

IOWA STATE UNIVERSITY  
COLLEGE OF ENGINEERING

# Mechanical Engineering



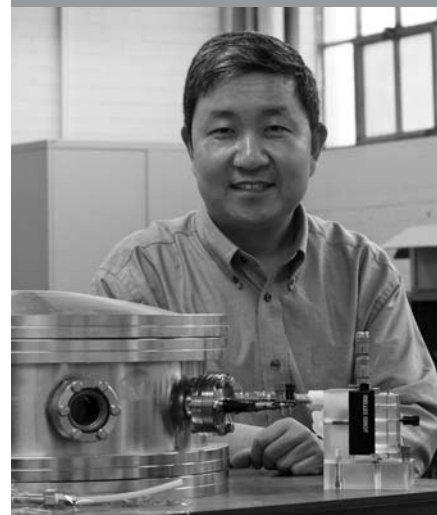
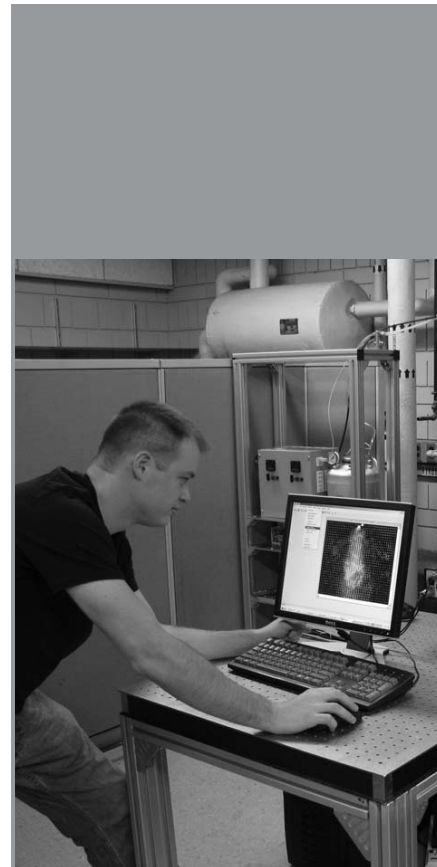
**Knowledge. Innovation. Leadership.**

**Annual Report  
2008-2009**

**August 2009**

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# Year in Review

This year serves as the first opportunity to measure progress on our departmental strategic plan. In 2007-2008 we set forth five priorities, and since then we have been moving forward guided by this plan. With each of their accomplishments, our faculty, staff, and students demonstrate the importance of our initiatives and the continued strength and growth of our department.

## Improving Student Services

Undergraduate students in the mechanical engineering department have a new home for advising and academic support. The Kiewit Undergraduate Student Services Center, which has been up and running since the beginning of the spring 2009 semester, was dedicated during an afternoon reception on April 8, 2009.



The center was constructed through a generous pledge from Kiewit Corporation and will help the department ensure academic and professional success for its undergraduate students.

As the first named space in the Henry M. Black Engineering Building, the center has doubled in square footage from the previous advising area. The department's three academic advisers say the new space is welcoming to students and visitors and allows them to provide more extensive services to students.

*Several leaders from Kiewit joined mechanical engineering faculty, staff, and students for a dedication event, including Bruce Grewcock, president and CEO of Kiewit Corporation.*

Within the center, there are two on-site computers for students to register for classes, a monitor that broadcasts announcements, and a help room. Additionally, a wall display showcases accomplishments and awards of students, student organizations, and the center.

## Advancing Our Department

Both our undergraduate and graduate programs have seen growth in enrollment this year. Our senior design class continues to grow with more projects from a wide variety of partners. Recruiting efforts at the graduate level have increased the visibility of our department's growing research enterprise, greatly improving our applicant pool.



*ME students work on design projects, applying classroom lessons to engineer a prototype that meets specific criteria and design requirements.*

