Annual Report 2008

Industrial and Manufacturing Systems Engineering

KANSAS STATE UNIVERSITY

Contents

Message from the Department Head

In this annual report for the Kansas State University Department of Industrial and Manufacturing Systems Engineering, our intention is to provide both the hard data that indicates achievement and impact, as well as share the context in which we operate.

The IMSE department has been educating young engineers for more than a half century. The department initially grew from an emphasis on shop practice in the early years of K-State's engineering college. In 1937, the industrial arts department was established, and by 1954 the department was renamed industrial engineering and industrial arts. Kansas State University has been granting industrial engineering degrees since that time. Over the years, we have maintained an emphasis on hands-on, project-oriented research and education. The department still has a strong emphasis on manufacturing processes and systems. But today, we increasingly emphasize the application of industrial engineering to service industries, especially healthcare systems.

Our department has a long history of contributions to the field. In this issue, we highlight contributions to operations research, specifically those of E. Stanley Lee. Key K-State OR researchers in this field have included Ching-Lai Hwang, noted for his work in decision making; Frank Tillman, noted for his work in large-scale systems optimization and systems reliability as well as his many contributions to industrial engineering as an academic leader and ABET board member; and E. Stanley Lee. Professor Lee has been a very productive faculty member in a career that spans more than 40 years at K-State. Author of more than 300 journal articles, he has produced important extensions, developments and insights to dynamic programming, stochastic programming, fuzzy set theory and application, and soft computing. He continues to make great contributions to the profession. For example, he currently serves in some editorial capacity for 17 scholarly journals. For this reason, we've chosen to emphasize his long and continuing impact in this first annual report.

Our department provides B.S., M.S. and Ph.D. degrees in industrial engineering. There are more than 160 B.S., 20 M.S. and 12 Ph.D. students currently in these programs. We also provide two distance education master's programs to working professionals. The first is the master of science in operations research provided under contract to the U.S. Army (35 students enrolled). The second is a master of engineering management provided to working professionals across the nation (53 students enrolled). Both programs fit our on-campus offerings and continue to grow. Two years ago, we created a concurrent B.S./M.S. degree program that attracts some of our top undergraduate students into our graduate program. These students have proven to become highly productive researchers and have been rewarded with average starting offers that are $15–20K more than our B.S. students. Our B.S. average starting salary offers are nearly $60K.

During 2008, the K-State IMSE faculty authored 29 journal articles and generated more than $1.5M in extramural grants. They also served in editorial positions on 25 journals.

Please feel free to contact us about anything you read in this annual report. You may also want to check us out on the web: *www.imse.ksu.edu*

Regards,

Bradley A. Kramer

Bradley A. Kramer, Ph.D.
Ike and Letty Evans Engineering Chair Professor and Head, IMSE
Director, Advanced Manufacturing Institute

Stanley Lee: an international reputation on operations research

World Impact

It is nearly impossible to describe the impressive achievements that E. Stanley Lee, IMSE professor, has produced during his 43 years at Kansas State University. After growing up during the Japanese occupation of China in a small village about 200 miles south of Beijing, China, most of Stanley's education was self taught as a result of poverty and the war preventing him from obtaining a formal pre-university education.

"Ever since I was young, I've always thought teaching is the most respected profession and wished I had someone to teach me. In addition, I feel strongly that being a teacher can contribute tremendously to society," Lee said.

It's that belief in teaching that drove Lee to impact hundreds of graduate and undergraduate students. His leadership and research contributions have given him an international reputation in operations research. As he nears retirement, the IMSE department can proudly tout his many achievements, which have and will continue to impact industrial engineering for many years.

Lee quickly rose to international prominence as one of the co-inventors of invariant imbedding, upon which the theory of dynamic programming is based. In 1966, Lee developed several efficient solution methods to tackle large-scale mathematical models using "divide-and-conquer" and recursive techniques. These methods take advantage of modern computer architecture in solving large models using limited computer memory and solving many divided local problems in parallel. Lee developed this avant-garde solution method back in the 1960s when modern digital computers were still primitive and parallel computers did not exist. Today these dynamic programming methods are widely used in numerous areas such as semiconductor production and quality control, airline crews and flights scheduling, capital investments, financial engineering and engineering economics.

One major achievement in a career is usually sufficient, but in the late 1970s and early 1980s Lee was again one of the pioneers for a new area in industrial engineering. Lee and his colleagues contributed to the development and practical applications of fuzzy set theory, fuzzy logic, soft computing and neural networks. These computational tools effectively solve complicated real-world problems that have imprecise input data. For example, these methods can help decision makers such as company executives or military leaders make complicated decisions based on inaccurate inputs, e.g., human opinions, surveys, missing data or predictions of future outcomes. Development of these theories and solution methods revolutionized the way people model and solve complex problems. Today, after almost 20 years of development, these methods and their fundamental theories are widely used in areas such as fingerprint recognition, group decision-making, portfolio management, stock/option investments, human ergonomics, aircraft landing processes and electrical and mechanical controls.

Throughout his career, Lee has received numerous grants and authored more than 300 journal articles and eight books/monographs. For all these outstanding achievements, Lee has been listed in both "Who's Who in the World" and "Who's Who in America." The quality of his research was appropriately recognized in 1987 when he was awarded the Honorary Professor for Chinese Academy of Sciences, the most prestigious scholarly achievement awarded by the People's Republic of China.

