics in the fall of 2019. She has volunteered and interned at NASA Glenn Research Center, where she conducted research that has been published and featured in multiple conferences. Lokey co-presented at the 2016 American Society of Gravitational and Space Research Meeting and received the YWCA Dr. Jennie S. Hwang Award for outstanding achievement by a female STEM student. Her senior design project was a mock-up and simulation of a hardware-based telemetry system for the Sierra Nevada Dream Chaser spacecraft. Lokey was both the treasurer and secretary of the Society of Physics Students and has been a member of CSU's student chapter of the Institute of Electrical and Electronics Engineers (IEEE) and the Society of Physics Students Outreach Team. She also worked on the administrative team for Operation STEM and assisted with VEX Robotics Competitions. She says that the things she liked best about CSU and the Washkewicz College of Engineering were the great professors, affordability and accessible location. Her best advice to students is to "persist when you experience failure."

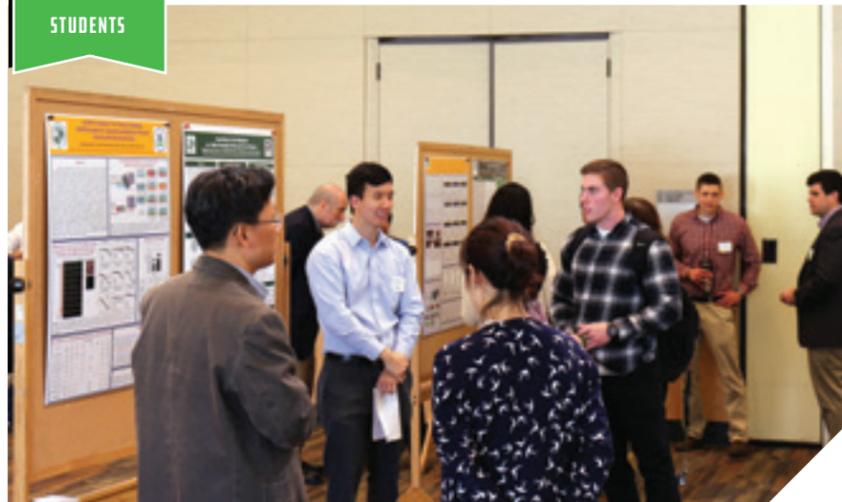
## KAYLI SENEDAK

### Washkewicz College of Engineering Salutatorian

Kayli Senedak graduated from the Washkewicz College of Engineering with a degree in civil engineering. She is in the 4+1 accelerated master's program and she expects to graduate with a master's of science in civil engineering in May of 2020. She has been an active member of CSU's student chapters of the American Society of Civil Engineers (ASCE), in which she served as treasurer, Tau Beta Pi, in which she also served as treasurer, and Phi Sigma Rho. She has also had a strong community involvement, being an active volunteer with Viking Expeditions, Possumwood Wildlife Rescue Center, Lake Effect Band, Fuller Center for Housing and Make a Difference Day.



STUDENTS



# RESEARCH DAY

2018 WASHKEWICZ COLLEGE OF ENGINEERING

The Washkewicz College of Engineering held its Annual Research Day on October 19, 2018. The keynote speaker, **Bill Eibon**, director of technology acquisition, automotive OEM coatings for PPG, gave a great presentation related to research and innovation in industry.

## BEST POSTER AWARDS

### FIRST PLACE

**Contact/Tracking Control With Impulse-Momentum Sliding Surface and Terminal Sliding Mode**

*by Holly Warner, Hanz Richter, Saleh Mobayen and Dan Simon*

Department of Mechanical Engineering and Department of Electrical Engineering and Computer Science

### SECOND PLACE

**Necessary Condition for Transmission Line Congestion**

*by Shubo Zhang and Hongxing Ye*

Department of Electrical Engineering and Computer Science

### THIRD PLACE

**Design and Preliminary Evaluation of a Pediatric Exoskeleton**

*by Curt A. Laubscher and Jerzy T. Sawicki*

Department of Mechanical Engineering

### HONORABLE MENTION

**Identification of a Control Law for Foot Placement During Human Walking**

*by Huawei Wang and Antonie van den Bogert*

Department of Mechanical Engineering



## Pursuit of EXCELLENCE

*Graduating engineering and computer science students take ethics pledge*

**ON APRIL 4, 2019**, the Washkewicz College of Engineering hosted the Order of the Engineer and the Pledge of the Computing Professional. The Pledge of the Computing Professional is an organization that promotes the notion of computing as a recognized profession at the time of graduation for students in computer science and related programs. It is solely intended to promote and recognize the ethical and moral behavior of graduates of computing-related degree programs as they transition to careers of service to society.

The Order of the Engineer ceremony in the United States was first held at Cleveland State University in the Washkewicz (then Fenn) College of Engineering on June 4, 1970. Since

then several other engineering colleges throughout the United States have adopted the ceremony. Ring ceremonies are conducted by Links (local sections) of the Order. There are currently 189 Links in the United States, and Washkewicz College is Link 1.

Approximately 104 students participated in the ceremony this past year and received either the Order of Engineering Steel Ring or the Pledge of the Computing Professional Pin.

In 2020, the College will celebrate the 50th Anniversary of the Order of the Engineer and the founding of the First Link at Fenn College in 1970.



STUDENTS



From left to right: David Gory, Matt Sokolich, Matt Grabowski, Sean Mulvin and Larry Littlejohn (USA Network)



From left to right: Oliver Shea, Matt Sokolich, "Stone Cold" Steve Austin, Cleveland Browns Quarterback Baker Mayfield and Sean Mulvin

# HOLLYWOOD EXPERIENCE

*This year, mechanical engineering students had the opportunity to build a catapult for Steve Austin's show on USA Network*

**IN APRIL 2019**, just a few days before final exams, Dr. Brian Davis, chair of the Department of Mechanical Engineering, was approached by USA Network. The initial phone call came through at 4 p.m. on a Friday afternoon. The person calling — Larry Littlejohn — requested if CSU students would help build a catapult for an upcoming TV shoot. Apparently, the film crew had planned on shipping a catapult from another location, but that plan had been shelved. This left the film crew in a tight spot for a segment they wanted to include, especially given the fact that TV shooting was just days away.

The concept entailed the Cleveland Browns quarterback Baker Mayfield competing against "Stone Cold" Steve Austin — a renowned former professional wrestler who held 19 championships throughout his wrestling career. Around 2003, he switched to acting, as well as producing and hosting television shows.

In his new TV series "Straight Up Steve Austin," he joins celebrity friends in exciting surroundings and they swap stories about their lives and careers. For the Cleveland shoot, the idea was for Mayfield and Austin to meet, do some tailgating in the parking lot of FirstEnergy Stadium, launch bean bags and compete for accuracy with a (yet-to-be-built) catapult. They also had some additional fun driving impressive "Warthog" vehicles around the parking lot. A Warthog is a four-wheel, all-terrain vehicle with a forward-housed, low-profile, liquid-cooled, hydrogen-burning internal combustion engine, which powers an automatic infinitely variable transmission.

While the Warthog was available, the catapult was not. After the call from Littlejohn, a mass email went out to mechanical engineering students in search of anyone who could design and build a catapult and verify that it could launch a projectile 30 feet. A group of undergraduate students led by Oliver Shea volunteered and the team consisting of Shea, David Gory,

## MISSION ACCOMPLISHED!

Matt Grabowski, Sean Mulvin and Matt Sokolich was in place by 6 p.m. on that day. By 10 p.m., Shea had created a design and a bill of materials was sent to USA Network for their approval.

On the following Sunday, USA Network flew an associate producer to Cleveland, who rented a truck and went shopping with the students. By Sunday evening, they had assembled the frame. The first test took place on Monday afternoon with the projectile travelling 89 feet. With the knowledge that the design was capable of exceeding the minimum threshold by a factor of three, the catapult was taken to the FirstEnergy Stadium for filming, with the team of students invited to the set.

The catapult performed as expected. The TV crew actually chose a heavier payload (bean bag chairs) and the launch mechanism had to be "beefed up," with the help of David Epperly, the machinist of CSU's Washkewicz College of Engineering, to accommodate the heavier loads. The increased stress on the release pin was successfully addressed by the students who performed on-the-spot adjustments. As for the performance of Mayfield and Austin, in true "Hollywood fashion," it came down to Austin's last launch for him to surpass Mayfield and launch a bean bag for a "hole-in-one."

Mission accomplished!

**The episode aired in August 2019 and can be viewed at [usanetwork.com](http://usanetwork.com).**





STUDENTS



Shaun Clark

# International WATERS

*Engineers Without Borders student gets hands-on experience out of the country*

**BY GWENDOLYN KOCHUR**

Student Shaun Clark received hands-on engineering experience when he traveled to the western end of Panama to study a community's water needs.

Clark represented CSU among six participants on the weeklong expedition with the Northeast Ohio Chapter of Engineers Without Borders (EWB).

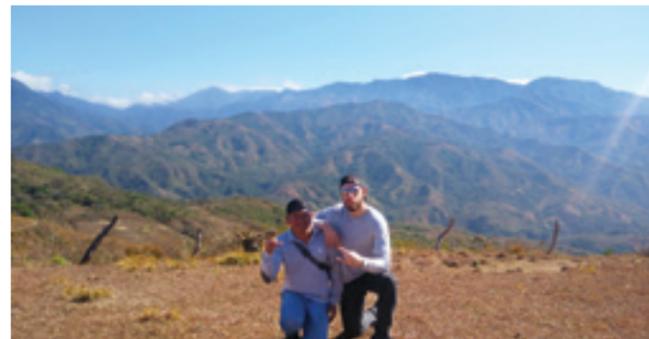
In Panama, the group was divided into tactical and PMEL (planning, monitoring, evaluation and learning) teams. Some of Clark's duties on the tactical team were to identify and test every water source, checking for pH levels and arsenic and bacteria counts. While the tactical team tested the waters, the PMEL team interviewed and surveyed the community to determine its water needs.

