Throughout human history, engineering has driven the advancement of civilization. During the 20th century, engineering recorded its greatest accomplishments. For example, the electric grid, automobile, airplane, television, spacecraft, laser, computer and internet represent some of the high points from a century in which engineering improved virtually every aspect of human life. Engineering accomplishments of the past have made the world smaller and more connected. As the modern world becomes increasingly interconnected and complex in the 21st century, adaptation to change has become a principal challenge. Fundamental issues — globalization, increasing economic interdependence, population growth and resource depletion — compound associated interdisciplinary technical problems related to human health improvements, energy utilization, infrastructure upgrades and information technology advancements. Consequently, these issues require interdisciplinary engineering-related research approaches, and hence, contemporary engineers must possess extensive knowledge that spans many domains, unprecedented expertise within a single domain, and the ability to integrate that knowledge and expertise into their respective fields.

The National Academy of Engineering has articulated several grand challenges that provide guidance for engineering research programs. As such, the K-State College of Engineering has applied past successes to develop a research agenda that embraces 21st century opportunities by driving innovation-related breakthroughs in health, energy, infrastructure and information technology. Indeed, research is central to achieving the K-State College of Engineering’s 2025 vision to become a top 50 public college of engineering, because research improves the quality of graduate programs and plays an important role in introducing undergraduates to exciting engineering opportunities. At K-State, it is not unusual to see faculty, graduate students and undergraduates working side by side in state-of-the-art facilities, and often with industry partners. It is with this modality that we continue ongoing research while laying the foundation and providing hands-on experiences for future engineering innovators.

“Knowledge is the frontier of tomorrow.”
— Denis Waitley
Motivational Speaker

“New technological discoveries will continue to create a thousand new frontiers.”
— Adapted from Herbert Hoover

K-State’s College of Engineering drives research- and innovation-related breakthroughs that change the world by investing in, promoting, and advancing research in health, energy, infrastructure, and information technology.
Architectural Engineering and Construction Science

The department of architectural engineering and construction science is nationally recognized for preparing graduates for careers in engineering and construction. The combination of these two programs in one department is unique and prepares students to work effectively as professional members of an integrated architecture-engineering-constructor team, and produce quality design and construction of the built environment.

Creative Inquiry
Architectural engineering students participate in the ASHRAE design competition, which recognizes outstanding student design projects, promotes teamwork and allows students to apply their knowledge of practical design. Since 2005, teams from K-State have been awarded first place five times and second place three times. Architectural engineering and construction science students participate in the Architectural Engineering Institute student design competition. The emphases of the competition are development and integration of innovative and original solutions, collaboration and peer review. Since the competition began in 2010, K-State has been the only school to have won or placed in at least one of the categories each year.

Construction science and architectural engineering students also participate in the Associated Schools of Construction Region IV student competition, which promotes excellence and a spirit of competition among the various construction programs. K-State teams routinely place in the top three in one or more categories.

Undergraduate Research
Undergraduate research projects team students and faculty on small-scale, focused projects related to architectural engineering and construction. Recent projects include the following:

- Emerging technology in construction — the use of Bluebeam, Revit, Navisworks and other software in the construction industry
- New construction materials from recycled plastic originating from household consumer waste or manufacturing/industrial process waste
- Better accommodation and retention of females who have successfully completed their engineering education, and enter the building design and construction workforce
- Design and construction of a sound booth for the Chapman Center for Rural Studies to be used to facilitate historical documentation of rural communities on the verge of extinction

Undergraduate Teaching
Graduate and undergraduate students are encouraged to present their work at conferences or in professional journals. Through her research, and encourages graduate and undergraduate students to pursue presenting and/or publishing their work as posters or papers at conferences or in professional journals.

Academic Highlights
Keen has been recognized for her contributions to teaching and advising through many awards including the 2015 College of Engineering Myers-Alford Memorial Teaching Award, 2010-2015 Bob and Betty Tointon Engineering Endowed Chair, 2013 Mark Keenan Family Architectural Engineering and Construction Science Faculty Award, 2005 and 2011 Michael and Karen Hafling ARE/CNS Faculty Fellowship, 2010 College of Engineering Charles H. Scholer Faculty Award and 2008 College of Engineering James L. Hollis Award for Excellence in Undergraduate Teaching.
“The Architectural Engineering Institute Design Competition Team has been a valuable learning experience. It provides a chance to collaborate with many other students and disciplines in an effort to put forward the best product possible. It is often challenging but offers many important lessons about what it’s like to work as a team in the real world.”

— Austin Curnutt
Undergraduate Student

“I couldn’t be more proud of the way team members come together across their various disciplines to present their ideas.”

— Russ Murdock
Competition Team Adviser

“We have an excellent tradition of strong showings at high-level student design competitions. I am consistently impressed by the performances of our students and faculty.”