Besides focusing on his own research, Lee has also been active in leadership positions around the globe. During the 1970s, he organized and served as chairman of the mathematical biosciences, which became the bioengineering department at

"Ever since I was young, I've always thought teaching was the most respected profession ... and being a teacher can contribute tremendously to society."

the University of Southern California. Between 1993 and 1994, Lee served as the chaired professor in support of a newly founded university in Taiwan. These special appointments allowed him to teach at Kansas State University while developing the strategic plans for the newly formed Yuan-Ze Institute of Technology, which later became the Yuan-Ze University. In this capacity, Lee was a special advisor to the university president and the Ministry of Education in Taiwan. During the period of 1993–2000, Lee was the planner and organizer of the new College of Information Sciences and the College of Business at the Yuan-Ze University. He currently serves as the editor-in-chief/editor/associate editor/editorial board for numerous professional journals. On top of that, he regularly organizes annual lecture series, curriculums and speeches in his research areas around the world. Lee is regularly invited to go to other universities abroad to help them establish research programs and to help establish new colleges and recruit new faculty members.

In spite of his numerous scholarly accomplishments, Lee is a humble man dedicated to helping others.

"My biggest and most satisfying accomplishment is to work with students and to see their various contributions and their successful and promising careers," he said.

Lee has positively impacted both the world and the IMSE department at K-State. His drive, expertise and intelligence have been a foundation of the IMSE department for more than four decades, providing numerous years of service and excellence.

Faculty

Bradley A. Kramer
Department Head and Professor

Dr. Kramer is professor and head of the industrial and manufacturing systems engineering department, director of the Advanced Manufacturing Institute (AMI), and holds the Ike and Letty Evans Engineering Chair at Kansas State University. His current effort is focused on building efficient means for accelerating collaborative university and industry innovation. Dr. Kramer joined the faculty in 1985.

Education:
- B.S., Kansas State University, 1980
- M.S., Kansas State University, 1981
- Ph.D., Kansas State University, 1985

David Ben-Arieh
Professor

Dr. Ben-Arieh concentrates mainly on applications of decision theory, and operations research in the area of healthcare delivery systems and product development. He teaches courses in the area of production and inventory control and healthcare systems, and conducts research in these areas. His interests include DEA modeling, risk-mitigation techniques and information system modeling. His industrial experience includes working for AT&T Bell Laboratories, and consulting for the aerospace industry and healthcare organizations. Dr. Ben-Arieh joined the faculty in 1990.

Education:
- B.S., Ben-Gurion University, Israel, 1980
- M.S., Ben-Gurion University, 1982
- Ph.D., Purdue University, 1985

Shing I. Chang
Associate Professor

Dr. Shing Chang serves as the chair of undergraduate committee. His research interests include multivariate statistical process control, nonlinear profile monitoring, neural networks and fuzzy set applications in quality engineering, short-run SPC, ISO 90000 documentation system, experimental designs, Taguchi methods and quality diagnosis. He teaches courses related to quality engineering at both undergraduate and graduate levels. Dr. Chang joined the department in 1991.

Education:
- B.S., Tsing-Hua University, Taiwan, 1983
- M.S., Arizona State University, 1987
- Ph.D., Ohio State University, 1991

Kimberly Douglas-Mankin, P.E.
Associate Professor
Director, Women in Science and Engineering Program

Dr. Douglas-Mankin is the director of the Women in Science and Engineering Program and holds the Spainhour Family Chair. Her research focuses on the development and assessment of effective strategies for K-12 outreach, recruitment, and retention of engineering and science students, particularly those who are under-served and under-represented in these fields. Dr. Douglas-Mankin is a licensed professional engineer. When she served in a more traditional faculty role, her teaching and research focused on management systems engineering, transportation engineering, quality management, performance assessment and engineering economics. She joined the faculty in 2003.

Education:
- B.S., Oklahoma State University, 1987
- M.S., Oklahoma State University, 1989
- Ph.D., Arizona State University, 1993

John R. English
Dean

Dr. English is dean of the College of Engineering, professor of industrial and manufacturing systems engineering, and holds the LeRoy C. and Aileen H. Paslay Chair in Engineering at Kansas State University. His research interest include quality control, reliability engineering and applied statistics. He has numerous journal articles in these areas. He is a registered professional engineer in the state of Arkansas and a fellow IIE. Dr. English joined the faculty in 2007.

Education:
- B.S., Brigham Young University 1993
- M.S., Stanford University 1994
- Ph.D., Georgia Institute of Technology 1999

Todd Easton
Associate Professor

Dr. Easton performs research in discrete optimization with an emphasis in integer programming and graph theory. His current research in integer programming focuses on finding improved techniques to solve integer programs. In particular, he has developed fast techniques to perform exact simultaneous uplifting for sets of binary variables. His graph theory research develops algorithms and heuristics to solve computationally challenging problems. Lately, he has been modeling and optimizing the response to the spread of an epidemic in rural Kansas. Dr. Easton joined the faculty in 2001.