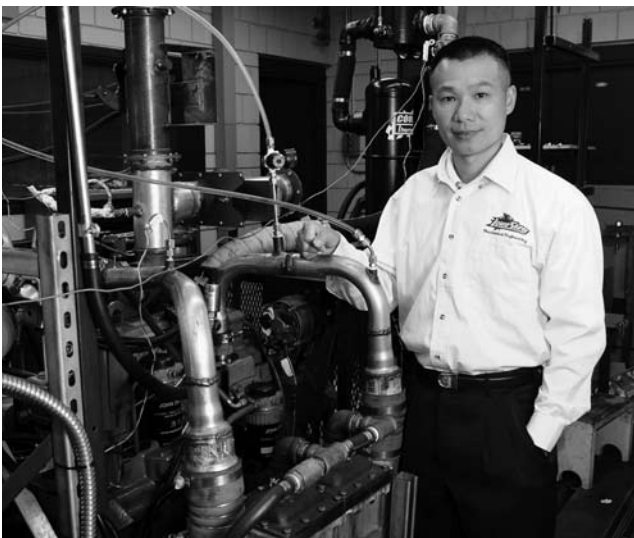


Much of the strength of our department comes from faculty who are dedicated to using their creativity to solve engineering problems that impact society. We welcomed four new faculty members to the department this fall: Tim Bigelow, Baskar Ganapathysubramanian, Valery Levitas, and Song Zhang. They bring with them a wealth of knowledge and skills that enhance our biological and nanoscale sciences, clean energy technology, complex fluid systems, design and manufacturing innovation, and simulation and visualization research programs. In addition, Emmanuel Agba joined the department as a senior lecturer in the spring.

Jonathan Wickert, former chair of the department, has been appointed dean of the College of Engineering at Iowa State and is now the James and Katherine Melsa Professor in Engineering. Pranav Shrotriya and Eliot Winer were both promoted to associate professor with tenure.

## Conducting Significant Research

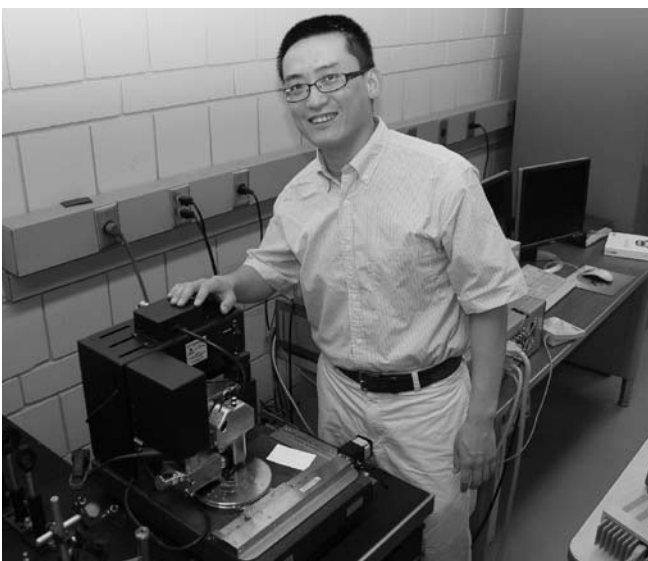
Our faculty led many research projects throughout the year, developing and improving technologies that have the potential to address some of the world's most serious challenges. These projects may be interdisciplinary efforts, as well as independent work, and each advances our knowledge to get us one step closer to important solutions.



*Kong*

Song-Chang Kong, assistant professor of mechanical engineering, is leading a research project team that is working to produce clean, renewable energy by developing a new, low-emissions burner and a new catalyst for ethanol production. The project is supported by a two-year, \$2.37 million grant from the Iowa Power Fund, a state program to advance energy innovation and independence.

The research team also includes Robert C. Brown, Iowa Farm Bureau director of Iowa State's Bioeconomy Institute, Anson Marston Distinguished Professor of Engineering, and Gary and Donna Hoover Chair in Mechanical Engineering; Victor Lin, professor of chemistry, director of Iowa State's Center for Catalysis, director of chemical and biological sciences for the U.S. Department of Energy's Ames Laboratory, and founder of Catilin Inc., an Ames-based company that produces catalysts for biodiesel production; Samuel Jones, assistant scientist for the Center for Sustainable Environmental Technologies; plus seven graduate students and two postdoctoral researchers.



*Zou*

Over the past four years, Qingze Zou has been working to increase the speed of a scanning probe microscope (SPM) with ambitions to improve the technology to characterize and manipulate materials in the nano world.

His research as an assistant professor in mechanical engineering has been delivering promising results, which is an important asset for his next project—characterizing soft materials such as DNA and biological cells. Recognizing the importance and potential of this work, the National Science Foundation selected Zou to receive a CAREER award to support his work.

## Appreciating Our Heritage

The Department of Mechanical Engineering has a strong heritage that can be traced back to the first years of the university. We must look back to what we were as we pave our way to the future. Collecting the department's historical information has shown us the profound impact of our predecessors and the history we share as we continue our role as leaders at the university, state, national, and global levels.