With their collective results, the group determined there were problems delivering water to the community. Now, the group is focusing on designing a centralized location for water delivery, which the professional chapter of EWB will travel back to Panama to implement.

During his trip, Clark discovered the importance of community engagement and education.

"We wanted the community to own this project," he says.

The Northeast Ohio EWB group held meetings with the community to establish credibility and accountability. They also met with a local technical college and helped students set up and bury pipes, taught them how to cover leaks and more.



**WE WANTED THE COMMUNITY TO OWN THIS PROJECT.**

SHAUN CLARK

"To keep a system working, it needs construction maintenance, and a community needs education to help with that maintenance," Clark notes.

This isn't the first time Clark has been on an international engineering-based trip; he went on an assessment trip to August Pine Ridge, Belize, in 2017 with the CSU chapter of EWB. The group is currently trying to obtain water meters to send to the community in order to start collecting data to improve the water delivery system.

Clark, who is pursuing his bachelor of science in civil engineering, expects to receive his undergraduate degree in May 2020 and finish his graduate program in May 2021. These international experiences have supplemented his CSU education.

"A big part of becoming a technical expert is seeing places where problems persist and then processing those problems into solutions," he says. "This experience helped me focus on identifying a need from the community and using my technical knowledge to come up with ideas on how to alleviate those problems in a healthy, sustainable and cost-effective way."

"I would highly recommend students take opportunities like this," he adds. "This not only helps put a gold star on a resume, but provides context on how to deliver a service to someone, whether it be an undeveloped community or a huge multinational client. Experiences like this give students the tools to become professionals."





PROGRAM



# INSPIRED SPACES

*New research and teaching laboratories are a hub for engineering education*

## THE WASHKEWICZ COLLEGE OF ENGINEERING'S

**NEW HOME**, Donald E. Washkewicz Hall, was officially completed in early 2019 and offers a range of resources for students, faculty and community members. This includes a wide variety of state-of-the-art laboratories, which enhance the College's dual mission of producing "Ready-to-Go Engineers" and developing cutting-edge research and technologies in all facets of engineering. These labs also serve as a regional resource for local industry and various government agencies who are utilizing the facilities and the expertise of Washkewicz students, faculty and staff to advance economic development and societal good.

## RESEARCH LABORATORIES

### ADVANCED MANUFACTURING & MATERIALS PROCESSING (AM<sup>2</sup>P) LABORATORY

AM<sup>2</sup>P, led by Dr. Tushar Borkar, an assistant professor in the Department of Mechanical Engineering, focuses on improving processing of advanced materials, such as metals, alloys and composites, via advanced manufacturing processes, including additive manufacturing.

These processes allow for the development of new materials with novel properties that could enhance technology development in a wide variety of fields from electronics to medicine. In addition, advanced manufacturing processes, such as spark plasma sintering, can produce finished products at lower temperatures and with shorter processing times, as compared to conventional processing routes. This could reduce costs and help increase competitiveness for American industries.

Current research activities being conducted in AM<sup>2</sup>P lab by Dr. Borkar's group include:

- Understanding the effect of selective laser melting (SLM) processing parameters on densification, microstructure and mechanical properties of 316L stainless steel. This study will help future researchers in selecting, as well as optimizing, SLM processing parameters to obtain desired microstructure and mechanical properties.
- Spark plasma sintering of low modulus beta titanium alloys. The main objective is to study the effect of different alloying elements on microstructure, phase transformation and mechanical properties of these newly developed titanium alloys. It seeks to establish new avenues for the future development of biocompatible titanium alloys with optimum microstructures and properties.
- Development and processing of in situ Ni-Ti-C composites by mechanical alloying followed by spark plasma sintering.

AM<sup>2</sup>P is also being utilized by students for senior design project work, master's and doctoral research and as a resource for instruction in manufacturing and mechanical engineering.

### THE TISSUE ENGINEERING AND BIOMECHANICS LABORATORY

The Tissue Engineering and Biomechanics Laboratory is directed by Dr. Chandra Kothapalli, an associate professor in the Department of Chemical and Biomedical Engineering. Research conducted there spans multiple areas of engineering such as microfluidics, tissue engineering, toxicology platform development, computational fluid dynamics and nanobiomaterials assessment. These projects have involved numerous high school, undergraduate and graduate students and have been conducted in partnership with the University of Akron, Cleveland Clinic and Case Western Reserve University, through funding from the National Science Foundation, National Institutes of Health and United States Department of Agriculture.

For example, the lab has worked to design and develop miniaturized chemical reaction and analysis systems to overcome the limitations of conventional batch or macroscale continuous-flow reactors in bulk colloid synthesis. These microfluidic mixers require very low volumes of fluids and facilitate the synthesis of micro- and nano-sized colloidal particles utilized in various biochemical and biomedical applications, including imaging, pharmaceuticals and cell and gene delivery.

The lab has also conducted a number of projects designed to better understand how diseases and disorders, such as cancer and cardiovascular disease, develop in human bodies and how cellular and tissue engineering principles could be applied to treat such pathophysiological conditions. This includes an NSF-sponsored project to develop novel nanoparticles that can reduce the incidence of aneurysms in humans.

### THE 3D-BIOPRINTING LABORATORY

The 3D-Bioprinting Laboratory is led by Dr. Moo-Yeal Lee, an associate professor in the Department of Chemical and Biomedical Engineering. The lab has developed 3D-bioprinting technology designed to create highly organized multicellular mini-tissues by precisely dispensing multiple human cell types in biomimetic hydrogels with automated printing robots. These printed tissues, with cells obtained from patients, can be used as disease models or screening tools for a wide variety of applications.

Currently, the lab is partnering with the National Institutes of Health, the National Science Foundation, the Environmental Protection Agency and Colgate Palmolive to expand use of the technology as a drug testing and toxicity assessment tool. This includes a project to utilize liver, pancreas and intestine tissues derived from human stem cells to simulate the normal mechanisms involved in inter-organ "crosstalk." The data provided will allow the team to better assess how hormones, nutrients and drugs might improve treatment for Type 2 diabetes.

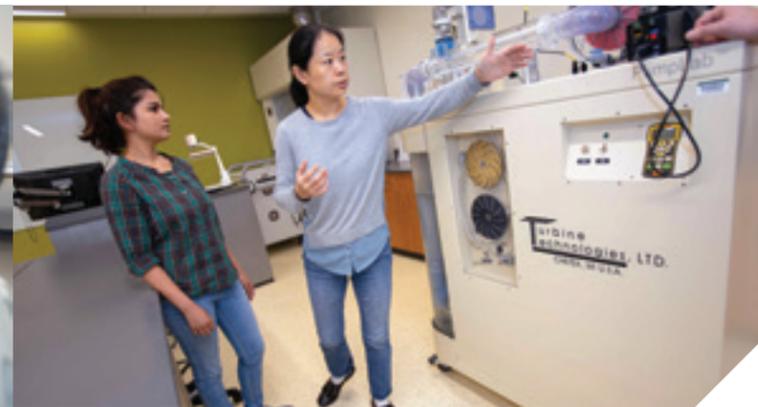
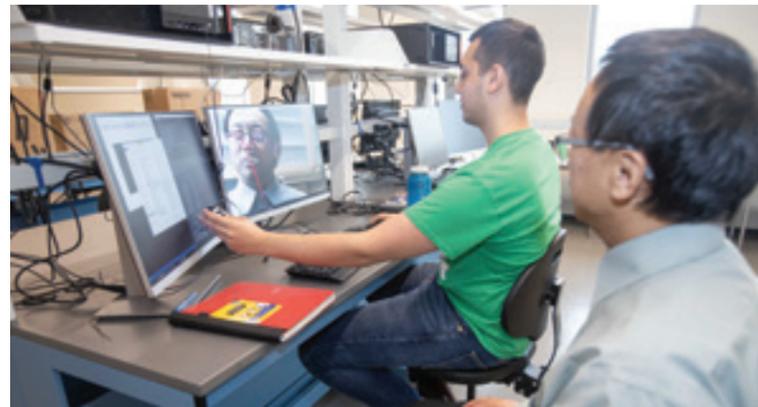
Based on the research already conducted by the lab, Dr. Lee has also established Bioprinting Laboratories Inc. to commercialize his bioprinting technology. The company could provide significant value to the global in vitro cell-based testing market, while also enhancing overall drug discovery and testing. Dr. Lee has received funding from the TeCK Fund and I-Corps at Ohio to further develop the company's market plan and product development strategy.

### CENTER FOR HUMAN-MACHINE SYSTEMS

The Center for Human-Machine Systems supports basic research in how humans control movement and how control is affected by injury or disease. It also conducts applied research designed to improve the development of electro-mechanical devices to restore functional capabilities lost to injury or disease and to aid in rehabilitation and optimal exercise.



PROGRAM



Dr. Antonie van den Bogert, a professor in the Department of Mechanical Engineering, utilizes the center to study the control mechanisms that allow humans to keep their balance in the presence of external disturbances while standing and walking. This research could ultimately improve design of controllers for prosthetic legs and robotic exoskeletons and enhance therapy interventions for people with balance deficits.