Education:
- B.S., Brigham Young University 1993
- M.S., Stanford University 1994
- Ph.D., Georgia Institute of Technology 1999

R. Michael Harnett
Professor

Dr. Harnett's interests center on large-scale systems modeling and optimization. He teaches courses in operations research, nonlinear programming, theory of decisions and games, and reliability theory. He joined the faculty in 1988.

Education:
- B.S., Louisiana Polytechnic Inst., 1967
- M.S., University of Alabama, 1972
- Ph.D., University of Alabama, 1974

E. Stanley Lee
Professor

Dr. Lee's research interest is primarily in the optimization and systems analysis area such as intelligent and soft computing, uncertainty reasoning, support vector machines and neural-fuzzy computing, fuzzy logic, probabilistic approaches and evidence theory. Another aspect is the applications of these techniques to solve various engineering and social problems such as water resource management, alternative energy developments, pollution and environmental systems, and the efficiency of nonprofit and profit organizations. Dr. Lee teaches courses in optimization theory, queueing, operations research and production, and inventory control. Dr. Lee joined the faculty in 1966.

Education:
- B.S., Chung-Cheng Institute of Technology, 1958
- M.S., North Carolina State University, 1957
- Ph.D., Princeton University, 1962

Faculty

Shuting Lei
Associate Professor

Dr. Lei's research interests include machining of difficult-to-machine materials such as structural ceramics, titanium alloys, superalloys and composites, laser-assisted machining of ceramics, femtosecond laser micromachining, numerical modeling of manufacturing processes and development of novel cutting tools. He teaches courses in manufacturing. Dr. Lei joined the faculty in 1999.

Education:
- B.S., Tsinghua University, China, 1987
- M.S., Tsinghua University, China, 1989
- Ph.D., Purdue University, 1999

ZJ Pei
Associate Professor

Dr. Pei's research interests include semiconductor wafer manufacturing processes, traditional and nontraditional machining processes, subsurface damage measurement in machined surfaces and energy manufacturing. He teaches manufacturing processes and systems, semiconductor manufacturing processes, product and process engineering, nontraditional machining processes, lean manufacturing and Six Sigma. Dr. Pei joined the faculty in 2000.

Education:
- B.S., Zhengzhou Institute of Technology, 1982
- M.S., Beijing Institute of Technology, 1984
- Ph.D., University of Illinois at Urbana-Champaign, 1995

Malgorzata J. Rys
Associate Professor

Dr. Rys' research interests include the human element in transportation systems, visibility and retro-reflectivity, rumble strips design and performance, roundabouts design and performance, modeling and simulation of natural disasters, transportation logistics, experimental design and benefit-cost analysis. She teaches courses in human factors engineering/ergonomics, design of experiments and engineering economy. Dr. Rys joined the faculty in 1989.

Education:
- B.S., Tech. University of Wroclaw (Poland), 1979
- M.S., Kansas State University, 1986
- Ph.D., Kansas State University, 1989

Chih-Hang (John) Wu
Associate Professor

Dr. Wu's interests include mathematical programming, network optimization, applied operations research, transpiration and air traffic systems, digital image processing, pattern recognition, material handling, robot control strategy, flexible manufacturing systems design, group technologies and machine loading. Dr. Wu joined the faculty in 1993.

Education:
- B.S., National Cheng Kung University, Taiwan, 1984
- M.S., Pennsylvania State University, 1991
- Ph.D., Pennsylvania State University, 1993

Adjunct Faculty

Kelly Easton

Dr. Easton's area of research is in operations research with an emphasis in discrete optimization. She was employed as a research associate at Barclays Global Investors, 1994–1996, where she developed nonlinear optimization models and a GUI for financial research. She is currently employed by The Sports Scheduling Group where she develops sports schedules for various college conference and professional leagues.

Education:
- B.A., Johns Hopkins University
- M.S., Stanford University
- Ph.D., Georgia Institute of Technology

Graham Fisher

Dr. Fisher is currently director of intellectual property at MEMC Electronic Materials Inc. He joined MEMC in 1985 and has held various positions including chief scientist, director of operations technology, technical operations manager and applications engineering manager. His most recent research interests have centered on silicon materials and manufacturing science, and developing robust high-throughput manufacturing processes for silicon wafers for the semiconductor and solar industries.

Education:
- B.Sc., University of Salford, England
- Ph.D., University of London, England

Young-Jou Lai

Dr. Lai is a senior forecast modeler of supply chain management at Halliburton Company. He also serves as an associated editor of the International Journal of Revenue Management. His recent professional interests are in the area of forecasting, optimization, planning/scheduling, inventory control and risk management, with focus on modeling visualization, system development and automation in a global operational environment.

Education:
- B.S., National Cheng Kung University, Taiwan
- M.S., Kansas State University
- Ph.D., Kansas State University

Jiangang Sun

Dr. Sun is a mechanical engineer at the nuclear engineering division in Argonne National Laboratory. His current research interests are in nondestructive evaluation (NDE) technologies including optical scanning, infrared thermal imaging, ultrasonic scanning, and x-ray imaging for characterization of advanced materials and manufacturing processes. He has also conducted research in computational thermo-hydraulic analysis for nuclear reactor systems and in multiphase-flow and heat-transfer processes.