## Budgeting in Uncertain Times

While our state budget allocations have been reduced from those of last year due to the economic downturn all states are facing, our financial position remains solid. We have been able to off-set some of the budget reductions through stimulus money received from the federal government; however, this money is one-time money and will not be available next year. We have gone to great lengths to prepare for future budget challenges and are running a very lean department.

To compensate for some reductions, we have had to increase class sizes and reduce hiring. We remain the most popular major on campus, and we continue to focus on providing students with a high quality education.

Our support from non-state sources, such as research and private giving, is very strong and continues to grow, and we will continue to build these partnerships. These sources are making an important investment in the future of our program, and their generosity is truly making a difference in our operations.

## Looking Ahead

We have an excellent group of faculty, students, and staff who are continuing the rich legacy of mechanical engineering at Iowa State University. Our strategic plan is keeping us focused on our priorities—making a difference in the lives of others through our educational, research, and service programs and impacting society for the good of all.



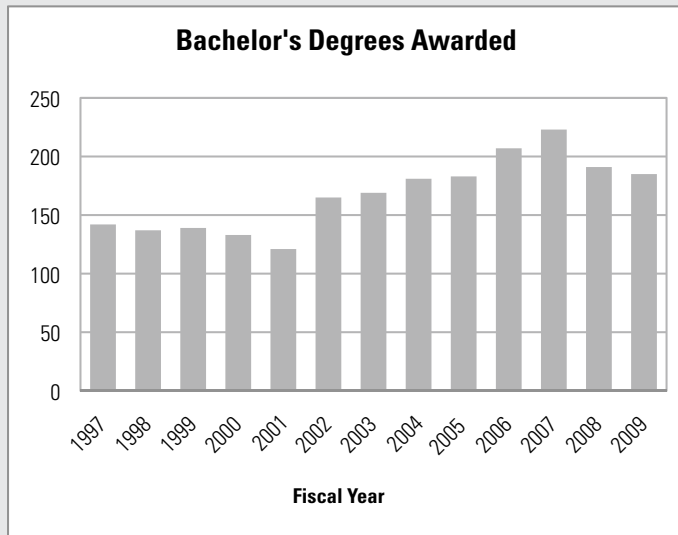
Theodore (Ted) J. Heindel  
Interim Chair, Department of Mechanical Engineering  
Art and Priscilla Bergles Professor of Thermal Science