Dr. Ann Reinthal and Dr. Debbie Espy, both associate professors in the Department of Health Sciences, are conducting research funded through the American Heart Association to evaluate the effectiveness of different physical therapy interventions to improve balance. This is particularly important for senior citizens and stroke victims who often suffer injuries or physical set-backs due to falls.

Finally, Dr. Dan Simon and Dr. Hanz Richter, both professors in the Department of Mechanical Engineering, and Dr. van den Bogert have been using center facilities, including a prosthesis test robot, to evaluate optimal control and energy regeneration strategies that allow people using trans-femoral powered prostheses to walk. The work is funded by the National Science Foundation.

The center also supports an NSF Research Experiences for Undergraduates program called Rehabilitation Engineering at Cleveland State University. Each summer, center faculty mentor 10-12 undergraduate students from around the country who take part in research projects. This program recruits students from underrepresented groups with a special emphasis on including students with disabilities.

### SOFT MATERIALS AND COMPLEX FLUIDS ENGINEERING RESEARCH LABORATORY

The Soft Materials and Complex Fluids Engineering Research Laboratory seeks to investigate, design and utilize nanoscale materials in a wide variety of applications. The lab focuses on materials measurement and fabrication, optical analysis and characterization and features a Malvern Zetasizer Nano ZS to measure the size and surface charge of nanoparticles, an Anton Paar Physica Rheometer for measuring the rheology of complex fluids and an Olympus digital microscopy system to conduct bright field, fluorescence and evanescent wave scattering microscopy.

Dr. Christopher Wirth, an assistant professor in the Department of Chemical and Biomedical Engineering, is using the lab to measure

the motions and forces that arise in a concentrated suspension of nanoparticles. The research could transform our understanding of how nanoparticles of complex shape or surface chemistry interact during the processing of coatings, production of complex fluids and in biology.

Dr. Geyou Ao, also an assistant professor of chemical and biomedical engineering, is conducting research in the lab designed to sensitively measure optical properties of various nanostructures, including carbon nanotubes and colloidal nanoplatelets. The goal is to develop nanomaterial tools to study specific molecular interactions in biological processes and create a new class of biocompatible, multicolor fluorescent probes for therapeutic and diagnostic mechanisms, such as early detection of cancer.

Dr. Nolan B. Holland, professor of chemical and biomedical engineering, designs and synthesizes novel protein-based polymers. The materials are produced in and purified from modified bacterial systems. Students in his lab have developed higher efficiency anti-freeze proteins and responsive materials that assemble into nanoparticles for drug delivery. In addition to building on these projects, he is currently working on hydrogel materials that can be used in 3D bioprinting applications.

## TEACHING LABORATORIES

### THE DAN T. MOORE MAKERSPACE

The Dan T. Moore MakerSpace consists of 6,000 square feet of open laboratory space, providing CSU students with access to the latest prototyping and fabrication technologies to assist in transforming ideas into practical applications. It houses high-resolution 3D printers and scanners, computer aided manufacturing equipment, digital fabrication tools, laser engraving and cutting machines and tools for testing and designing electronic devices.

It is also the home of the Samuel Austin Woodshop, a state-of-the-art, hands-on wood and materials lab, which features open teaching spaces, multiple pieces of woodworking equipment and an advanced Shopbot, a 3-axis CNC machine for fabricating wood, plastic and aluminum. The woodshop was made possible thanks to a partnership with the Austin Company, a Cleveland-based process design consulting and architectural engineering firm.

The MakerSpace, which was made possible through a gift from CSU trustee Dan T. Moore, is a key component of the Washkewicz College's

interdisciplinary, hands-on and collaborative approach to engineering education. It also is being utilized for student research, senior design projects and demonstration and outreach efforts being undertaken by the College.

### PARKER HANNIFIN MOTION AND CONTROL LABORATORY

The Parker Hannifin Motion and Control Laboratory is a state-of-the-art instructional facility with the most modern instrumentation, which provides a unique learning experience to our students. It includes hydraulic and pneumatic circuit stations, a localized power station, an electrohydraulic station, a motion control station and an electrohydraulic vehicle station.

Through the courses offered in the lab, students will learn fluid power laws, principles, benefits and limitations; conduct experiments using motion control components and circuits relative to energy transfer and power efficiency; understand machine level requirements and translate them into system requirements; apply design, simulation and analysis tools to appropriately size components in motion control systems; inspect, analyze and develop corrective action for system failure; and optimize the integration of sensing and electronic control functions with motion control components and systems.

The lab was established through generous and continuous support by the Parker Hannifin Corporation.

### ADDITIVE MANUFACTURING LABORATORY

The Additive Manufacturing Laboratory seeks to enhance training and education in additive manufacturing, both for CSU students and faculty and for local companies and entrepreneurs. The lab was made possible thanks to a grant from the Ohio Department of Higher Education's Regionally Aligned Priorities in Delivering Skills (RAPIDS) program.

The lab supports multiple engineering courses on campus by providing the equipment and space necessary to develop hands-on skills in advanced manufacturing, machine design, biomedical design, hybrid manufacturing and computer aided engineering. It also assists students in acquiring familiarity with the latest equipment they will be using during cooperative education assignments and in their first jobs following graduation.

The laboratory is directed by Dr. Tushar Borkar, an assistant professor in the Department of Mechanical Engineering, and also assists in

preparing students to conduct research and design projects run through Dr. Borkar's Advanced Manufacturing & Materials Processing (AM<sup>2</sup>P) Laboratory as well as other research labs within the College.

### ELECTRONIC PRINTING LABORATORY

The Electronic Printing Laboratory is managed by Dr. Lili Dong, an associate professor in the Department of Electrical Engineering and Computer Science, and seeks to educate undergraduate and graduate students and train industrial collaborators on this emerging technology.

The lab offers full service electronic printing, prototyping and design facilities, which mirror what students will utilize in engineering positions following graduation. It includes two Optomec Aerosol Jet 200 electronic printers, an ultrasonic cleaning system, a curing system, circuit measurement and testing instruments and devices for preparing ink and circuit substrates.

Dr. Dong has developed a cross-listed course, offered to electrical and mechanical engineering majors, which uses the lab as a teaching space. Students are required to develop a series of prototypes and electrical devices utilizing the latest electronic printing techniques and technology. The course seeks to match industrial specifications and adequately prepare students for future careers in electronics manufacturing. In addition, the lab supports senior design projects conducted by engineering students, demonstration events for local industry and training programs for faculty, staff and business partners.

### THERMAL-FLUIDS LABORATORY

The Thermal-Fluids Laboratory seeks to reinforce conceptual understanding of the fundamental theories of fluid mechanics, heat transfer and thermodynamics by providing hands-on experience with the latest techniques and tools in an experimental setting. Student work in the laboratory is woven into multiple mechanical engineering courses and focuses on investigating a wide range of contemporary topics in engineering.

The lab features a wind turbine performance test bench, a centrifugal pump and flow system, a steam turbine power station and a forced and free convection unit. All equipment meets current industry standards and assists students in learning how to use facilities they will be operating in various engineering positions following graduation.

### THE LAWRENCE J. CAWLEY INNOVATION LAB

The Lawrence J. Cawley Innovation Lab, also known as the Engineering Freshman Design Lab, is utilized by the Washkewicz College's Introduction to Engineering Design course to provide entry-level students with experiential training in fundamental engineering concepts. The course is required for most majors and the lab provides a state-of-the-art, professional-quality environment, which maximizes Engaged Learning.

Students work in teams of four to complete a wide variety of experiments designed to introduce a range of theories that will be central to future coursework, research and cooperative education requirements. Each team also conducts two design projects, presents their results to the class and submits a brief report highlighting



findings. In addition to the technical aspect of the course, students are introduced to topics involving engineering ethics, safety and professional development.

### PROGRAMMABLE LOGIC CONTROLLERS & CONTROL LABORATORY

The Programmable Logic Controllers & Control Laboratory provides a state-of-the-art learning environment for experimentation and training on Programmable Logic Controllers. PLCs are industrial digital computers which have been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, robotic devices or any activity that requires high reliability control and ease of programming and process fault diagnosis. The lab is equipped with 14 stations of professional-quality PLC equipment.

The facility supports multiple required courses in engineering technology, and gives students hands-on experience in process control theory, ladder logic programming and advanced controls hardware. The lab also serves as a platform for Industrial Internet of Things projects, supporting both student research and senior design efforts.

### COMMUNICATIONS AND ELECTRONICS LABORATORY

The Communications and Electronics Laboratory is utilized to augment instruction in laboratory-based electrical engineering courses from the beginning through the advanced levels. This includes training in electronic circuits, electronic device design, advanced communications and software defined radio. These courses cover introductory circuit-based experiments, intermediate-level module-based experiments and more advanced system-based implementations.

For example, students in the upper-level Software Defined Radio (SDR) course utilize the lab to implement functioning SDR systems involving various aspects of a communication system, such as modulation, detection, pulse shaping, channel estimation and equalization, frame detection and frequency offset correction.

The laboratory is accessible to students outside of regularly scheduled class hours and can also be utilized for student research and senior design.

### DIGITAL SYSTEMS LABORATORY

The Digital Systems Laboratory supports all of the hardware-related courses in the computer engineering program and provides hands-on training in system design, computer organization, hardware-software co-design and embedded systems development. The lab contains 12 work stations, each equipped with electronic design automation

software packages for digital system synthesis and simulation. Students can develop their own prototyping systems with field programmable gate array or micro-controller-based boards and verify the operation of the physical hardware.