— Ray Yunk
Department Head
The department of biological and agricultural engineering is driven by a mission to advance the knowledge and application of engineering and technology to living systems, agriculture, and the environment. The department provides excellent teaching, research, and service for biological, agricultural, and food systems, and strives for excellence in preparing the next generation to address future global challenges and sustainability.

**Research Activities**

Biological and agricultural engineering researchers are leading research and development into issues central to environmental sustainability, biofuel and bio-based products, and precision agriculture and machinery. Research activities at BAE are divided into three focus areas:

**Advanced Biological Products**

This research focuses on utilization of bio-based materials from existing renewable resources, and development into issues central to environmental sustainability, biofuel and bio-based products, and precision agriculture and machinery. Research areas include mechatronics, human interaction, precision agriculture, and robotics.

**Terra-Machine Mechanics**

This research focuses on conservation and preservation of natural resources to meet increasing global demands for biological products, and utilization of biosystems in sustainable food systems. Emphasis areas include air quality, climate change, water resources, ecological systems, and land-water interaction.

**Environment and Ecology**

This research focuses on conservation and preservation of natural resources to meet increasing global demands for biological products, and utilization of biosystems in sustainable food systems. Emphasis areas include air quality, climate change, water resources, ecological systems, and land-water interaction.

**Food Production Systems Intelligence**

This research focuses on agricultural systems intelligence. Vision, system integration, and data augmented agriculture are key components of agricultural systems intelligence. Ultimately, the goal of systems intelligence is adding economic, environmental and energy (food availability, labor savings) value to the food systems.

**Professional Experience**

Dr. Donghai Wang received a bachelor's degree from Northeast Agricultural University, China, in 1984, and was an instructor and lecturer there from 1982 to 1990. In 1994, Wang received a master's degree at the University of Illinois at Urbana-Champaign, followed by a doctorate from Texas A&M University in 1997. From 1997 to 1999, he was a research associate at the U.S. Department of Agriculture Center for Grain and Animal Health Research in Manhattan. He spent the following year as a project manager at Kansas Advanced Technologies, also in Manhattan. Wang joined K-State in 2001 as an assistant professor. In 2007, he became an associate professor and was promoted to professor in 2011. He teaches courses in food engineering, bioprocessing and biomaterials.

Wang's research contributions are primarily in three areas: production of biofuels from renewable resources, development of biodegradable materials such as adhesives and composites using renewable resources, and development of rapid near-infrared spectroscopy methods for characterization of physical and chemical properties of biomaterials.

Since coming to K-State, he has received more than $3 million in external funding as principal investigator and $18 million as co-principal investigator. These funds have helped build research labs and have supported 32 graduate students, eight postdoctoral research associates, 14 undergraduate students and eight visiting scholars. In addition, Wang has established collaborative research with USDA Labs, universities and industries.

**Research**

Wang, as principal investigator, has secured more than $3 million in external research funding, primarily in three areas: production of biofuels from renewable resources, development of biodegradable materials such as adhesives and composites using renewable resources, and development of rapid near-infrared spectroscopy methods for characterization of physical and chemical properties of biomaterials.

**Academic Highlights**

Wang has advised 21 doctoral students and 11 master's students. He has published 147 peer-reviewed papers in scholarly journals and has delivered more than 150 meeting presentations. He serves as associate editor for Transactions of the ASABE and Applied Engineering in Agriculture, and serves on three journal advisory boards. His research has been highlighted in bioenergy journals and has been recognized by the USDA.

In 2009 and 2015, Wang won the Frankenhofer Outstanding Research Award. He was a member of the USDA/K-State team that received the ASABE Rain Bird Engineering Concept of the Year Award in 2010 and 2016, and received the ASABE Superior Paper Award in 2011, 2013, and 2015. Since 2010, he has secured two patents and written 90 refereed journal articles/book chapters and 70 conference/technical papers. He maintains support for a full-time research associate, a postdoctoral fellow and six graduate students per year. He has also developed international cooperative research opportunities with several universities in China, including visiting professor exchange research opportunities.
“My favorite part of research at K-State is the strong mentorship from my advisers. They are always supportive and encouraging of my ideas, and allow me to pursue groundbreaking novel research.”

— Kelsey McDonough
Ph.D. Student

“The K-State research experience is great! Biological and agricultural engineering is equipped with world-class facilities and instruments for analytical measurements, which make it easier and fun to work in the laboratory.”

— Nana Baah Appiah-Nkansah
Ph.D. Candidate
Chemical Engineering

The department of chemical engineering at K-State provides all students a solid education in fundamental sciences (chemistry and physics), advanced mathematics and engineering principles. The curriculum is a balanced mixture of engineering theory and practice, plus an emphasis on building analytical and communications skills. The degree prepares students for successful careers in industry, academia or government.