Education:
- B.S., University of Science and Technology of China
- M.S., University of Illinois at Urbana-Champaign
- Ph.D., University of Illinois at Urbana-Champaign

Research

Convex fuzzy systems, Optimization and analysis

The definitions of convex and concave functions for crisp systems are too restrictive to apply to fuzzy or more general systems. Several new convex and concave theories for fuzzy systems, which are parallel to the Karush-Kuhn-Tucker theory for classical systems, have been proposed.

Multilevel optimization plays an important role in decentralized planning for organizations in which decision makers are arranged at hierarchical levels, and is a very useful tool for large organizations such as government policy, economic systems, transportation networks, etc. Since the problem is basically fuzzy and not well defined, fuzzy approach appears to be ideally suited to improve the basic multilevel approaches. A book has been published in this area: *Fuzzy and Multi-Level Decision Making: Interactive Computational Approach*, Springer-Verlag, London (2001). Another book to solve the multi-level problem based on evolutionary concepts is in the development stage.

Data envelope analysis (DEA), based on linear programming, has proven to be a useful tool for comparing and improving the efficiencies of non-profit and very large organizations. But, the basic systems of such organizations are vague and not well defined. Thus, a fuzzy approach can help to overcome some of the problems in applying DEA. A book in this area will be published by IGI-Global, entitled *Fuzzy Data Envelopment Analysis: Technologies, Concepts and Applications*.

Discrete optimization

The bulk of our recent integer programming research uses feasible integer points to generate valid inequalities and facet-defining inequalities. This new technique has led to numerous new results in integer programming including development of the first algorithm to simultaneously lift sets of general integer variables, a new way to perform sequential lifting, polynomial time methods to simultaneously lift numerous inequalities into a cover inequality and discovering a new class of facet-defining inequalities called three set inequalities for the knapsack polytope.

Our most recent research in graph theory primarily revolves around the modeling of the spread of infectious diseases. This research has received funding from the National Science Foundation. Another aspect we are proud to announce is our formation of EPICENTER at K-State, which seeks to model and describe the spread of epidemics. This research has developed a core simulation software package, which can be applied to specific instances of certain diseases. The ultimate goal of this research is to use integer programming and graph theory concepts to devise methods and policies to contain the spread of an infectious disease so that the impact of such an unfortunate event is as small as possible.

Healthcare initiatives

K-State's healthcare focus is in its third year. One of the more mature projects is the modeling of the progression of sepsis (acute systemic infectious response) in the body, at a cellular level, using system dynamics and computer simulation. This project aims at modeling this phenomenon at a more aggregate level using advanced parallel simulation mechanisms, thus allowing acute care personnel or care managers to predict the status or risk of the patient during an episode of care. This will help to make best use of resources on patients that are at a higher risk in developing sepsis shock. The project is conducted in close collaboration with faculty at the University of Kansas Medical School Hospital.

Another project uses data envelopment analysis (DEA) methodology to assess the effectiveness of safety-net clinics in the state of Kansas. The project is funded by the Center of Engagement and Community Development. This research is focusing on assessing the effectiveness, core competencies, and weakness of individual clinics regardless of size, location, or community served. In addition the project examines the differences between clinics that are state funded vs. those without state funds and clinics in rural areas vs. urban clinics.

Human factors engineering in transportation

This research project, which focuses on the effectiveness of different lane-departure systems, specifically centerline rumble strips (CLRS), was sponsored by Kansas Department of Transportation and University Transportation Center. "Promoting Center-Line Rumble Strips to Increase Rural, Two-Lane Highway Safety" addressed some of the major concerns with CLRS that could prevent their widespread use and thus affect safety for the driving population. One of the major concerns, and a possible drawback, of CLRS is an unacceptable level of noise to the roadside residents. The goal of the project is to develop a model that predicts the amount of external noise produced by the vehicles crossing over the center line. This model will help state agencies select the least intrusive design of CLRS and improve its acceptance and thus improve safety on rural roadways. The main objective of the project, "Effectiveness of Larger Traffic Signs, High-Performance Sheeting and Clearview Font on Accident Reduction," sponsored the University Transportation Center, is to determine typical locations and/or scenarios where bigger signs are effective in reducing accidents on rural/urban roads.

Laser-scattering measurement of subsurface damage in machined surfaces

For semiconductor wafer manufacturing, subsurface damage induced by mechanical machining processes must be removed by subsequent processes. However, current subsurface damage characterization methods are mostly destructive, time consuming and expensive. There are no nondestructive evaluation methods that can provide subsurface damage information across the whole wafer. Lack of such tools has hindered further reduction in manufacturing costs of semiconductor wafers and integrated circuits. Collaborating with Dr. JG Sun at Argonne National Laboratory, we developed two laser-based techniques, an improved laser-scattering method and an innovative cross-polarization confocal-microscopy method.