### SMART INTERNET OF THINGS LABORATORY

The Smart Internet of Things Laboratory provides essential education and training in the emerging fields of data innovation, connected devices and networked systems that make up the Internet of Things (IoT). The growth of the IoT over the last decade has created a wide variety of applications in health care, public safety, manufacturing and more.

CSU is at the cutting-edge of research and education in this field, through its Internet of Things Collaborative in partnership with Case Western Reserve University. The Smart Internet of Things Laboratory is supporting emerging coursework in the area, as well as student research and senior design projects that are supporting regional IoT development and implementation. This expertise will give CSU engineering graduates a "leg up" as they enter the workforce, as the IoT continues to transform numerous aspects of engineering, computer science and computer engineering.

### STRENGTH OF MATERIALS LABORATORY

The Strength of Materials Laboratory is an interdisciplinary facility focused on testing and enhancing the durability of a wide variety of materials and components. The lab is being utilized to enhance coursework, student research and design in biomedical engineering, civil engineering and mechanical engineering.

It includes an Instron load machine, which will allow experiments for the investigation of material tension, compression and bending, as well as a torsion tester, a thin cylinder stress tester and a hardness tester. All of the devices meet industry standards and provide students with the opportunity to become familiar with instruments they will use regularly in their future professional careers.

### CIVIL AND ENVIRONMENTAL ENGINEERING COMPUTER SIMULATION LABORATORY

The Civil and Environmental Engineering Computer Simulation Laboratory assists students in gaining valuable introductory skills in simulation, design and analysis, while also supporting upper level student research and design projects. The facility includes state-of-the-art, professional-quality software and hardware, including SPSS, RISA, HydroCAD, HEC-HMS 4.2.1 and HEC-RAS 5.0.6. It augments engineering course work in structural analysis, surveying, hydraulics, hydrologic analysis and engineering design.



## INNOVATIVE THINKING

*Creative problem-solving was on display at the annual Senior Design Symposium*

**THIS ANNUAL SENIOR DESIGN SYMPOSIUM** and Awards Dinner took place on Friday, May 3, 2019, in CSU's Student Center. There was a poster competition highlighting more than 70 design projects.

A team of mechanical engineering students took first place for their project entitled, "NFPA Fluid Power Vehicle Challenge." Members of the team included Jason Downie, Markus Kotze, Sean Mulvin, Patrick McDonough, Matt Sokolich and Jen Wisniewski. (See featured article on page 38.) Dr. Majid Rashidi and Bogdan Kozul served as faculty advisors. The project was sponsored by the National Fluid Power Association (NFPA), an organization that represents fluid power industry partners and collaborates to advance fluid power technology.

An electrical engineering and computer science team of students took second place for their semi-automated nursing simulation with mixed reality technology. Members of the team included Eric Bobel, Keisi Kotobelli and Isaiah Traben. Professor Wenbing Zhao advised the team.

A chemical engineering team of students, including Mohammed Kalil, Farid Khoury, Nandini Padaraju and Fjorela Xhyliu earned third place for their design of a cancer drug manufacturing facility entitled, "Manufacturing Facility Design: Monoclonal Antibodies." The project was advised by Dr. Marvin Thrash.

Thanks to donors, the top three teams won cash prizes of \$5,000, \$3,000 and \$2,000, respectively.

The Senior Design Symposium and Awards Dinner celebrates the completion of the two-semester-long senior design capstone course, where teams of engineering students collaborate with industry members to develop solutions to real-world engineering problems.

In addition to the poster session, there was a keynote presentation by Patricia Babington, vice president of engineering services at Rockwell Automation, followed by the awards ceremony, which included the recognition of the year's college valedictorian, Jen Wisniewski, from the Department of Mechanical Engineering, and the salutatorian, Kayli Senedak, from the Department of Civil and Environmental Engineering.

*The industry-sponsored Senior Design program of the Washkewicz College of Engineering has a new leader*



Dr. Michael L. Adams has become the director of senior design for the Washkewicz College of Engineering. In addition to this task, he is the chair of the Department of Engineering Technology. After receiving his doctorate from Case Western Reserve University in 2001, he embarked on a machinery troubleshooting mission which continues to this day. In 2004, he began a new professional hobby — teaching as a part-time instructor in the Department of Mechanical Engineering at CSU. This new-found hobby eventually became the favorite part of his day, and, in 2012, he opted for full-time employment at CSU in the Department of Mechanical Engineering. In 2016, he was promoted to chair of the Engineering Technology Department, and, in 2019, he was appointed as director of Senior Design for the college. Dr. Adams was also granted tenure in 2019. His current focus is on student success, which he has historically found to be tied to his own success.



PROGRAM



# — One-of-a-Kind — OPPORTUNITIES

*Fenn Academy prepares future engineers*

**FENN ACADEMY'S MISSION** is to encourage middle and high school students to pursue an engineering career by expanding their knowledge and enthusiasm for the engineering profession. This task is achieved in a number of ways. First, by providing teachers, counselors and parents with information about engineering and related careers. Secondly, students are engaged in fun and inspiring activities including egg drops, tower building, Ozobot coding, environmental competitions, parachute drops, Rube Goldberg competitions and more.

Efforts are also made to reach out to underrepresented populations, including women, by using a diverse team of undergraduate and graduate students, as well as faculty, for outreach activities. Individual and group tours, job shadowing and one-on-one interaction with engineering student organizations make the engineering profession come to life for prospective students.

This year, the Engineering Student Recruiting Assistant staff included Megan Keleman, Marcus Wilde, Chloe Zifcak, Christina Pope, Zavier McClean, Jessica Stange, Patrick Schlund, Tyler Vegh, Tim Szeltner, Victor Rosa, Trinity Robinson and Chris Chajon. The team represented a variety of engineering majors and several students were members of engineering student organizations, student government, OpSTEM and

the Honors Program. The team was led by Gregg Schoof, manager of Engineering Student Programs and associate director of Fenn Academy.

Currently, 78 schools in six counties in Northeast Ohio participate in activities. Many of the schools have existing STEM clubs. Some, like Polaris Career Center, work with the Fenn Academy, Tri-C and companies like FirstEnergy in "pipeline" activities that prepare students for job opportunities after graduation. Nearly 180 students participated in the recent Fenn Academy-FirstEnergy STEM Alliance to help FirstEnergy identify potential future employees.

Established in 2005, the Fenn Academy has helped raise engineering enrollment at CSU to unprecedented levels — nearly double what the enrollment was in 2012. The academic quality of students entering the College has also improved, and the number of underrepresented groups, including women, has also risen significantly. In the past year about 34% of students in Fenn Academy activities came from underrepresented groups.

More than 1,300 students were engaged in 33 Fenn Academy activities during the past academic year, with the majority taking place on the CSU campus. Interesting videos, a prize raffle and an opportunity to



ride a Segway are additional components of campus visits. Food and bus transportation costs were covered by the program, thanks to support from the college, as well as generous individual and corporate donors.

In 2018-19, new high school partners joined the Fenn Academy, including St. Edward High School, Padua Franciscan High School, Andrews-Osborne Academy and St. Ambrose School. The program also continued its outreach to middle schools and a limited number of elementary schools.

Activities during the summer included collaboration with the Math Corps, the Girl Scouts and summer camp activities with students from Beaumont School and Benedictine High School. The summer camp took place in the Dan T. Moore MakerSpace.

In May 2019, Fenn Academy hosted the new Future Earth environmental competition involving over 200 middle school students, led by Westlake High School teacher Kurt Thonnings. Participants also received a tour of the Washkewicz College of Engineering.

Corporate sponsors are an important partner in Fenn Academy's ongoing success. Twenty-eight companies provided job shadowing placements for 82 students in grades 9-12 for the annual Engineer for a Day program, held during National Engineers Week every February.

Providing additional resources for teachers is another program focus. The small grants program was developed to provide financial help for creative engineering-related projects in Fenn Academy schools.

Individual visitors and STEM-related activities in the community also receive Fenn Academy support. These include many underrepresented students in the ACE Mentor Program, CSU's Operation STEM (OpSTEM) and True 2 You, a program active in all CMSD schools.

Academy staff also gave presentations to students and teachers in the FIRST Robotics competition and served as judges at the Northeast Ohio Science and Engineering Fair, held at CSU for over 400 students. Science fair parents were also able to take a tour of the Washkewicz College of Engineering and speak with current engineering students.

The Academy's Advisory Board is composed of 24 members representing schools, business, government and nonprofit agencies. Voluntary members normally meet twice a year to provide guidance regarding Fenn Academy events and funding. Committees focus on school relations, scholarships and academic affairs, fundraising and marketing.

"Continued support from donors is essential to keep our activities going," says Gregg Schoof, manager of Engineering Student Programs and associate director of Fenn Academy. Donors are encouraged to contact the College at 216-687-2558 to learn about funding options.

**ADDITIONAL INFORMATION IS AVAILABLE AT**  
[CSUOHIO.EDU/FENNACADEMY](http://CSUOHIO.EDU/FENNACADEMY).



PROGRAM



# Growing PARTNERSHIP

## College of Engineering advances programming with New Tech East High School

**OVER THE PAST YEAR**, the Washkewicz College of Engineering has increased its engineering outreach activities through the Fenn Academy program with New Tech East High School in the Cleveland Metropolitan School District. Gregg Schoof, manager of Engineering Student Programs and associate director of Fenn Academy, along with student recruitment assistants Zavier McClain and Christina Pope led hands-on activities at New Tech's college and career fairs and spoke to classes. Job shadowing was also provided for New Tech East students, and a Fenn Academy small grant was awarded to teacher LaShawn Thomas.