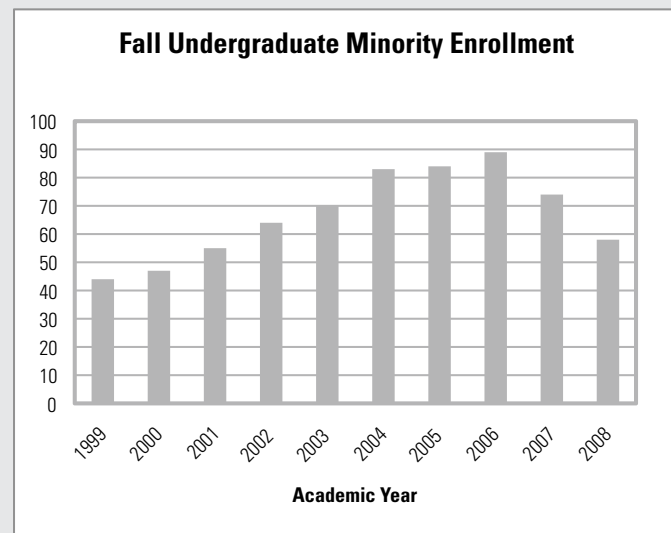
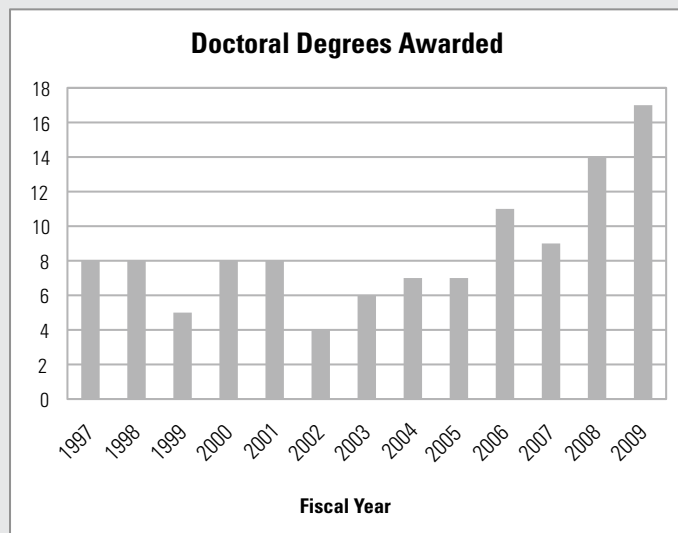
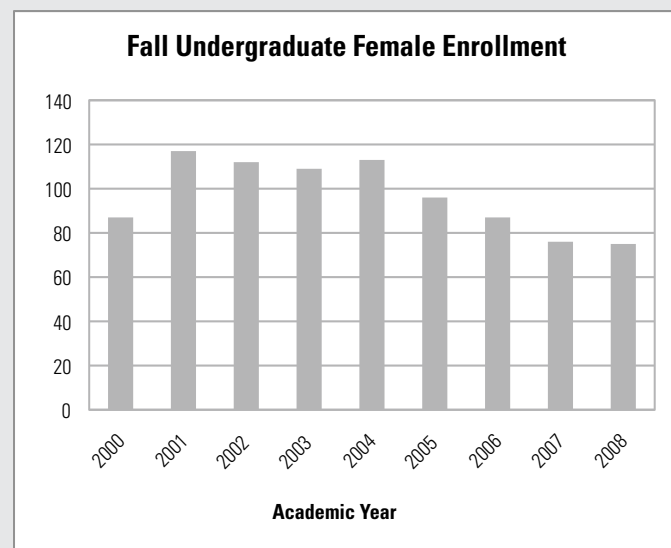
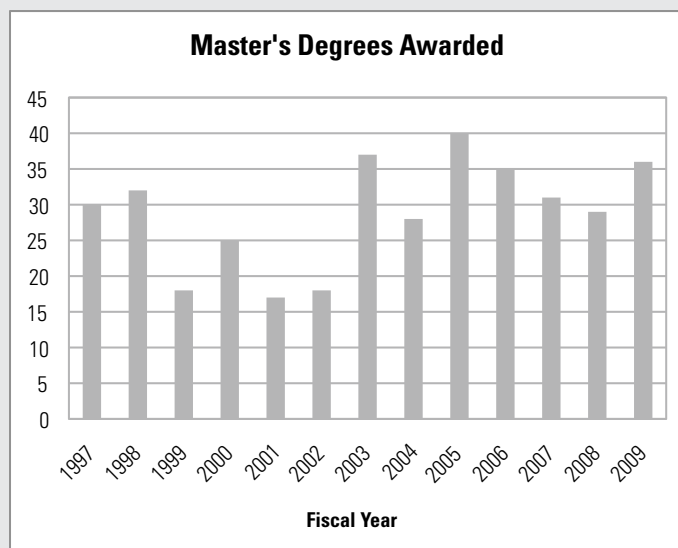
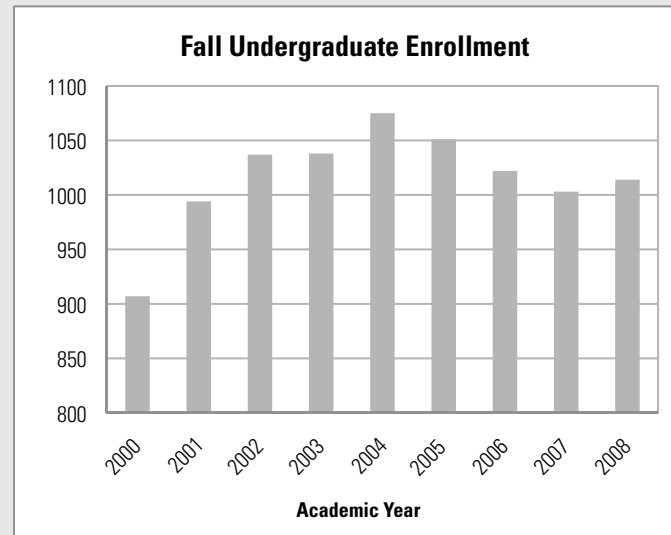
*Manhole covers in use across campus today were part of a mechanical engineering project when Iowa State University was known as Iowa State College.*