Research Activities

The research focus of the department of chemical engineering is in two main areas: sustainable and renewable biological sources for fuels and chemicals, and advanced materials for catalysis as well as radiological and biological sensors. Since petroleum is a finite resource, it will eventually run out. Therefore, new sources are needed to produce the valuable chemicals of modern life. To address this problem, the chemical engineering faculty are developing methods to produce chemicals and fuels from biomass such as grasses, grain and corn stalks. This requires new chemical processes capable of working in water-rich conditions, leading to the desired products while minimizing low-value by-products. Simultaneously, these new methods must minimize the production and release of carbon dioxide, a greenhouse gas.

Examples of specific research involving sustainable and renewable energy include the following:

- New catalysts are being developed to convert butanediol (produced by the fermentation of biomass) to butadiene, an essential component to synthetic rubber.
- Synthetic routes to produce ammonia (the world’s most popular fertilizer) at low temperatures and low pressure without natural gas (thereby eliminating or minimizing the release of carbon dioxide) are under investigation.
- Catalysts are modeled by molecular simulation to predict which catalysts produce the best conversions and highest selectivities.
- Chemical engineering principles are being applied to find the best synthesis processes for making advanced materials for energy storage and chemical, biological and radiation sensors.
- Methods of preparing highly aligned carbon nanotubes are being developed to increase energy storage capacity of lithium ion batteries.
- A process to grow high-purity single crystals of hexagonal boron nitride is being advanced for applications in optical and high-resolution imaging, chemical sensing and quantum computing.

Research

Rezac researches the production of alternative and sustainable fuels, chemically resistant and thermally stable organic membranes for separation, and hybrid reactor-separator systems. To date, she has served as principal investigator or co–principal investigator on 42 funded projects with support totaling nearly $15 million. She has received research funding from multiple sources including the National Science Foundation, the U.S. Department of Agriculture and Energy, American Chemical Society and Environmental Protection Agency. She served as principal investigator on federally funded projects that provided research training and financial support for 35 doctoral students and 50 undergraduates. She has served on numerous policy-making groups, including as a director of the Council for Chemical Research and of the Separations Division of the American Institute of Chemical Engineers.

Academic Highlights

Rezac holds multiple patents, has authored more than 80 publications in diverse fields and technical journals, and has presented more than 200 papers at national and international meetings. She has mentored or advised more than 35 graduate students. She was named the Tim Taylor Chair in Chemical Engineering in 2015. From 2010 to 2014, Rezac was the ConocoPhillips Professor of Sustainable Energy as well as the 2014-2015 Phillips 66 Professor of Sustainable Energy. Rezac was named the Outstanding Professor in Chemical Engineering in 2009. She also received the 2010 College of Engineering Frankenhoff Outstanding Research Award and the 2015 Commerce Bank and WT Kemper Foundation Distinguished Graduate Faculty Award.

Dr. Mary Rezac

Professor and Tim Taylor Chair in Chemical Engineering

Professional Experience

Mary Rezac received her bachelor’s degree in chemical engineering from K-State in 1987. She then worked in research and development for the Phillips Petroleum Co. from 1987 to 1990. Rezac earned her master’s (1992) and doctoral (1993) degrees in chemical engineering from the University of Texas at Austin. Her academic career began at the Georgia Institute of Technology, where she was an assistant professor from 1994 to 1998 and an associate professor from 1998 to 2002. Rezac came to K-State in 2002 as an associate professor and was promoted to professor in 2004. She served as department head from 2004 to 2009. Since 2007, Rezac has been director of the Center for Sustainable Energy, where she has served as principal investigator or coordinator on more than $50 million in proposals.

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“The unique facilities and expertise in the department allow the synthesis of one-of-a-kind materials that are produced nowhere else in the world. These materials are highly sought after by researchers around the world.”

— J.H. Edgar
Department Head

“The research is interesting. We are learning from each other and making progress. K-State provides a powerful way to know the world and to change the world.”

— Jiahan Li
Ph.D. Student

“The K-State chemical engineering faculty continue to teach, inspire and entertain all of us in every aspect, which will benefit our future.”

— Song Liu
Ph.D. Candidate
Civil Engineering

The department of civil engineering is a community of learners committed to providing outstanding educational opportunities to students. The improvement of urban infrastructure and access to clean water are among the engineering grand challenges identified by the National Academy of Engineering. Students, staff and faculty in the department are engaged in a variety of state, federal and industry-supported research projects that directly address improvement of urban infrastructure and access to clean water.

Research Activities

Civil and Transportation Infrastructure Engineering

This includes geotechnical engineering, pavement and materials engineering, traffic and transportation engineering, and structural engineering.

Water and Environmental Engineering

This includes surface/groundwater hydrology, hydraulic engineering and environmental engineering.