In addition, on October 5, 2018, a class of New Tech East students attended an on-campus Engineering Activity Day at the Washkewicz College of Engineering, led by Hannah Milgrom, coordinator of Engineering Student Programs, and graduate assistant Jessica Stange. During that event, students engaged in a team competition, visited engineering labs and listened to an overview of available engineering programs. Later, they participated in a Q&A session with engineering students representing multiple disciplines.

On April 24, 2019, six New Tech East students, Azareah Rice, Jamyah Howard, Troy Wimbs, Dante Byrd, Aliyah McCaskill and Kaisha Horton, spent part of the day at Washkewicz College with members of CSU's student chapter of the National Society of Black Engineers (NSBE). Students attended a NSBE meeting and lunch and learned more about the engineering fields they wish to pursue. A campus tour was also provided. Students learned about available programs and services, including OpSTEM, tutoring, co-ops, scholarships and the Engineering Student Success Scholars (ESS) Program.

New Tech East is a STEM focused high school, located at East 55th and Quincy. It is one of 86 members of the nationwide New Tech Network of schools. The school is certified by Project Lead the Way and has an engineering certification from the Ohio Department of Education. New Tech East enrolls about 200 students and boasts a 93.5% graduation rate, offering hands-on self-directed learning in classes with a 15:1 student to faculty ratio.



## POWERFUL PROGRAMS

*How a co-op helped a first-generation college student*

**FERNANDO ARIAS** is an alumnus from CSU's College of Engineering. He graduated in 2015 with a bachelor of science in electronic engineering technology as the first college graduate in his family. He praises the College for the support he received from the faculty and staff as a student and considers it one of the most important factors for his early career success.

He points out that CSU's focus on understanding of and caring for student success inside and outside of the classroom was very important to him. "The College of Engineering understands how important it is to help provide students with the tools and skills necessary to succeed in the [professional] engineering field," says Arias.

He adds that the most rewarding experience with a significant impact on his early professional career was the Fenn Co-op program. "[The College's Senior Manager of the Center for Engineering Experiential Learning] Sandra English worked very closely with different companies to seek an internship that could work with my academic schedule," explains Arias. "She was able to help me find a part-time internship opportunity at the Northeast Ohio Regional Sewer District (NEORS) working in the construction and electrical department as a para-professional electrical engineer. I worked and learned an array of different technical skills."

He says that the experience allowed him to obtain a new perspective and a better understanding of the "responsibilities, technical requirements in the field and business model" of a real engineering environment.



**I HAD THE OPPORTUNITY TO DEMONSTRATE MY INTERNSHIP EXPERIENCE IN CLEVELAND, MY ACADEMIC PERFORMANCE AND ACHIEVEMENTS.**

FERNANDO ARIAS



"I became very successful in completing a one-year internship program while continuously keeping an outstanding academic performance as a full-time student," says Arias. He was able to manage his co-op and class activities and pursued other leadership roles during his senior year, such as becoming vice president of CSU's student chapter of the Society of Hispanic Professional Engineers (SHPE), for which he credits his involvement in the Fenn Co-op program. He attended one of the biggest career fairs as part of the annual SHPE National Conference, in Detroit, Michigan, where he networked with CEOs, managers and other leaders from top engineering companies seeking to recruit young talents to join their organizations. He was able to secure job interviews, one of which was with General Motors.

"I had the opportunity to demonstrate my internship experience in Cleveland, my academic performance and achievements," says Arias, who believes that his co-op experience shown in his resume made a significant difference during the interview process. As a result, a few months before graduating from CSU, he was offered a position at General Motors' Global Technical Center in Warren, Michigan, as a diagnostic software development release engineer. His job has evolved from powertrain system support in the early phase of his career to chassis system support. He is currently working on developing the diagnostic repair procedure for the chassis control system for all responsible micro-controllers of the vehicle. He is also completing his master's degree in engineering technology from Wayne State University.



PROGRAM



# Program MILESTONE

*The College celebrated 95 years of cooperative education in 2018*

**THE WASHKEWICZ COLLEGE OF ENGINEERING** celebrated its 95th anniversary of cooperative education on Thursday, November 15, 2018, in the Student Center Ballroom. Organized by the College's Center for Engineering Experiential Learning (CEEL) Office, the event hosted over 100 guests from industry partners, students, alumni, faculty and staff.

The celebration was very successful and a great experience for all attendees. First, President Harlan Sands welcomed everyone and highlighted the importance of experiential learning opportunities, specifically cooperative education, for engineers. Then, Provost Jianping Zhu expressed the importance of cooperative education in molding modern aspiring engineers. Associate dean George Chatzimavroudis pointed out in his speech the importance of co-op in engineering education, and CSU Trustee Dan T. Moore discussed the importance of co-op for career success. Additionally, John Hubbard was the alumnus co-op spotlight and he gave an overview of his co-op experience. Finally, Sandra L. English, senior manager of CEEL, gave recognition to co-op student scholarship award winners, industrial partners and faculty.

The CEEL office has a very active advisory board of approximately 35 industry, alumni and faculty members that were in attendance.



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STUDENTS *Helping* STUDENTS

*Tutoring services help students succeed*



**TASC HELPS YOU GAIN CONFIDENCE WHEN YOU'RE UNSURE OF YOURSELF.**

LONDON OGLESBY

**DURING THE ACADEMIC YEAR**, out of the 90 employees of CSU's Tutoring and Academic Success Center (TASC), located in Berkman Hall 233, at least eight are engineering students. TASC includes a writing center and a math learning center. In Spring 2019, the Washkewicz tutoring team included Mark Travis, Dylan Doyle, Louise Beckstrom, Ellen Rea, Cassidy Reaser, Juliana Rolince, Ben Frederick and Harsh Prajapati.

TASC student employees have an average cumulative GPA of 3.71. Approximately 40% of TASC student employees are first-generation college students and nearly half are members of special programs, including University Honors and Scholars, Operation STEM, McNair Scholars, TRIO, CSUteach, KeyBank Scholars and the CSU-NEOMED Partnership. About 65% of the TASC team has received awards, scholarships, grants and fellowships. The students work an average of 17 hours per week.

Dylan Doyle, an electrical engineering student, was recognized as a "Student of the Week" by his peers in March 2019. The award recognized his teaching skills and the enthusiasm he showed while helping other engineering students with their courses. He said he was thrilled and honored by the award. Doyle was previously a peer mentor in remedial math at Tri-C before coming to CSU one year ago. As a CSU engineering tutor, Dylan tutored 12 students in the spring semester — most for an hour each week, and sometimes twice each week before an exam. He described his role as time-consuming, but not tiring. The job taught him to use time efficiently and be prepared before meeting his students. He says the job is fun.

One of the students being tutored by Doyle was Landon Oglesby, an electronic engineering technology student expecting to graduate in 2021. Oglesby, a graduate of Cornerstone Christian Academy, grew up in Cleveland. He holds a part-time evening job off campus and also works in CSU's Mobile Campus office, loaning computers and similar items to students. He learned about TASC and met Doyle through Starfish, an automated software system that matches students with tutors. He says the value of TASC is that, no matter how strong you feel in a subject, you can always learn a better way of approaching it. "I found that one semester of tutoring in electrical circuits has been very helpful. It's one-on-one and helps you learn the material better and engage with issues directly," Oglesby says. "TASC helps you gain confidence when you're unsure of yourself."

Both students are still exploring their career options. Doyle says he would enjoy teaching but wants further experiences before making a decision. More importantly, he wants to have a positive impact on people's lives. Oglesby says he enjoys technology and wants a career that is "hands-on." He says he'll continue to explore his options by attending CSU's career fairs and networking with engineering professionals. "CSU has special people working here. I really enjoy the TASC staff, as well as my classmates. It's a great experience," Doyle says.



From left to right: Sean Mulvin, Jason Downie, Jen Wisniewski, Patrick McDonough, Matt Sokolich and Markus Kotze.

# POWER MOVES

— Fluid power vehicle team races to first place victory —

**THE PURPOSE OF THE NATIONAL FLUID POWER VEHICLE CHALLENGE**, which was held at Bimba's IMI Precision Engineering facility in Littleton, Colorado, from April 10-12, was to build a fluid-powered vehicle that would be the fastest in a sprint and endurance race, while also being able to travel a far distance with a low accumulator pre-charge for the efficiency race. CSU's Washkewicz College of Engineering team members included Sean Mulvin, Matt Sokolich, Patrick McDonough, Markus Kotze, Jen Wisniewski and Jason Downie.

The Washkewicz team's vehicle took countless hours and a full semester to build. The 175-pound vehicle was designed to be easy to ride while being able to withstand the high output torque generated from the 2.5-gallon accumulator, a black cylinder attached to the frame. Team members cited courses like physics, CAD and machine design for aiding in their success. They learned from last year's competition that this year's car had to advance from two to three wheels.

The competition did not start very well, with a flat tire 15 minutes before the first sprint race. It was all hands on deck to replace the inner tube and remove the aluminum chip stuck in the outer tread. Despite the setback, the first race ended in a 14.71-second time. Teamwork was crucial. The bike moved so fast that they had to shorten the course to accommodate it. As a result, CSU's vehicle hadn't even reached top speed by the end of the 475 sprint, yet the team still managed to take first place.

