



2020

WM MICHAEL BARNES '64 DEPARTMENT OF  
**INDUSTRIAL AND  
SYSTEMS ENGINEERING**

# LETTER FROM THE DEPARTMENT HEAD



This year has brought challenges and great rewards for the students and faculty in industrial and systems engineering.

As with many universities, our campus went completely online in March 2020 and our faculty did an outstanding job adjusting their courses to be taught remotely. While our students are graduating into a new normal, they are still prepared to go out into the world and lead in industry and academia. We are grateful for their enduring spirits and hard work.

This year we are thankful for the generosity of Mike and Sugar Barnes. The Barnes have given over \$10 million to Texas A&M, including a major endowment this year in honor of the department's 80th anniversary. In their honor, the department has been renamed the Wm Michael Barnes '64 Department of Industrial and Systems Engineering.

Barnes received his bachelor's and master's degrees in industrial engineering and his doctoral degree in operations research, all from Texas A&M. He was the second doctoral graduate from the department in 1968. He worked at Rockwell International for 33 years, becoming senior vice president and chief financial officer.

In 2016 he was named a Distinguished Alumnus by Texas A&M and The Association of Former Students for excellence in his profession and meaningful contributions to Texas A&M and the community. This honor has been bestowed on only 303 Aggie graduates since 1962.

We extend our sincere thanks to the Barnes family for their generosity and continue to encourage our students and faculty to excel academically and professionally to honor their generous gift.

The vision I have set for our department is to be a top 5 program in the next five years and a powerhouse of excellence and talent in engineering education and research. To attain this lofty vision, we have set five integrated goals: 1) recruit and retain the brightest students, 2) retain and attract top research and teaching faculty, 3) establish world-class teaching and research facilities, 4) foster diversity and inclusion, and 5) increase departmental visibility.

For further information about our department and to find recent news items, we invite you to explore our website. We promote a culture of openness and collaboration that welcomes everyone to Texas A&M, remotely and in person.

Sincerely,

A handwritten signature in black ink, appearing to read "L. Ntamo", enclosed within a circular scribble.

**Lewis Ntamo, Ph.D.**

Department Head

Professor

Mike and Sugar Barnes Department Head Chair



**Sugar and Mike Barnes**





TEXAS A&M UNIVERSITY  
Wm Michael Barnes '64  
Department of Industrial  
& Systems Engineering

# BY THE NUMBERS

## RANKINGS (2021)

**#8** Undergraduate Program  
Ranked No. 8 (Public)  
*(U.S. News & World Report)*

**#8** Graduate Program  
Ranked No. 8 (Public)  
*(U.S. News & World Report)*

## ENROLLMENT\*

(FALL 2020)

**877** Undergraduates

**260** Graduates

*\*preliminary*

## FACULTY

**49** Total Faculty

**22** Tenured Faculty

**9** Tenure-Track

**18** Academic Professional Track

**10** Society Fellows

**7** Endowed Chairs and Professorships

## DEGREES AWARDED (FALL 2019-SUMMER 2020)

**141** B.S.

**107** M.S./M.E.

**5** Ph.D.

## DIVERSITY

**58%** Minority

**31%** Female

**29%** International

# ADVANCED MANUFACTURING

The advanced manufacturing research area focuses on manufacturing processes and systems, additive manufacturing, logistics and supply chain, quality, reliability and maintenance.

## UNCOVERING THE ART OF PRINTING EXTREMELY HARD STEELS FLAWLESSLY

For millennia, scientists have been meticulously tweaking the ingredients of steel to enhance its properties. As a result, several variants of steel exist today; but one type, called martensitic steel, stands out from its steel cousins as stronger and more cost-effective to produce. Researchers from the department and Texas A&M, in collaboration with scientists from the U.S. Air Force Research Laboratory, developed guidelines that allow 3D printing of martensitic steels into very sturdy, defect-free objects of nearly any shape.

To have diverse applications, low-alloy martensitic steels need to be assembled into objects of different shapes and sizes. This is accomplished through additive manufacturing. Complex items can be built layer by layer by heating and melting a single layer of metal powder along a pattern with a sharp laser beam. Each of these layers is joined and stacked to create the final 3D-printed object. However, 3D printing martensitic steels using lasers can introduce unintended defects in the form of pores within the material.

The research team chose an existing mathematical model inspired from welding to predict how a single layer of martensitic steel powder would melt for different settings for



laser speed and power. By comparing the type and number of defects they observed in a single track of melted powder with the model's predictions, they were able to change their existing framework slightly so that subsequent predictions improved.

Their framework can correctly forecast if a new, untested set of laser settings will lead to defects in the martensitic steel. The guidelines are general enough that the same 3D printing pipeline can be used to build intricate objects from other metals and alloys.

## FEATURED STUDENTS



### Ashif Iquebal

graduated in summer 2020 and began working as an assistant professor at Arizona State University. His dissertation is titled "Graph Analytics for Smart Manufacturing." In November 2018, he was named the winner of the best student poster award at the INFORMS annual meeting.