Machining of advanced materials

Our objectives in this research area are (i) to advance the fundamental knowledge of machining advanced materials at both macro and micro scale through numerical modeling and processes and (ii) to develop laser-assisted machining and laser micromachining processes and advanced cutting tool technologies to enable high-performance machining techniques for difficult-to-machine materials. One current research focus is laser-assisted machining of ceramics. Ceramic materials such as structural ceramics, bioceramics and ceramic matrix composites are hard and brittle. They are difficult to be shaped using conventional machining processes. Laser-assisted machining is being developed to machine these materials in a cost-effective way. We are also actively working on femtosecond laser micromachining research, currently funded by DoD and NSF in collaboration with the physics department at Kansas State University, the mechanical engineering department at Illinois Institute of Technology, and our industrial partner, Caterpillar, Inc. With high-intensity, ultra-short pulses from the femtosecond laser, we try to develop new laser machining techniques for creating features in both micro and nano scale for a variety of materials.

Machining of semiconductor wafers

Semiconductor devices are found almost everywhere—in computers, cell phones, televisions, automobiles and airplanes. More than 90 percent of the semiconductor devices in use today are built on silicon wafers. We are using finite-element analysis and theoretical modeling to develop grinding parameters for cost-effective silicon-wafer manufacturing. Progress in this research area will mean decreased cost of silicon wafers and semiconductor devices.

Manufacturing of biofuels

Growing concern over limited petroleum resources, environmental impacts and national security has stimulated broad interest in producing and utilizing biofuels (e.g., biodiesel and ethanol) from domestic biomass resources. Collaborating with faculty in the department of biological and agricultural engineering, we are working on manufacturing-related issues in producing biofuels from algae and cellulosic biomass.

Profile analysis for multivariate statistical process control

A special case in multivariate SPC is the profile analysis in which a quality characteristic is measured over time or space. Most current research tackles this problem by forming a quality characteristic vector containing all measured points in a profile. We have been working on dimension-reduction techniques to further simply the difficulty of SPC implementation. Specifically wavelet filtering is applied to separate a profile into two distinct channels. The approximate channel contains the information on profile shape changes while the detail channel bears the information of amplitudes of a profile. We then apply a cubic B-Spline function to fit the signals from the approximate channel. Dimension reduction is then achieved by considering only a handful of control points in the B-Spline function. We have been working on applying this framework on composite manufacturing. We have also been applying profile analysis on bioinformatics applications.

Rotary ultrasonic machining of hard-to-machine materials

Using rotary ultrasonic machining, we develop new drilling methods for hard-to-machine materials such as advanced ceramics, titanium, stainless steel and composites. Many components made from these materials require drilling operations. However, these materials are notorious for their poor machinability, resulting in high cost and low efficiency with current drilling methods. Therefore, there is a critical need to develop more cost-effective drilling processes for these materials. Research in this area has been supported by Boeing, Sonic Mill and NBR Diamond Tool.

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Research

Ultra-precision, non-contact surface-strain measurements

The main objective of this multi-department research effort is the development of ultra-precision non-contact measurement techniques to measure dynamic changes on the surface strains in a variety of real-world applications, including bridge inspection, pre-stress concrete elements manufacturing, semiconductor wafer surface-strains measuring and metallic structure dynamic stress. Previous research efforts have shown that by recognizing the tiny shifts of the fringes or speckle patterns reflected by the measured surfaces, precise surface-strain changes can be calculated mathematically using sophisticated digital imaging processing algorithms and their corresponding domain transformations.

Our objective is to dynamically measure pre-stressed concrete, element-distension processes using low-cost, high-precision but rugged optical devices that can be used by the field engineers. Various innovative image-processing algorithms and optic-design processes based on nonlinear optimization and matrix factorization are used for calculating image correlations and peak-findings processes. We were able to use fundamental operations research techniques to enhance the speckle resolution tenfold. Therefore, it was possible to use low-cost hardware to achieve a high measure of precision.

In recent work, we revamped this development to work with general surfaces using a single unified device while maintaining +/–15 m-strains of accuracies (i.e., 1.5×10–5 of the effective measuring spans). Robust optimization design models were used to efficiently identify the sensor-repositioning processes and determine the speckle images captured on the fly. Second-generation prototype devices are currently being extended to perform two dimensional-strain measurement and surface-stress structure studies.

Appointed Editors

IMSE faculty are actively engaged in supporting our profession. The following list details current editorial positions held by K-State IMSE faculty members.

- Editorial board, International Journal of Information and Operations Management Education.
- Department editor of Quality and Reliability Engineering, IIE Transactions.
- Associate editor, Fuzzy Optimization and Decision Making, Kluwer Academic Publishers, 2000–present.
- Associate editor, Mathematical Sciences Research Hot-Line, an international journal of rapid publication, 2000–present.
- Associate editor, Computer and Mathematics with Applications, an International Journal, Pergamon Press, Inc., 1975–present.
- Associate technical editor of Machining Science and Technology, 2008–present.
- Editor in chief, Energy Science and Technology—A Series of Graduate Textbooks, Monographs, Research Papers, 1976–present.
- Associate editor, Indian Journal of Management and Systems, 1984–present.
- Area editor, Journal of Engineering Chemistry and Metallurgy, 1989–present.
- Area editor, The Journal of Fuzzy Systems Association, Taiwan, ROC, 1994–2006.
- Editor, Journal of Nonlinear Differential Equations: Theory, Methods and Applications, 1993–present.
- Honorary editor, Journal of the Chinese Institute of Industrial Engineers, 1998–present.
- Area editor, International Journal of Fuzzy Systems, 1999–present.
- Honorary editor, The Chinese Journal of Process Engineering, Chinese Academy of Sciences, 2001–present.
- Associate editor, Journal of Uncertain Systems (JUS), World Academic Press, 2006–present.
- Editor in chief, International Journal of Artificial Life Research, IGI-Global Publishing, 2008–present.
- Editorial board, International Journal of Mechatronics and Manufacturing Systems.
- Editorial board, International Journal of Engineering Business Management, 2008–present.
- Editorial board, International Journal of Machine Tools and Manufacture, 2005–present.
- Editorial board, International Journal of Machining and Machinability of Materials, 2007–present.
- Editorial board, International Journal of Nanomanufacturing, 2007–present.
- Editorial board, Journal of Machining and Forming Technologies, 2008–present.
- Editorial board, Open Mechanical Engineering Journal, 2007–present.
- Editorial board, Recent Patents on Mechanical Engineering, 2007–present.
- Editorial board, International Journal of Industrial Engineering: Theory, Practice and Application.