The efficiency challenge was aptly named. The parking lot was on an incline so the Washkewicz device had to move the greatest amount of distance while also moving up hill. The back tire was the secret weapon. It had the ability to be put into a neutral position, which did not turn the pump. The only force the vehicle had to overcome was frictional force. Despite all the odds, the team still finished second in that challenge with a score of 10.36.

The endurance challenge also put the team to the test because they were not allowed to use the drill that the team had previously used to charge the vehicle to its operating pressure of 3,000 psi. Instead, the team had to push the vehicle in five minutes and hope for the best outcome. The team didn't get the vehicle up to its full

operating pressure. They only ended up racing at 2000 psi. Sokolich and Mulvin really dug deep to give the team a second-place finish of 5:40:00. They had to pedal the vehicle 7.5 laps around an inclined parking lot. The team's ability to shift from first to third gear made it a smoother ride, but there was a lot of power needed to push it to the top.

Team members said the win gave them an amazing feeling. They became a family. Leadership and project management skills grew exponentially. They also learned how to delegate responsibilities based upon each team member's skill set. It was a test not only in the realm of fluid power and machine design but also in the area of group dynamics. They learned about each other's strengths and succeeded because they engaged their respective skills in areas like calculations, administration, manufacturing and fabrication.

The team credited their education at CSU for preparing them to meet the challenge and cited retired Parker Hannifin CEO Donald Washkewicz for motivating them. They were notably grateful for the help provided from Parker Hannifin mentor, Nate Settlemire, as well as Parker's market manager Valencia Rucker, Washkewicz College of Engineering technician Dave Epperly and CSU mechanical engineering professor Bogdan Kozul. The team also thanked Lincoln Electric for the help provided to weld the reservoir on the car.

Winning first place not only in the category of "overall competition," but "best presentation" and "best design" was a testament to the hard work of everyone involved. The fact that the designation "best design" was voted on by 15 other schools was also a source of pride. Competitors included California Polytechnic State, San Luis Obispo, Colorado State University, Iowa State University, Kennesaw State University, Montana State University, Murray State University, Purdue Northwest University, Purdue University, University of Akron, University of Cincinnati, University of Denver, University of Utah, West Virginia University Institute of Technology and Western Michigan University. It also proved that asking the right questions and knowing the right course of action can yield the best results. The team is thrilled with their accomplishment and their excitement is palpable.

**ASKING THE RIGHT QUESTIONS AND KNOWING THE RIGHT COURSE OF ACTION CAN YIELD THE BEST RESULTS.**



PROGRAM



# Reaching STUDENTS

*A new program offers support to underrepresented minority students*

## The Engineering Student Success

**(ESS) Scholars program** offers support to underrepresented minorities studying engineering and computer science at Cleveland State University. Following students from their first year through graduation, the ESS Scholars program provides specialized curricula as well as comprehensive advising tailored to the needs of students.

## PROGRAM BENEFITS

- SCHOLARSHIPS
- TUTORING AND INSTRUCTIONAL SUPPORT
- CO-OPS, INTERNSHIPS AND JOB SHADOWING
- INDUSTRY EVENTS AND PROGRAMMING
- RESEARCH OPPORTUNITIES

The program has received funding support from the Cleveland Foundation and the Parker Hannifin Corporation. For more information, please contact Sandra English, senior manager of CEEL, at 216-687-6968 or via email at [s.l.english@csuohio.edu](mailto:s.l.english@csuohio.edu).

# NEWS FROM OUR STUDENT ORGANIZATIONS

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION



The newly formed CSU student chapter of the American Institute of Steel Construction (AISC) participated in the 2019 AISC Steel Bridge Regional Competition at the University of Akron in April 2019. More than 13 universities from Ohio, Pennsylvania and Kentucky participated in the competition, designing and building steel bridges that span over 20 feet. The ideal bridge would be one that weighs the least, does not deflect greatly when loaded and can be built in the fastest time with the least number of builders.

Designing the bridge takes months of teamwork and ties in with structural classes at CSU. It is a great experience for students who have an interest in structural engineering and it reinforces communication, leadership and teamwork skills throughout the process. This year, the new organization took fifth place.

## NATIONAL SOCIETY OF BLACK ENGINEERS



CSU's student chapter of the National Society of Black Engineers (NSBE) provides excellent opportunities for both personal and professional success. From October 25-28, 2018, the Fall Regional NSBE Conference was held at the Westin Cleveland and Huntington Convention Center in Cleveland. CSU NSBE members were able to attend via a short bus ride from campus. Additionally, the 45th annual national convention took place March 27-31, 2019, at the Cobo Center, in Detroit, Michigan. It was the largest to date with over 14,000 attendees and nearly 350 exhibitors at the event's career fair. Twenty-five members of CSU's chapter attended the five-day event, which included workshops, lectures, networking events, hospitality suites and a career fair. Many of them were offered co-op/internship and full-time employment opportunities with companies such as Honeywell and United Technologies. Venues such as the aforementioned provide great benefits to student members, including leadership training, professional development, mentoring opportunities and career placement services.

## SOCIETY OF HISPANIC PROFESSIONAL ENGINEERS



CSU's student chapter of the Society of Hispanic Professional Engineers (SHPE) provides great service and opportunities to its membership. The group, among other activities, serves as a platform for leadership development, mentoring, career advice and networking. Additionally, students are given the chance to travel to events of the organization. From November 8-11, 2018, the SHPE National Convention was held at the Huntington Convention Center in Cleveland. Thirteen CSU chapter members went to the convention, where they had the chance to network and interact with a number of companies and organizations, such as Chevron, Google, NASA, Rolls Royce, Tesla and Uber. The convention offered resume reviews, a variety of workshops and networking opportunities.



ALUMNI

# READY FOR TAKEOFF

*For decades, CSU has been graduating “Ready-to-Go Engineers” — several of whom played a role in the launch of Apollo 11*

ON JULY 20, 2019, the world celebrated the 50th anniversary of Apollo 11 landing on the moon. This achievement was the culmination of nearly two decades of testing and research by scientists, engineers, astronauts and pilots working for the National Aeronautics and Space Administration, the United States military and numerous private contractors.

Alumni and faculty of Fenn College, the forerunner of Cleveland State University, played a significant role in this effort and helped develop a strong connection between the university and the American Space Program, which continues today through CSU's research and education collaboration with NASA's John Glenn Research Center.

Below are just a few of the individuals with Fenn/CSU connections who contributed to the ultimate success of Apollo 11.

**Frank Burgett**, a 1965 electrical engineering graduate, was part of the first group of cooperative education students selected to work at the NASA Manned Spacecraft Center, later renamed the Johnson Space Center (JSC), in 1962. He would be hired by JSC as an electrical engineer in 1965 and would make major contributions to the development of life support systems and space suits for the Mercury, Gemini and Apollo programs. This included providing real time mission support testing on the improvised life support system developed for Apollo 13 astronauts. He retired from JSC in 2003.

**Frank DeMarinis**, chair of the biology department at Fenn College, was selected to serve as deputy scientific attaché at the U.S. Embassy in Rome in 1960. During his two-year tenure he assisted in coordinating international biology research related to space flight and served as a scientific expert to NASA in their efforts to develop global support among U.S. allies for space flight activities. This included accompanying Vice President Lyndon B. Johnson, then chair of U.S. Space Operations, during meetings with Italian government officials in 1961.

**Frank C. DiLuzio**, a 1938 civil engineering graduate, played a central role in developing U.S. space policy during the 1960s. He served as staff director of the U.S. Senate's Committee on Aeronautical and Space Science from 1963 to 1965. In that role, he managed legislative oversight and budget operations related to NASA and the U.S. Space Program. He was also appointed by President Lyndon B. Johnson to serve on the NASA Aerospace Safety Advisory Panel in 1968.

**Annie Easley**, a 1977 graduate in mathematics, served as a mathematician and computer engineer at NASA Lewis Research Center from 1958-1999. She made major contributions to the development of the Centaur upper stage rocket, which has been a major component of NASA launch vehicles, including Apollo 11, since the 1960s. Her life and career at NASA were chronicled in the best-selling book *Hidden Figures*.



Frank DeMarinis



Annie Easley

**Gordon Kautz**, a 1941 mechanical engineering graduate, served as the assistant director of NASA's Project Ranger from 1961 to 1965. The Ranger program consisted of a series of unmanned space missions to the moon by the United States. The effort obtained the first close-up images of the lunar surface and helped lay the groundwork for Apollo 11's successful landing.

**Albert M. Lord** was a senior researcher at Lewis Research Center before serving as an associate professor of mechanical engineering at Fenn College from 1956 to 1960. At both institutions, he conducted research that assisted in the development of jet engine and rocket technology, and helped advance education in rocket science and engineering. This included partnering with Lewis Research Center to form the first student chapter of the American Rocket Society in the state of Ohio at Fenn College in 1957. A former student of Lord's, Bill Latto, who served for a decade as an engineer with NASA upon graduation, created the Albert Lord Endowed Scholarship in the CSU Washkewicz College of Engineering in his honor.

**William Lund**, a 1955 electrical engineering graduate, played a key role in the development of the guidance systems for the Apollo 11 Space Craft. He served as an engineer for many years with Raytheon Co. and was a member of their Apollo program design team.

**Burt Rosenbaum** was a senior researcher at NASA's Lewis Research Center from 1945-73 and an instructor in mathematics at Fenn College as part of the collaboration between the two institutions. His statistics research contributed to the successful flight of Apollo 11 and led to him being honored with the Apollo Achievement Award.

**Bob Verderber**, a 1957 mechanical engineering graduate, worked for many years for Rockwell's Space Division. In that role he served as a project engineer on the Apollo program, contributing to the design of the Apollo 11 spacecraft and the Saturn V Rocket.