# Performance Indicators

## Degrees Awarded

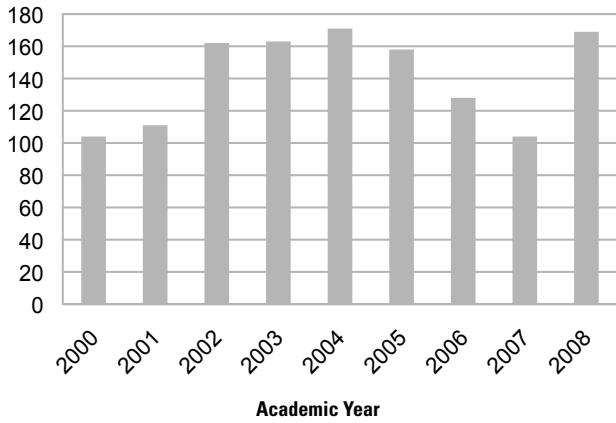


## Undergraduate Enrollment



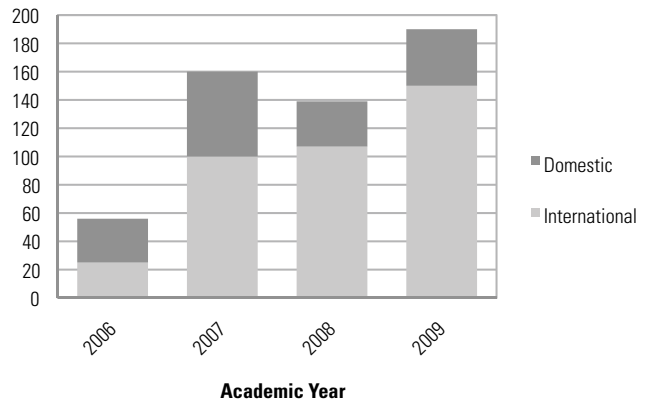
## Graduate Enrollment

### Fall Graduate Enrollment

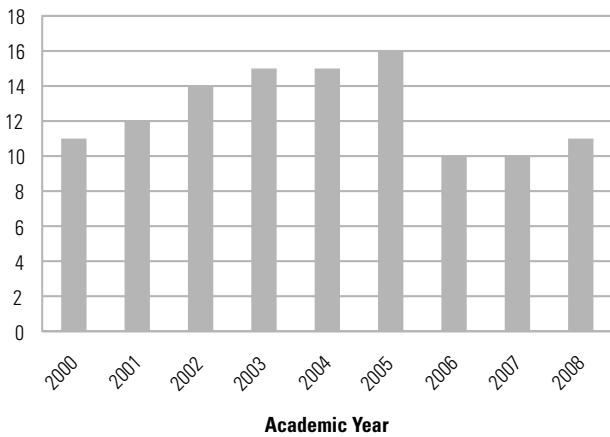


## Graduate Program Recruitment

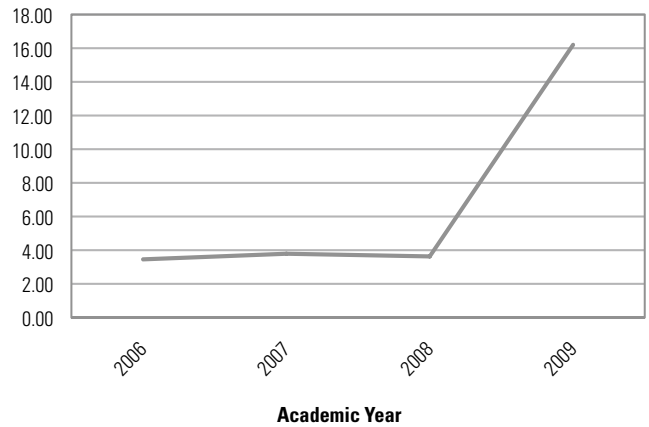
### Complete Applications



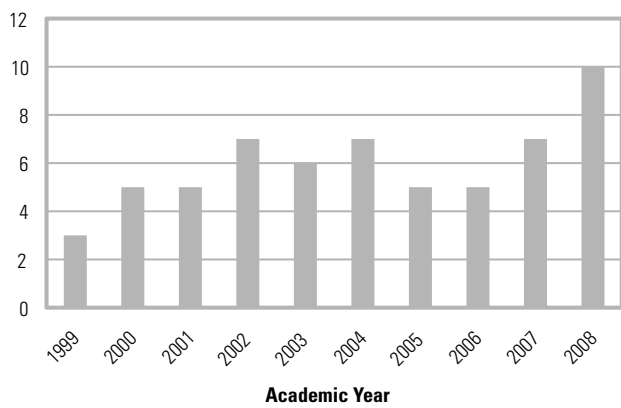