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- Yang, B., Shen X., and Lei, S.: "Mechanisms of edge chipping in laser-assisted milling of silicon-nitride ceramics," International Journal of Machine Tool and Manufacture, accepted 2008.
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Grants

Grants

Todd Easton

- Co-PI (Caterina Scoglio and Walter Schumm), National Science Foundation, "SGER: Exploratory Research on Complex Network Approach to Epidemic Spreading in Rural Regions," $50,001, September 2008–August 2008.

Michael Harnett

- PI, U.S. Army, "Part-Time MS Program in IE," $55,476, January 2008–May 2008.
- PI, U.S. Army, "Part-Time MS Program in IE," $41,652, June 2008–July 2008.
- PI, U.S. Army, "Part-Time MS Program in IE," $49,926, August 2008–December 2008.

Bradley Kramer

- PI, NSF grant, "Partnership to Accelerate Commercialization of Kansas Bioscience Products and Technologies," $592,000 with KTEC matching funds of $62,000, October 2004–September 2008.
- PI, Kansas Department of Commerce, "Develop and Implement Early-Stage Technology Development Assistance Center, $45,000, August 2007–July 2010.
- PI, Kansas Technology Enterprise Corporation, "EDA Early-Stage Technology Development Assistance Center: Phase II," $50,000, July 2007–June 2010.
- PI, Kansas Technology Enterprise Corporation, "Kansas Technology Enterprise Corporation Center of Excellence Grant Agreement," $645,000, July 2008–June 2009.
- PI, U.S. Department of Commerce, "Early-Stage Technology Development Assistance Center: Bridging the Gap between New Technologies and Commercialization," $170,000, August 2007–July 2010.
- PI, U.S. Environmental Protection Agency, "Phosphorus Removal Research Project Agreement," $50,000, February 2008–December 2008.
- PI, Kansas Environmental Management Associates, LLC, "Phase IV & V: Farm-Scale Phosphorus Recovery Master Agreement: Construction, Startup and Monitoring (P08-0102)," $120,984, January 2007–January 2011.

Shuting Lei

- PI, National Science Foundation, "CAREER: Design & Development of Navel Responsive Cutting Tool for Laser-Assisted Machining & Diagnosis of Structural Ceramics: A Research-Integrated Education Center Landscape," $6,000, August 2004–January 2008.
- PI, Aurora Flight, "5-Axis, Laser-Assisted Machining of Silicon Carbide Ceramic Matrix Composites," $37,083, April 2007–June 2006.
- Co-PI (with Zenghu Chang and C. Lewis Cocke), DOD, "Attosecond Optical Technology Based on Recollision and Gating," $3,497,125, May 2007–April 2012.
- Co-PI (with Zenghu Chang), National Science Foundation, "Collaborative Research: Mathematical Modeling and Experimental Study of Femotosecond Laser Machining of High-Aspect Ratio Microstructures," $161,380, September 2008–August 2009.

Zhijian Pei

- PI, National Science Foundation, "CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," $400,000, February 2004–January 2010.
- PI, National Science Foundation, "Supplemental- CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," $8,588, February 2004–January 2010.
- PI, National Science Foundation, "Supplemental- CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," (REU) $6,000, February 2004–January 2010.
- PI, National Science Foundation, "Supplemental- CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," (REU) $7,008, February 2004–January 2010.
- PI, National Science Foundation, "Supplemental- CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," (RET) $10,000, February 2004–January 2010.
- PI, Boeing, "Ultrasonic Drilling Testing," $55,000, February 2006–December 2009.
- PI, National Science Foundation, "Innovative Laser-Based Techniques for Characterization of Subsurfaces Cracks in Semiconductor Wafer," $64,197, September 2005–August 2009.