Research Facilities

Civil Infrastructure Systems Laboratory

The Civil Infrastructure Systems Laboratory houses one of six accelerated testing facilities in the nation, capable of testing large-scale pavement, structural and bridge elements.

Structural Engineering Research Laboratories

The department recently obtained state-of-the-art structures and concrete laboratories in the newly completed Engineering Hall.

Transportation and Materials Engineering Research Laboratories

Transportation/materials lab facilities include Concrete, Cement and Aggregate Materials Laboratories; Superpave and Advanced Asphalt Laboratory; Concrete Hardened Properties Laboratory; and Cement and Concrete Microstructure Laboratory.

Geotechnical Engineering Research Laboratories

These laboratories are equipped with conventional testing devices for the evaluation of bond between concrete and various reinforcements. In addition, his research interests include the durability of bridge decks and time-dependent deformations in structures.

Peterman is currently the lead principal investigator on a $2.2 million interdisciplinary research grant from the Federal Rail Administration and LB Foster/CXT Concrete Ties. This nationally competitive grant is one of the largest ever received by a faculty member in the department of civil engineering.

Since 2011, Peterman has secured more than $4.5 million of research funding, with more than $3.3 million as principal investigator. During that same time period, he made 36 formal research presentations, and authored or co-authored 46 refereed publications and five research reports.

A quality control test developed by Peterman and a graduate student was officially adopted by the American Concrete Institute (PCI). In 2013, Peterman was elected as a PCI Fellow, considered as a title reserved for outstanding contributions to the industry and to PCI.

Dr. Robert J. Peterman
Professor and Mark H. and Margaret H. Hulings Chair in Engineering

Professional Experience

Robert Peterman received his bachelor’s degree from Lafayette College in 1987. He worked as a structural engineer from 1989 to 1992 at Precast Concrete Systems, Inc. in Indianapolis and became a licensed professional engineer in 1992. Peterman then attended Purdue University and earned his master’s degree in 1989 and doctorate in 1996. He remained at Purdue as a visiting assistant professor until 1997 and as a post-doctoral research associate from 1997 to 1998. He came to K-State as an assistant professor in 1998 and was promoted to professor in 2008.

Research

Peterman’s research focuses on the experimental evaluation of structures and materials, especially concrete, prestressed concrete and fiber glass structures. His specific research expertise is in the evaluation of bond between concrete and various reinforcements.
"I chose K-State because of its long-held reputation as a high-quality research institution. My research experience is unique because I combine geotechnical and geophysical methods to address a civil engineering problem. For me, it has been a wonderful experience."

— Md Zahidul Karim
Ph.D. Student

"Research here is full of freedom and you also gain useful input from advisers. My professor is amazing to work under, and is insightful and personable. He makes his students feel value in their contributions to his projects."

— Barry Schmidt
Undergraduate Student
Computer Science

The motto of the department of computer science is simple — world class. Computer science faculty are world-class researchers and teachers who have attracted funding from federal agencies and industry for not only research, but also teaching, curriculum development and K-12 outreach.

Research helps undergraduate and graduate students gain in-depth knowledge and valuable experience that allows them to become even more effective problem solvers, applying software in a variety of disciplines. Faculty areas of expertise include cybersecurity, healthcare, cyber-physical systems, scientific computing and high-assurance computing. Points of pride include designation as a National Center of Academic Excellence for Research in Cybersecurity by the National Security Agency and the Department of Homeland Security, a high level of multidisciplinary research and teaching, excellent placement of students after graduation, a University Distinguished Professor, and extremely active and competitive student organizations.

Research Activities

High Assurance

Faculty at the laboratory for specification, analysis and transformation of software, or SANToS, conduct research in high-assurance system; software analysis and verification; and language-based security and safety in next-generation medical systems, mobile platforms and smart grids.

Security

The distributed-systems security laboratory focuses on design of secure, usable software and protocols, with an emphasis on medical, cyber-physical and Internet of Things systems. The lab works closely with SANToS to create high-assurance, reliable and secure systems.

Bioinformatics

The Machine Learning and Bioinformatics group designs algorithms and develops tools for analyzing large amounts of data, in particular, molecular sequence and text data.

Knowledge Discovery

The Knowledge Discovery in Databases Lab develops technologies for building models of events and processes from data, and then uses these models to help make decisions.

Beocat

The Distributed Systems Lab supports a wide range of interdisciplinary research around a core interest in efficient, effective, parallel and distributed systems.

Dr. John Hatcliff

University Distinguished and Lucas-Rathbone Professor in Engineering

Professional Experience

John Hatcliff received a bachelor’s in computer science and mathematics from Mount Vernon Nazarene University in 1988, a master’s in computer science from Queen’s University in 1991 and a doctorate in computer science from K-State in 1994. From 1994 to 1996, he was a visiting assistant professor at the University of Copenhagen, and then an assistant professor at Oklahoma State University from 1996 to 1998. In 1998, Hatcliff returned to K-State as an assistant professor. He was promoted to associate professor in 2001, professor in 2005, and, in 2011, he was awarded the rank of University Distinguished Professor.