### Zimo Wang

graduated in summer 2020 and began working as an assistant professor at The State University of New York-Binghamton. His dissertation is titled "Smart Sensing in Advanced Manufacturing Processes: Statistical Modeling and Implementations for Quality Assurance and Automation." He had the best student

paper at the quality control and reliability engineering session at the IISE conference. ▀

# DATA SCIENCE

The data science research area focuses on developing innovative methods for analyzing large-scale heterogeneous data that assists the process of making complex decisions in a timely manner. These areas include data analytics, production economics, simulation, spatial optimization and stochastic optimal control.

## ENHANCING THE ACCURACY OF COMPUTER SIMULATIONS

Enhancing the accuracy of computer experiments requires new statistical and data science methodologies that can determine how these experiments should be designed, how data from the experiment should be analyzed and how to create more accurate simulations.

Dr. Rui Tuo's National Science Foundation-funded research aims to establish a new uncertainty quantification method — an approach that seeks to minimize uncertainties in computational experiments — through experimental design, data analysis, and model validation and calibration.

Creating and enhancing computer simulations through the development of new models to measure their efficiency and cost will help improve simulations and impact many areas of research.



## FEATURED STUDENT



**Imtiaz Ahmed** is a 2020 graduate and works as a postdoctoral scholar at Texas A&M University. His dissertation is titled "Unsupervised Anomaly Detection of High-Dimensional Data with Low-Dimensional Embedded Manifold." Ahmed also placed first in the 2019 INFORMS Annual Conference Poster Presentation. ▼



# HEALTH AND HUMAN SYSTEMS

The health and human systems research area focuses on biomechanics, cognitive engineering, ergonomic risk assessment and management, engineering management, health care delivery, human information processing, neuroergonomics and systems engineering.

## NEW WEARABLE TOOL HELPS MANAGE MENTAL HEALTH



Mental health issues are becoming more prevalent on college campuses across the country, and a team of researchers led by Dr. Farzan Sasangohar is developing a wearable continuous monitoring tool to be used in a pilot program called Mental Health Evaluation and Lookout, or mHELP.

The tool utilizes advanced machine learning and a wide range of sensors provided on commercial smartwatches to detect signs and symptoms of high anxiety and direct the user to resources. The device is triggered by negative indicators, such as anxiety patterns of heart rate and self-reports by the smartwatch user, and prompts them to engage in therapeutic activities.

The researchers hope that mHELP can bring mental health care to students as they experience anxiety or depression, and provide on-demand or proactive access to virtual and in-person counseling.

## FEATURED STUDENTS



### **Changwon Son**

is a current graduate student and plans to graduate in spring 2021. His dissertation is titled "Analyzing Work-as-Imagined and Work-as-Done of Incident Management Teams Using Interactions Between Cognitive System Components." Son won the student competition at the 2019 Resilience Week

Symposium for his work on resilience traits of incident management teams during Hurricane Harvey.



### **Yibo Zhu**

is a current graduate student and plans to graduate in fall 2020. His dissertation is titled "Neuroergonomic Assessment of Exoskeleton Interaction." Zhu was awarded the Creativeness in Ergonomics Student of the Year award in 2020 for his work exploring the neuroergonomic fit of

passive exoskeletons during simulated manual material handling tasks. ▀

# OPERATIONS RESEARCH

The operations research area focuses on optimization, stochastic processes, applied probability and risk analysis.

## WHERE ARE THEY NOW? FORMER STUDENTS ARE MAKING IMPACTS ACROSS THE NATION IN ACADEMIA



### **Dr. Manish Bansal**

is an assistant professor at Virginia Tech. He received his doctoral degree from the department in 2014. His research interests include operations research, integer programming, stochastic and distributionally robust optimization, and location science.



### **Dr. Austin Buchanan**

is an assistant professor at Oklahoma State University. He received his doctoral degree from the department in 2015. His research interests include solving combinatorial optimization problems in networks, particularly those with connectivity or distance constraints, including

applications in political redistricting. Buchanan received the 2020 National Science Foundation CAREER Award.



### **Dr. Adolfo R. Escobedo**

is an assistant professor at Arizona State University. He received his doctoral degree from the department in 2016. His research interests include computational social choice, power systems operation and planning, circular economy and computational linear algebra.



### **Dr. Michelle Alvarado**

is an assistant professor at the University of Florida. She received her master's degree in 2010 and doctoral degree in 2014, both from the department. Her research interests include improving the operation of complex systems under uncertainty through the use of integrated simulation and optimization

methods applied to health care systems engineering for decision-making under uncertainty. ▀



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[engineering.tamu.edu/industrial](http://engineering.tamu.edu/industrial)

WM MICHAEL BARNES '64 DEPARTMENT  
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# AREAS OF FOCUS

Advanced Manufacturing

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Data Science

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Health and Human Systems Engineering

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Operations Research