ALUMNI AND FACULTY

OF FENN COLLEGE

PLAYED A SIGNIFICANT

ROLE IN THE AMERICAN

SPACE PROGRAM



# ACTIVE LEARNING

*Dr. Zhiqiang Gao and Dr. Lili Dong organize a workshop on ADRC*



Dr. Zhiqiang Gao (left) and Dr. Lili Dong (right) present the IEEE certificate of appreciation to Dr. Li Sun

**THE 2019 CACT TUTORIAL AND WORKSHOP** on Active Disturbance Rejection Control (ADRC) was held at Cleveland State University on July 2, 2019. Attendees included faculty and students from CSU, Case Western Reserve University and Youngstown State University; scholars from the Chinese Academy of Sciences, Southeast University, South China University of Technology and North China University of Electric Power; and researchers from the NASA Glenn Research Center. Engineers from local companies, such as Bendix, also attended the workshop.

Steven Galecki, chair of the IEEE Cleveland Section, gave the opening remarks, introducing IEEE and the ADRC research program at CSU. Jack Kraszewski and Ben Ward from CSU's Office of Research talked about CSU's research programs and the mechanisms for industry collaborations. This has led to follow up discussions between CSU and local companies.

An ADRC tutorial was given by Dr. Zhiqiang Gao, an associate professor in CSU's Department of Electrical Engineering and Computer Science, titled "ADRC: 20 Years in the Making," where he traced the idea from H.S. Tsien passing to Guan Zhaozhi and finally becoming materialized as ADRC by Han Jingqing about 20 years ago. Dr. Gao showed, with two examples, what ADRC made possible that would otherwise be impossible, together with a full agenda for current and future research. Then, Dr. Wenchao Xue from the Chinese Academy of Sciences focused on the crucial design of the extended state observer (ESO) and its various forms and improvements. Among the very interesting components of the talk were how one can add disturbance rejection to an existing design without modifying its structure or parameters, how to deal with time delay and how to optimize its parameters in real time.

On the theoretical side, Dr. Sally Shao, a professor in CSU's Department of Mathematics and Statistics, showed how an area of mathematical study, singular perturbation, matches with the nature of ADRC perfectly and showed an elegant mathematical proof of why ADRC is so effective as an engineering solution. She reminded the audience, with two engineering examples, that successful practice of ADRC could, and should, be accompanied by mathematical analysis. Then, Dr. Wen Tan from North China University of Electric Power showed how any

controller in the form of transfer function can be implemented and potentially improved, in the form of ADRC. Dr. Xiangyang Li from South China University of Technology took this one step further as he gave, probably for the first time ever, a general form of PID for the  $n^{\text{th}}$  order process.

The application side of the workshop covered many aspects of engineering practice. Dr. Frank Li, professor of Youngstown State University's Department of Electrical and Computer Engineering, discussed the power electronic problem in industry and in space, using an SBIR project featuring an ADRC solution as an example. Dr. Lili Dong, an associate professor in CSU's Department of Electrical Engineering and Computer Science, extended the applications of ADRC from conventional mechanical systems to micro-systems. Particularly she successfully employed a nonlinear ARDC to an electrostatically actuated micro-electro-mechanical device, and significantly enlarged the travel range of the micro-actuator to its most extent. Subsequently, Dr. Li Sun from Southeast University presented several ADRC solutions for the power and energy systems, and Dr. Qinling Zheng, from Samsung, showed how more than 20% in energy savings can be achieved in a server farm using the ADRC solution to obtain a tighter temperature regulation, thus allowing operations in higher temperatures and better heat dissipation. Finally, Anusree Mandali, a doctoral student of Dr. Lili Dong in the Department of Electrical Engineering and Computer Science at CSU, discussed her research on voltage regulation and disturbance rejection in power system operations.

What was impressive from this event was the strong participation of engineers from NASA, Bendix and other external entities. They made a significant contribution to the success of the event and we would like to thank them for their active participation. Their sharp and pertinent questions brought the context on which the discussions were grounded.

We would also like to thank the IEEE Cleveland Section and CSU's Office of Research, as well as all the speakers and participants, for their support of this event.

Dr. Bijan Bastani (left) with Dr. Rashidi. Dr. Bastani is the director of NorthCoast Clinical Trials, a member of the medical staff of Laurelwood and Heather Hill Hospitals and a leader within the Iranian community in Northeast Ohio. He gave a very heartfelt tribute to Dr. Rashidi, highlighting his selfless devotion to students and to the College of Engineering in general. The "Dr. Majid Rashidi Endowed Scholarship" fund was created (from anonymous sources) as a result of Dr. Rashidi's dedication to CSU and its students. This will benefit many future graduate students who choose to study at CSU.



## Student FOCUSED

*Dr. Rashidi's commitment to CSU results in an endowed scholarship*

**ON JULY 19**, friends, family and colleagues of Dr. Majid Rashidi, a professor in the Department of Mechanical Engineering, gathered in Washkewicz Hall to honor Dr. Rashidi's commitment to student education over the past three decades by announcing the creation of the "Dr. Majid Rashidi Endowed Scholarship" fund. It was a wonderful event, with many of his family members present, as well as CSU faculty, staff and individuals from the Iranian community.

Dr. Rashidi's journey at CSU started in the fall of 1987, when he joined the University as a tenure-track faculty member in mechanical engineering. In 2009, Dr. Rashidi was named the Betty L. Gordon Distinguished Professor at Cleveland State, a position he held until 2014. During his time at CSU, Dr. Rashidi has made major contributions to research, teaching and service:

**RESEARCH:** The breadth and depth of his research is apparent when considering areas where he has advised graduate students: medical device design, renewable energy devices, machine system design, dynamics of gear trains, design/analysis of rotating machinery, design for manufacturing (DFM), vibrations of machinery and fluid-solid interactions in machinery. His research has been funded by the U.S. Department of Energy, the State of Ohio and the National Science Foundation. His work has been featured in national and international outlets, including the New York Times, Business Week, Reuters and Wind Tech-International. He has over 12 patents.

**TEACHING:** Over the past 32 years, Dr. Rashidi has taught all of the courses related to machine design and solid mechanics. He also contributed to the Applied Biomedical Engineering program (a joint doctoral program between CSU's Washkewicz College of Engineering and the Cleveland Clinic) by teaching a new course on the mechanics of living tissue. At the pre-college level, through NSF funding, he developed "Math-in-Motion" to inspire the next generation of engineers. In 2005, he received CSU's Merit Recognition Award for teaching. He has been elected as Faculty Member of the Year in mechanical engineering on nine separate occasions.

**SERVICE:** Dr. Rashidi helped create a unique collaboration with Cuyahoga Community College for STEM education and preparation of high school students to start their engineering education. He is also a director of the Fenn Academy, a consortium among Cleveland State University's Washkewicz College of Engineering, local school districts and industry partners that collaborate on educational activities designed to encourage high school students to pursue post-secondary education and careers in engineering.

*For those wishing to add to the "Dr. Majid Rashidi Endowed Scholarship Fund," please make your check payable to the Cleveland State University Foundation, write "Dr. Majid Rashidi Endowed Scholarship Fund" in the memo line and mail it to:*

**The Cleveland State University Foundation**  
2121 Euclid Avenue  
Cleveland, OH 44115-9897



## The CSU-CWRU Internet of Things Collaborative Receives Additional Funding

The Internet of Things Collaborative (IOTC) is a partnership between Case Western Reserve University and Cleveland State University to bring together industrial, governmental, educational, neighborhood and nonprofit entities in the region to harness the IoT's vast potential. IOTC was created in 2017, and the Cleveland Foundation has awarded another \$2.2 million, 1-year grant to the collaborative for 2019.

Through the support of the grant, Shilpa Kedar has joined CSU as executive director, digital and IoT Innovations, and also serves as co-executive director of the IoT Collaborative. She is charged with leading the University's efforts in fostering foundational research, development, application and education in digital and IoT technologies. These activities have included research and development of an Industrial IoT Roadmap (led by Team NEO and funded by the Burton D. Morgan Foundation), which will help manufacturers deploy and integrate smart manufacturing technologies, and work on multiple neighborhood-based demonstration projects across Greater Cleveland.

Late last year, the IOTC awarded several pilot grants to research teams at both universities as seed money for wide-ranging projects. Projects led by CSU engineering faculty (and their CWRU partners) include:

- **Sunnie Chung (EECS) and Ming-Chun Huang (CWRU):** "Protect Privacy in a Distributed Learning Platform with a Natural Language Processing Example"
- **Haodong Wang (EECS), Philip Feng (CWRU) and Mark Griswold (CWRU):** "Integrating Wireless Sensors and Data Streams into Virtual Reality of Smart Buildings"
- **Christopher Wirth (CBE) and Emily Pentzer (CWRU):** "IoT Enabled Chemical Analysis"
- **Chansu Yu (EECS) and Chris Papachristou (CWRU):** "An Indoor Navigation and Localization System"

To learn more about the Internet of Things Collaborative, visit [iotcollaborative.org](http://iotcollaborative.org).

## Geyou Ao Receives NSF Research Grant

Dr. Geyou Ao, an assistant professor in the Department of Chemical and Biomedical Engineering, has received \$346,889 for three years from the National Science Foundation for the research project titled "Engineered Organic Color Centers for Profiling Protein-Carbohydrate Recognition."

Dr. Ao also received an REU supplement for this grant of \$10,080 to support undergraduate student research.