Research

Hatcliff’s research targets technologies and tools for building and verifying safety- and security-critical systems. His research approach emphasizes mathematical and logic-based techniques for specifying system requirements and behaviors, and for automating reasoning about the correctness, safety and security of systems. Hatcliff was one of the leaders in the early development of software model checking. Over the last 15 years, his research group has continued to expand the scope of that work, and his students have gone on to lead related efforts at organizations including NASA, Fujitsu and Microsoft.

Hatcliff is a pioneer in the development of integrated medical systems known as medical application platforms, or MAP. Due to the flexibility and reusable critical infrastructure provided by this approach, MAP-based systems are enabling rapid innovations in integrated medical systems, and in customized clinical care specific to patient characteristics and needs.

Academic Highlights

Hatcliff received an NSF Early CAREER Award to fund his original work in software model checking. Based on collaborations with NASA on that work, he and other K-State researchers were members of the NASA Java Pathfinder Team that received NASA’s 2003 Turning Goals Into Reality Award, one of 15 awards given to NASA projects that best demonstrated progress toward NASA’s mission objectives that year.

Hatcliff’s research group has received more than $15 million in funding from many national agencies and companies including Department of Defense, National Science Foundation, DARPA, Department of Homeland Security, NASA, National Institutes of Health, Air Force Office of Scientific Research, IBM, Rockwell Collins and Lockheed Martin.

In 2010, he and his collaborators received ACM SIGSOFT’s prestigious Impact Paper Award and International Conference of Software Engineering Most Influential Paper Award for their paper on the Bandera software model-checking framework. Both of these awards are given to the paper with the greatest impact on the theory and practice of software engineering in the 10 years since its publication.
“The K-State computer science department has a culture that is not commonly shared by many other computer science departments in that it encourages collaborations amongst its faculty members, which gives rise to a very collegial environment and world-class leadership in its focus areas.”

— Robby
Professor

“I chose K-State because of the reputation of the computer science department. Every faculty member has their own research area, and they help you a lot.”

— Chandan Chowdhury
Ph.D. Student
Electrical and Computer Engineering

The department of electrical and computer engineering strives to be a top-performing department in both research and teaching in the College of Engineering. The department leads the college in both Ph.D. graduates and scholarly publications. The department embraces the philosophy that faculty excellence leads to strong undergraduate and graduate programs. Recruiting and retaining top faculty is critical, and the department has four faculty members who hold endowed chairs or professorships, four who are Fellows of the Institute of Electrical and Electronics Engineers, and one who is a Jefferson Science Fellow. Funding for departmental research comes from a variety of sources, including the National Science Foundation; NASA; Burns & McDonnell; Westar Energy; Black and Veatch; and the U.S. Departments of Energy, Agriculture and Homeland Security.

Research Activities

Advanced Power and Energy Systems

The advanced power and energy systems area includes research in power systems, power electronics, alternative energy, computer networking, communication and controls, intelligent systems, optimization and cybersecurity.

Smart Health

Smart Health is the smart health area includes development of devices for both human and animal health care. This includes biomedical sensors, therapeutic medical devices, embedded systems, bio-fabrication, communication circuits, wireless communications, energy harvesting, signal processing, brain computer interfaces, biosecurity and image processing.

Systems and Networks

The systems and networks area includes research in communication systems, controls, optimization, network science, epidemic modeling, artificial intelligence, information theory, data fusion, cybersecurity, biosecurity and big data.

FACULTY

Dr. Caterina Scoglio
LeRoy and Allen Paslay Professor

Professional Experience

Caterina Scoglio received a doctorate in electronics engineering in 1985 and a post-graduate degree in system analysis and control in 1988 from Sapienza - University of Rome. From 1987 to 2000, she was a research scientist in the Fondazione Ugo Bordoni, a National Telecommunication Research Institute in Rome. In 1991 and 1992, she was a visiting researcher at the College of Computing at the Georgia Institute of Technology, and she returned in 2000 as a research engineer in the department of electrical and computer engineering. Scoglio joined K-State in 2000 as an associate professor and was promoted to professor in 2013.

Research

Scoglio's research focuses on developing network-based technologies and tools in several fields. She is co-director of the Network Science and Engineering Group at K-State, which conducts research in network theory problems and develops solutions to real-world problems in the fields of computer networks and infectious diseases modeling.

Scoglio's major accomplishments include developing theoretical models for spreading processes on complex networks, developing the Generalized Epidemic Model framework software tool for the simulation of spreading processes, applying models and tools developed by her team to human and animal infectious diseases, developing models of protein corona formation in nanoparticles validated by experimental data, and developing network architectures and protocols for secure communication in smart grids.