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- PI, National Science Foundation, "Supplemental–CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," (REU) $6,000, February 2004–January 2010.
- PI, National Science Foundation, "Supplemental–CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," $50,370, February 2004–January 2010.
- PI, Saint Gobain, "Abrasive Product Development and Finishing Process Development for Ceramics/Crystals," $145,047, January 2007–September 2008.
- PI, National Science Foundation, "Innovative Laser-Based Techniques for Characterization of Subsurfaces Cracks in Semiconductor Wafer," (RET) $10,000, September 2005–August 2009.
- PI, National Science Foundation, "Supplemental–CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," (RET) $11,972, February 2004–January 2010.
- PI, National Science Foundation, "NSF Proposal Writing Workshop–Alaska," $48,535, June 2007–May 2009.
- PI, National Science Foundation, "Supplemental–CAREER: Fundamental Research on Silicon Wafer Fine Grinding to Foster a Quantum Leap in Manufacturing of Silicon Wafers," (RET) $11,972, February 2004–January 2010.
- PI, National Science Foundation, "Innovative Laser-Based Techniques for Characterization of Subsurfaces Cracks in Semiconductor Wafer," (REU) $7,008, September 2005–August 2009.
- PI, Crystal Technology, "Development of Advance Fabrication Process of Lithium Niobate," $27,500, November 2007–August 2008.
- PI, National Science Foundation, "SGER: Exploratory Research on Solid Carriers for Manufacturing Algae Biofuels in the Ocean," $98,560, September 2008–August 2009.
- PI, National Science Foundation, "NSF CAREER Proposal Writing Workshop–Chicago," $23,758, January 2008–December 2008.
- PI, National Science Foundation, "Innovative Laser-Based Techniques for Characterization of Subsurfaces Cracks in Semiconductor Wafer," (REU) $6,000, September 2005–August 2009.
- PI, National Science Foundation, "Workshop: 2009 NSF CAREER Proposal Writing Workshop," $22,958, August 2008–July 2009.
- Co-PI (with Wenqiao Yuan), National Science Foundation, "SGER: Exploratory Research on Solid Carriers for Manufacturing Algae Biofuels in the Ocean," (REU) $12,000, September 2008–August 2009.
- PI, National Science Foundation, "Funding for Student Participation in the 2009 SMMI Grantees Conference," $188,782, November 2008–October 2009.
- PI, National Science Foundation, "SGER: Exploratory Research on Solid Carriers for Manufacturing Algae Biofuels in the Ocean," (RET) $10,000, September 2008–August 2009.

Malgorzata Rys

- Co-PI (with Robert Stokes and Eugene Russell), United States Department of Transportation, "Development of a Comprehensive Rural Transportation Safety Research Program for the 21st Century," $100,000, May 2006–June 2008.
- Co-PI (with Eugene Russell), UTC-project #6, "Effectiveness of a Larger Traffic Sign, High-Performance Sheeting and Clearview Font on Accident Reduction" $49,659, February 2007–May 2009.
- Co-PI (with Eugene Russell), UTC-project #2, "Promoting Center-Line Rumble Strips to Increase Rural, Two-Lane Highway Safety," $20,000, February 2007–May 2009.
- Co-PI (with Eugene Russell), Kansas Department of Transportation, "Promoting Center-Line Rumble Strips to Increase Rural, Two-Lane Highway Safety," $59,000, February 2007–May 2009.

Chih-Hang John Wu

- Co-PI (Bob Peterman and Terry Beck), UTC, "Implementation of Non-Contact Strain Measurement Device for Bridges and Piers," $62,138, September 2008–January 2010.
- Co-PI (Bob Peterman and Terry Beck), KDOT, "Implementation of Non-Contact Strain Measurement Device for Bridges and Piers," $21,280, September 2008–January 2010.

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Undergraduate Studies

Our undergraduate enrollments have continued to grow during the past few years. IMSE had a total enrollment of more than 160 undergraduate students; approximately 30 percent of those students are females. On average, our students have more than two engineering intern positions prior to graduation. During the spring and fall 2008 commencement ceremonies, 20 BSIE degrees were granted. Graduates of our program are in strong demand in Kansas, the Midwest region and across the nation. The majority of our students had jobs before graduation. Companies that recruited our graduates last year include Accenture, Altec Industries, Inc., Burlington Northern-Santa Fe Railway, Caterpillar, Cessna, Exxon Mobile, Halliburton, Honeywell and Hormel Food. The average annual starting salary for our students was $60,000.

The IMSE department recently created a concurrent B.S./M.S. degree program that allows top students to begin to work on a master of science degree while they are still undergraduate students. Just last year, six of our outstanding undergraduate students enrolled in this program. Starting salaries for graduates of the program have been approximately $75,000, which is $15K more than the starting salary offers for the B.S. graduates. Students in the program earn a broader and deeper appreciation for industrial engineering through advanced-level course work. They also significantly enhance their technical skill set through active engagement in research.