Protein-carbohydrate recognitions are crucial events in many biological processes including cell-cell communication, immune response, cancer development and metastasis. Understanding specific interactions between carbohydrates and carbohydrate-binding proteins has been a challenging task due to the lack of versatile probes. Organic color centers created on nanomaterial hosts with precise optical and carbohydrate functionalities are uniquely suited to profile protein-carbohydrate recognition, which can lead to clarifying the functions of both molecules and their underlying molecular mechanism and discovering therapeutic and diagnostic mechanisms as well.

This project in collaboration with Dr. Moo-Yeal Lee, an associate professor in the Department of Chemical and Biomedical Engineering, and Dr. Xue-Long Sun, a professor in the Department of Chemistry of CSU's College of Sciences and Health Professions, aims at advancing the fundamental understanding of structure-property relationships of engineered organic color centers with biological functionalities and establishing the probing behavior of carbohydrate-functionalized color centers for specific biological targets in physiological and pathological pathways.

## Tushar Borkar Receives U.S. Air Force Research Grant

Dr. Tushar Borkar, an assistant professor in the Department of Mechanical Engineering, has received \$159,906 for two years from the United States Air Force Office of Scientific Research (AFOSR) for the project titled "Fundamentals of Strengthening Mechanisms in Carbon Nanotube (CNT)/ Graphene Nanoplatelet (GNP) Reinforced Metal Matrix Composites for Aerospace Structural Applications."

CNT/GNP-metal nanocomposites have certain properties, such as high tensile strength, stiffness, excellent wear and corrosion resistance, which make them potential candidates for high-performance aerospace structural applications. This research project is aimed at significantly enhancing the understanding of the strengthening mechanisms in CNT/GNP-metal matrix composites, with a broad impact on materials characterization, modeling and applications in the development of new hybrid materials.

## Stephen Duffy Receives RTA/ U.S. DoT Grant

Dr. Stephen Duffy, a professor in the Department of Civil and Environmental Engineering, assembled a cross-disciplinary team that has been awarded a grant from the Greater Cleveland Regional Transit Authority (RTA) and the U.S. Department of Transportation to provide a sensor-based research effort focused primarily on rail maintenance and bus emission issues.

The University Transportation Center at Cleveland State University and Case Western Reserve University's Institute for Smart, Secure and Connected System (ISSACS) are collaborating on the project. Team members include Dean Nigamanth Sridhar, Dr. Nicholas Zingale (Urban College) as well as Dr. Ken Loparo (Electrical Engineering – Case Western Reserve University).

The project will receive \$500,000 in research funds. Team members will contribute expertise in the design of systems configured and attached to a select number of transit vehicles (railcars as well as busses). These systems will act as mobile data hubs, collecting and sending information associated with the assessment of rail ballast fouling, health monitoring of rail car wheels, assessing bus emissions and monitoring on-time performance and passenger wait time. The additional systems must be capable of transmitting, archiving and interpreting the data acquired in each of these assessment endeavors.





## CEEL Receives Grant from the Fenn Educational Fund

The Cleveland Foundation, through its Fenn Educational Fund, awarded \$161,160 to Dr. Anette Karlsson, former dean of the Washkewicz College of Engineering, Dr. George Chatzimavroudis, associate dean, and Sandra English, senior manager of CEEL, through the CSU Foundation, for the project titled, "Maximizing Accessibility: Engineering Cooperative Education Experiences for Underrepresented Minorities and First-Generation Students."

The College partners with 500 corporations to provide cooperative education opportunities to students. Over the past six years, Fenn Co-op has engaged over 700 students completing more than 1,400 co-op assignments. However, there has been a challenge, which also is prevalent nationwide, in recruiting and retaining underrepresented minorities and first-generation engineering students. This two-year project aims at strengthening the existing infrastructure and programs to support student success for underrepresented minorities and first-generation engineering students.



## Colgate-Palmolive Awards Research Grant to Moo-Yeal Lee

The Colgate-Palmolive Company has awarded \$80,000 to Dr. Moo-Yeal Lee, an associate professor in the Department of Chemical and Biomedical Engineering, through the Cleveland State University Research Corporation, for the project titled, "Development of a Predictive Methodology to Assess Microbial Robustness of Home Care Products."

For quality control purposes, the home care industry has been supplementing antimicrobial preservatives to home care products, including dishwashing liquids. Current counting methods to measure the efficacy of antimicrobial preservatives are labor-intensive, inaccurate, difficult to automate and very time-consuming. To improve the throughput and accuracy of antimicrobial activity measurement, Dr. Lee and his group are developing a 384-pillar plate with sidewalls and slits (384PillarPlate) that can be used to encapsulate microbials and measure cell viability rapidly and accurately after exposing to candidates of antimicrobial preservatives. The new plate platform allows testing of hundreds of compounds in parallel, while removing tedious colony counting steps, and will introduce more accurate cell staining methods to determine cell viability after preservatives exposure.

## Moo-Yeal Lee Receives NIH Research Grant

Dr. Moo-Yeal Lee, an associate professor in the Department of Chemical and Biomedical Engineering, has received \$545,000 for two years from the National Institute of Diabetes and Digestive and Kidney Diseases and the National Center for Advancing Translational Sciences of the National Institutes of Health through the Cincinnati Children's Hospital Medical Center for the project titled, "Modeling Diabetes Using an Integrated Plate System."

The major goal of this research project is to develop a tractable, high-throughput, integrated plate system containing human pluripotent stem cell (PSC)-derived liver, pancreas and intestine organoids to simulate normal mechanisms involved in inter-organ crosstalk and investigate how hormones, nutrients and drugs might mediate the reversal of Type 2 diabetes.

## Dan Simon Receives Research Grants from Ford

Dr. Dan Simon, a professor in the Department of Electrical Engineering and Computer Science and CSU's associate vice president of research, has received two research grants from the Ford University Research Program (URP).

The first grant, for \$150,000, is for the project titled, "Ridesharing Optimization with Real-Time Multi-Objective Swarm Intelligence." Ridesharing aims at bringing together automotive travelers with similar itineraries and schedules. Ridesharing could lead to more efficient use of empty car seats and could significantly alleviate problems such as diminishing oil reserves, rising fuel prices, increasing traffic congestion, climate change and toxic levels of air pollution.

One of the greatest obstacles to effective ridesharing is optimization. That is linked to the following challenges, which this three-year research project aims to address: (1) Ridesharing optimization includes multiple objectives, such as minimization of total vehicle miles, minimization of total travel time, maximization of participant preference matches and maximization of the number of participants. In addition, ridesharing optimization is highly constrained due to individual route preferences, schedule preferences and personal constraints such as smoking versus non-smoking and male versus female; (2) Ridesharing optimization needs to match drivers and riders on short notice, or even during a commute; and (3) If ridesharing is to be successful, then it must be widely adopted, which means that the optimization problem will include an extremely large number of dimensions.

The second grant, also for \$150,000, is for the project titled, "Real-Time Multi-Objective Automotive Control Optimization." Automotive performance optimization can provide an important competitive edge for manufacturers. However, automotive system performance is difficult to optimize because it comprises a problem that is complex, nonlinear, time-varying and multi-objective. Dr. Simon's objectives in this three-year research project are to develop cloud-based, swarm-based algorithms to optimize automotive engine control systems with respect to multiple objectives, such as fuel economy and time-to-torque. His approach includes the use of micro particle swarm optimization (micro-PSO), fuzzy interpolation algorithms for pseudo weight-based multi-objective optimization and cloud computing to enable automobiles to learn engine control strategies from each other.

## Hongxing Ye Receives Research Grant from MISO

Dr. Hongxing Ye, an assistant professor in the Department of Electrical Engineering and Computer Science, received additional support of \$50,000 for the fiscal year 2019-2020 from Midcontinent Independent System Operator (MISO). This funding supplements last year's \$80,000 grant for the same project. MISO is a nonprofit organization that operates the power system for 15 U.S. states and one Canadian province. The sponsored project titled, "Data-Driven Approach to Building Watchlist of Security Constraints," aims at leveraging tremendous data and optimization techniques to analyze, identify and forecast congestions of power flow in the power grid. The approach developed by Dr. Ye's group will help the industry partner solve previously unsolvable optimization problems and save up to tens of thousands of dollars per day for power system operation by finding better optimal solutions.

## Ye Zhu and Haodong Wang Receive NSF Research Grant

Dr. Ye Zhu and Dr. Haodong Wang, both associate professors in the Department of Electrical Engineering and Computer Science, in collaboration with Dr. Xiongyi Liu and Dr. Karla R. Hamlen Mansour, both associate professors in the Department of Curriculum and Foundations of CSU's College of Education and Human services, have received \$299,977 from the National Science Foundation for a two-year project titled, "SaTC: EDU: Game-Based Cyber Security Education on Anonymous Communication." Anonymity networks, networks that allow users to remain anonymous, are becoming increasingly popular. It has been reported that Tor, a second-generation anonymity network, has about 1.2 million regular users. Although research efforts have generated important results regarding anonymous communication and anonymity networks are widely adopted by Internet users, the education on anonymous communication is very limited. This project will develop and implement a curriculum that will teach students the basics of anonymity networks using game-based learning. Students completing the curriculum will have an extensive knowledge of anonymous communication and will be able to apply this knowledge to combat a range of cybersecurity attacks when they enter the workforce.



DONATIONS

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**A HEARTFELT THANK YOU** to the 549 donors who gave \$936,649 in gifts and pledges to the Washkewicz College of Engineering during the Fiscal Year 2019 (July 1, 2018-June 30, 2019).

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