She received the Frankenhoff Outstanding Research Award in 2016.

Academic Highlights

During the past 10 years, Scoglio has acted as principal investigator or co-principal investigator on more than 20 projects sponsored by the National Science Foundation; the National Academies – Keck Futures Initiative; the State of Kansas; and the U.S. Departments of Agriculture, Energy and Defense. Total funding granted for these projects exceeds 57 million. Scoglio has had fruitful collaborations with scientists from other K-State colleges and the USDA. She actively collaborates with colleagues from the Network Science Institutes of Indiana University, Northeastern University, the Delft University of Technology and the University of Grona. Scoglio is chair of the Technical Committee on Medical and Health Care Systems of the Institute of Electrical and Electronics Engineers Control Systems Society, made up of 48 scientists with research interests in medical and health care systems. She is one of the leaders of the Network Science Spoke within the NSF Midwest Big Data Hub, which was created by the NSF to respond to big data challenges, and to capture special opportunities, interests and resources unique to the Midwest.

Contact

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“I like the freedom and independence that the ECE labs offer. I have the opportunity to work on my own, but at the same time I learn a lot working alongside Ph.D. students and professors.”

— Daniel Clausing
Undergraduate Student

“The faculty provide support and are very helpful. They make the key difference in shaping the research, and I have had a very good experience working with them both in research and in the classroom teaching environment.”

— Akanksha Singh
Ph.D. Student
Industrial and Manufacturing Systems Engineering

Industrial engineers strive for continuous improvement in designing, analyzing, and improving the myriad of systems that keep our world running. The same drive for optimization can be seen throughout the Department of Industrial and Manufacturing Systems Engineering in its research and graduate programs. Faculty work hard to ensure the IMSE graduate programs are personal and challenging. Through classwork and collaborative research, they foster student creativity and drive for success. IMSE graduates are in high demand as engineers, analysts, and management associates. Throughout their careers, many establish themselves as prominent leaders, serving as members of the National Academy of Engineering, and rising to such esteemed positions as university presidents, military generals, and captains of industry.

Research Activities

Advanced Manufacturing
IMSE research in advanced manufacturing focuses on difficult-to-machine materials, additive manufacturing and energy manufacturing. Research strengths include laser micromachining, ultrasonic machining, machining of semiconductor wafers and 3D printing of advanced materials. Additional research in manufacturing systems examines multivariate statistical control.

Operations Research
IMSE researchers contribute to the theoretical foundations and modern applications of operations research. They conduct key fundamental research in discrete optimization, mathematical programming, and dynamic systems modeling and optimization. Recent applications of IMSE research include health systems modeling, humanitarian logistics, pattern recognition and scheduling.

Systems Engineering
IMSE researchers in this area work to optimize a variety of complex systems. Their research groups have concentrated efforts on the increasingly complex systems in humanitarian logistics, healthcare operations, transportation engineering, quality production systems, and product and technology development.

Dr. Shuting Lei
Professor

Professional Experience

Shuting Lei received his bachelor's degree in 1987 and master's degree in 1989, both in precision instruments and mechanology from Tsinghua University in China. He then worked as a researcher and lecturer there until 1993. Lei earned his doctorate in mechanical engineering from Purdue University in 1999. Soon after, he was hired as an assistant professor for the department of industrial and manufacturing systems engineering at K-State. He was promoted to associate professor in 2005 and professor in 2013.

Research

At K-State, Lei specializes in the advanced manufacturing of difficult-to-machine materials such as structural ceramics, titanium alloys, super alloys and composites. He is most noted for his work in laser-assisted machining (LAM), particularly femtosecond laser micro-machining.

Combining finite-element analysis and distinct-element simulation, Lei and his students develop models that predict optimal operating conditions for LAM. Using a femtosecond laser, which creates bursts of laser energy at an extremely fast rate, he can shape materials at a molecular level without damaging adjacent areas. His novel approach has potential applications in laser surgery, stents and thin-film solar cells, as well as integrated photonics, which could lead to higher-performance sensors, computers and communications networks.

Lei’s method is an industry game changer, allowing manufacturers to precisely and smoothly cut materials that would frequently stress or fracture under conventional methods. His most recent project, funded by a National Science Foundation (NSF) grant, focuses on machining ultra-thin precision parts for high-performance products with broad applications in areas of health care, biomedical, energy and photonics.

Academic Highlights

Lei has served as principal investigator or co-principal investigator for 11 externally funded projects, including six NSF grants totaling more than $7 million. In addition to consistently securing grant funding, he also helps advance research and education at K-State by collaborating with internationally recognized researchers and industry partners, including Aurora Flight Science and Caterpillar, Inc. In spring 2016, the Office of International Programs awarded Lei an incentive grant to develop a research partnership between K-State and Aix-Marseille University in France. Lei is an active member of the American Society of Mechanical Engineers (ASME), and represents K-State on the editorial boards of the International Journal of Manufacturing, Materials and Mechanical Engineering, and the Journal of International Scholarly Research Notices Ceramics.