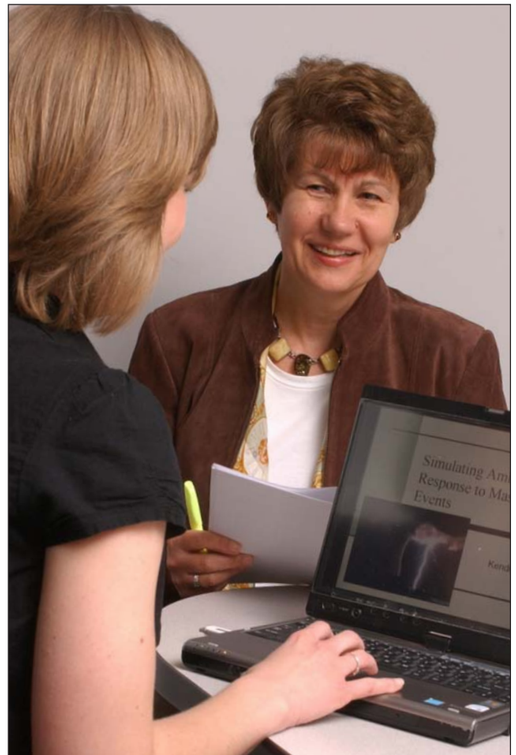
IMSE students and faculty are working together to improve healthcare systems. Our goal is to increase the quality of healthcare while simultaneously reducing costs. To do so, IMSE students work with IMSE faculty on projects sponsored by hospitals, clinics and other health organizations. Last year, 12 IMSE undergraduate students worked on projects emphasizing process improvement, facility layout and safety with hospitals in Pratt, Fort Riley, Omaha, Kansas City and Manhattan. To accomplish these projects, the students used IMSE tools such as process modeling, simulation, quality engineering and design and implementation of modern information systems.

Awards

In 2008, one of our students received the Material Handling Education Foundation Scholarship. Since its inception in 1976, 28 K-State IMSE students have been awarded this scholarship. Over that same time period, approximately 620 students received that award. That means 4.5 percent of all awards given nationally were received by students from our department.

IIE student chapter

The department has an active student chapter of the Institute of Industrial Engineers, advisor, Professor Margaret J. Rys. IIE officers organized a number of activities promoting academic and social interaction between the members. The chapter hosted student/faculty picnics, mentor day, financial workshop, tailgate party with the University of Oklahoma IIE student chapter and the Kansas City IIE senior chapter and displays at K-State Open House and participated in the Technical Paper Conference and other interesting activities. Our chapter received the Gold Award in the 2008 IIE national chapter recognition competition.



Graduate Studies

The IMSE department is committed to excellence in scholarly research and graduate teaching. We offer a rich variety of projects in the areas of operations research, ergonomics, manufacturing and office systems, uncertainty representation and intelligent reasoning as well as quality engineering. In addition to basic research, our curriculum emphasizes collaborative and interdisciplinary research, collaboration with industrial partners, and develop and modeling of various industrial processes.

We offer four graduate degrees: the master of science in industrial engineering (MSIE), the master of science in operations research (MSOR), the master of engineering management (MEM) and a doctor of philosophy in industrial engineering. The master's degrees in operations research and in engineering management are available via distance learning to better serve our students.

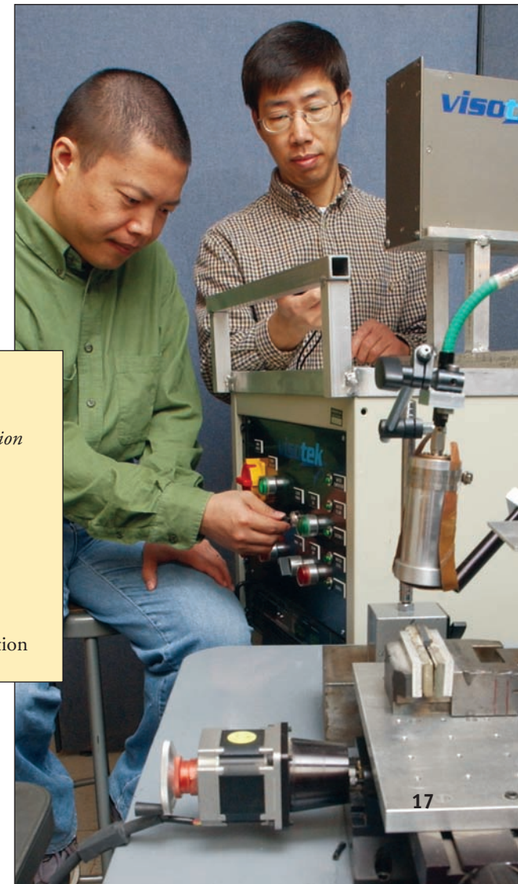
The MSIE program teaches students the mathematical, scientific and analysis skills to solve complex business problems in manufacturing, healthcare, transportation, financial organizations, communications, government, military and many other organizations. The MSOR program focuses on application of mathematical models to analyze complex problems and develop optimum solutions. The MEM program is geared toward management of engineering or highly technical organizations as well as money, people and equipment.

Admission requirements

Applicants for our graduate degrees must possess a bachelor degree in engineering with at least a 3.0 grade point average or equivalent, from accredited institutions. Students not possessing a degree in engineering must have a background that includes the equivalent of core undergraduate engineering and mathematics courses. We also require our international students to have a quantitative GRE score of at least 700 and an Internet-based TOEFL of 79.

Areas of concentration

The IMSE department has expertise in discrete systems, continuous systems, stochastic systems, linear and nonlinear programming, quality and control of quality, decision making, ergonomics, manufacturing processes design and improvement, efficiency of manufacturing and office systems, engineering management, fuzzy sets, neural networks and intelligent systems.



Where to apply

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Application materials

- Online application: *www.k-state.edu/grad/application*
- Confirmation sheet
- Application fee
- Official transcripts
- TOEFL and GRE scores
- Affidavit of financial support
- Statement of objectives
- Three letters of recommendation

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