He has earned numerous awards and honors from K-State and national organizations, including the NSF CAREER Award in 2002, the Big 12 Faculty Fellowship Award in 2003, ASME MED BOSS awards in 2006 and 2008, and the College of Engineering Dean's Award of Excellence in 2014.

FACULTY SPOTLIGHT

Dr. Shuting Lei

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Academic Highlights

Lei has served as principal investigator or co-principal investigator for 11 externally funded projects, including six NSF grants totaling more than $7 million. In addition to consistently securing grant funding, he also helps advance research and education at K-State by collaborating with internationally recognized researchers and industry partners, including Aurora Flight Science and Caterpillar, Inc. In spring 2016, the Office of International Programs awarded Lei an incentive grant to develop a research partnership between K-State and Aix-Marseille University in France. Lei is an active member of the American Society of Mechanical Engineers (ASME), and represents K-State on the editorial boards of the International Journal of Manufacturing, Materials and Mechanical Engineering, and the Journal of International Scholarly Research Notices Ceramics.

Lei has earned numerous awards and honors from K-State and national organizations, including the NSF CAREER Award in 2002, the Big 12 Faculty Fellowship Award in 2003, ASME MED BOSS awards in 2006 and 2008, and the College of Engineering Dean's Award of Excellence in 2014.
“Research in IMSE has added a lot of value to my professional development. The most exciting thing for me is to think what nobody else has thought. I also enjoy my work in the Health Care Operation Resource Center with the nice and helpful professors.”

— Yan Kuang
Ph.D. Candidate

“I was always drawn to and fascinated by the concept of experimenting on rotary ultrasonic machining. Studying at K-State has given me an excellent opportunity to enhance my technical skills and abilities through my research.”

— P. Kasun S. C. Fernando
Ph.D. Student
Mechanical and Nuclear Engineering

The department of mechanical and nuclear engineering is the largest in the College of Engineering. With more than 1,000 students, the department generates millions of dollars in external funding expenditures every year, and operates the following nationally recognized laboratories:

- Semiconductor Materials and Radiological Technologies Laboratory
- Institute for Environmental Research
- Nanoscience and Engineering Laboratory
- National Gas Machinery Laboratory
- 1.25 MW TRIGA Mark II research reactor

A degree in mechanical engineering from K-State provides a solid foundation for careers in the automotive and aerospace industries, petroleum industry, construction, comfort engineering, biotechnology, nanotechnology and numerous other fields.

Research Activities

Radiation Detection and Applications

The Semiconductor Materials and Radiological Technologies, or SMART, Lab at K-State is the preeminent radiation-detection laboratory in the country. It has two clean rooms, and fabrication and characterization equipment. Detectors of all types are designed, constructed and tested at the SMART Lab.

Environment

The Institute for Environmental Research (IER) has been in existence for more than three decades, and is a national resource for research and testing. The SMART Lab team have won more than 20 awards, which are given to the top 100 inventions for the SMART Lab. McGregor’s funding comes from many national agencies and laboratories including the National Science Foundation, the U.S. Departments of Energy and Defense, and are highly sought after by national laboratories and industry.

Composites

MNE faculty perform research in nano- and macro-composites. Nano-composites hold promise for improved battery performance and energy storage. Macro-composites are used to produce light aircraft components and textile materials with improved properties such as resistance to projectile impact.

Transportation

MNE faculty collaborate with faculty in other departments to investigate transportation topics such as concrete railroad ties, where improving their properties will lengthen life-cycle use.

Nuclear Reactor Neutronics and Thermal Hydraulics

MNE faculty perform leading-edge research on reactor core calculations and thermal hydraulics for next-generation power reactors.
Here at K-State, if I want to get something done, I can do it. I have the freedom, flexibility and encouragement to do so.”

— Jeremy Roberts
Assistant Professor

“We have a gem here. We want people to know about the opportunities for hands-on laboratory experiences, and working with very talented and accomplished faculty.”

— April Mason
K-State Provost and Senior Vice President
A great research program begins with great research faculty — inspiring advisers and scholars who want to make a difference in the lives of engineering graduate students and in the larger world. Decades after leaving K-State, graduate student alumni still remember the dedicated faculty who helped them to understand a difficult research topic, compose high-impact publications, and find the path to personal and professional success. Those life-changing conversations continue to take place at the College of Engineering every day as our faculty members share their passion for engineering, and their commitment for research and advising our graduate students. Specifically, faculty lead the way in addressing urgent national and global issues, from homeland security to sustainable energy, and our aspiration to be a top 50 public research college of engineering depends upon their achievements. These faculty members also bring extraordinary insight and enthusiasm to our classrooms, while mentoring our graduate students in discovery-based projects in preparation for the next generation of academics, scholars and engineering leaders.

“"I am able to conduct research in bioprocessing with the strong support and supervision of my academic adviser, Dr. Donghai Wang, while networking with colleagues and peers within the BAE department, College of Engineering and the grain science department.""

— Nana Baah Appiah-Nkansah
Ph.D. Candidate

Keystone Research Scholars Program

The reputation of a great university is amplified by the research impact of its faculty. A Keystone Research Scholar title is bestowed upon a faculty member who has made outstanding research contributions that address urgent national and global issues. This type of named position allows K-State to recruit and retain dynamic scholars who are in the early stages of their career, but yet are in high demand at all universities throughout the nation. By providing targeted funding for groundbreaking exploration and inquiry, the research scholars program enables talented, early-career faculty members to catapult their intellectual activities to higher levels of achievement.

Based on a previous record of outstanding research accomplishments, faculty members are nominated by their department head for research scholar positions in each of the departments throughout the college. Each Keystone Research Scholar is given a three-year appointment with a salary increase and discretionary funds to support the purchase of specialized equipment, provide travel support and/or fund additional graduate students to be part of their research team. The accomplishments of a research scholar are closely reviewed to ensure the holder maintains academic excellence and high student interest.

“The beauty of a gift to support faculty is that it can provide seed funding for high-risk, high-payoff research. Through their tremendous commitment to investing in K-State and our successful faculty members, donors advance our progress toward becoming a top 50 public engineering college.”

—Darren Dawson
Dean, College of Engineering
Faculty Development Initiatives

**Endowed Professorships and Chairs**

The excellence of any university depends on its faculty. An endowed professorship or chair is bestowed upon faculty members who have made extraordinary contributions to research and teaching. These type of endowed positions enable K-State to offer competitive compensation packages in recruiting and retaining faculty who are in high demand around the country and the world. Those who hold endowed professorships represent the most distinguished faculty members of their generation, while the endowed chair represents the highest honor K-State can confer on a prominent faculty member. By providing dedicated resources for innovative research and teaching opportunities, endowed professorships and chairs enable the most gifted faculty members to excel in their scholarly activities.

Based on a previous record of outstanding research and teaching accomplishments, faculty members are nominated by their department head for endowed positions in each of the departments throughout the college. A holder of endowed professorship or chair is given a five-year, renewable appointment with a salary increase and discretionary funds to support the purchase of specialized equipment, provide travel support and/or fund additional graduate students to be part of their research team. The accomplishments of an endowed professorship or chair are closely reviewed to ensure the holder maintains academic excellence and high student interest. Currently, the College of Engineering has 30 endowed professorships and chairs. To ensure that we achieve our “top 50” goal, we seek to increase this number to 50 by 2025.

**Giving opportunities**

Your gift will ensure that great educators will continue to make a difference in the lives of K-State engineering students in the following ways:

**Naming of a Departmental Keystone Research Scholar**

Your gift to name a research scholar will allow us to recruit and retain dynamic faculty in the early stages of their career.

- Expendable gift of $10,000/yr. for three years or
- Endowment gift of $250,000, payable through pledge of up to five years

**Naming of an Endowed Professorship**

Your gift to name an endowed professorship will allow us to recruit and retain outstanding faculty.

- Endowment gift of $1 million, payable through pledge of up to five years

**Naming of an Endowed Chair**

Your gift to name an endowed chair will allow us to recruit and retain prominent faculty.

- Endowment gift of $2 million, payable through pledge of up to five years

**Impact of philanthropy**

Thank you for considering an investment in competitive recruitment of excellent faculty and rewarding them at a level that keeps them at K-State. Your investment in the dedicated faculty who educate K-State engineering students in and out of the classroom will guarantee our strong teaching tradition for generations to come. To learn how you can invest, contact the engineering development office at 785-532-7609 or engineering@found.ksu.edu.
Kansas State University prohibits discrimination on the basis of race, color, ethnicity, national origin, sex (including sexual harassment and sexual violence), sexual orientation, gender identity, religion, age, ancestry, disability, genetic information, military status, or veteran status, in the University's programs and activities as required by applicable laws and regulations. The person designated with responsibility for coordination of compliance efforts and receipt of inquiries concerning nondiscrimination policies is the University's Title IX Coordinator: the Director of the Office of Institutional Equity, equity@k-state.edu, 103 Edwards Hall, Kansas State University, Manhattan, Kansas 66506, (785) 532-6277. The campus ADA Coordinator is the Director of Employee Relations, charlott@k-state.edu, who may be reached at 103 Edwards Hall, Kansas State University, Manhattan, Kansas 66506, (785) 532-6277.

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