### Fall Graduate Female Enrollment



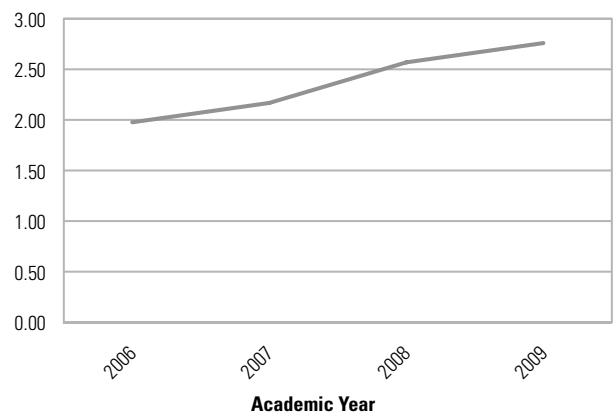
### Selectivity: Ratio of Complete Graduate Applications to Admissions Offers



### Fall Graduate Minority Enrollment

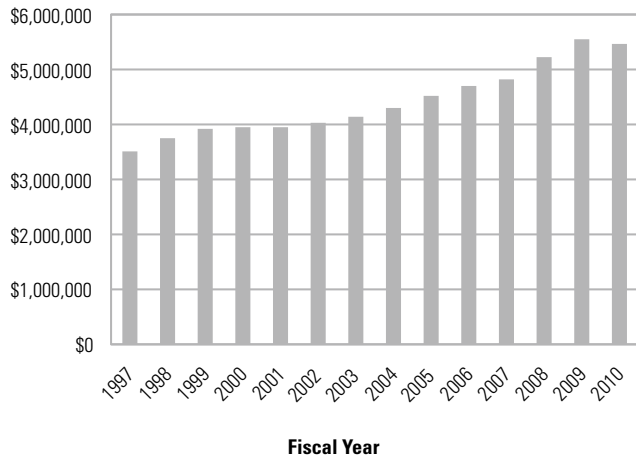


### Conversion: Graduate Admission Offers to Acceptance Ratio

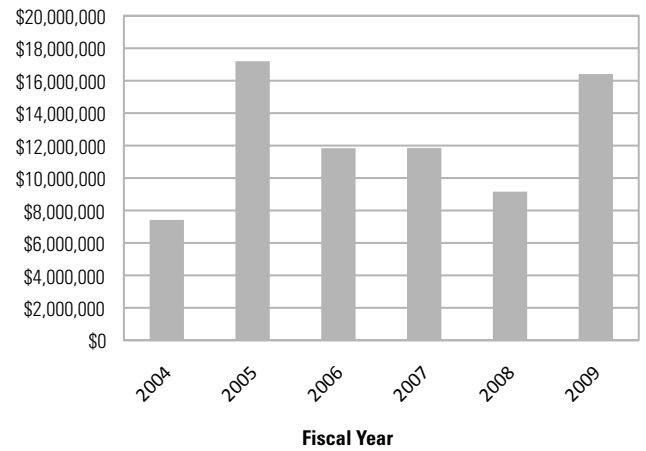


# Department Operations

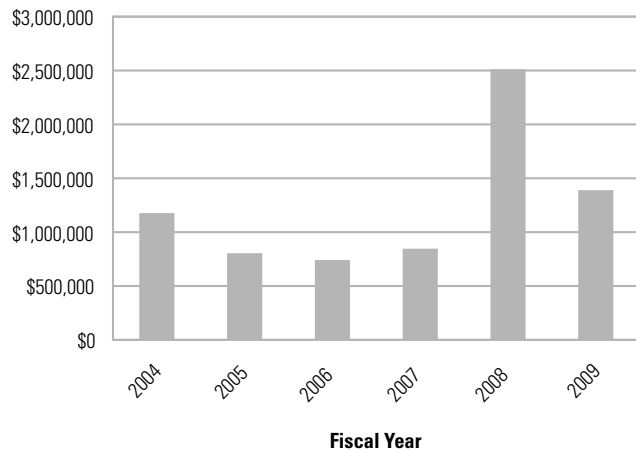
### Departmental General University Budget



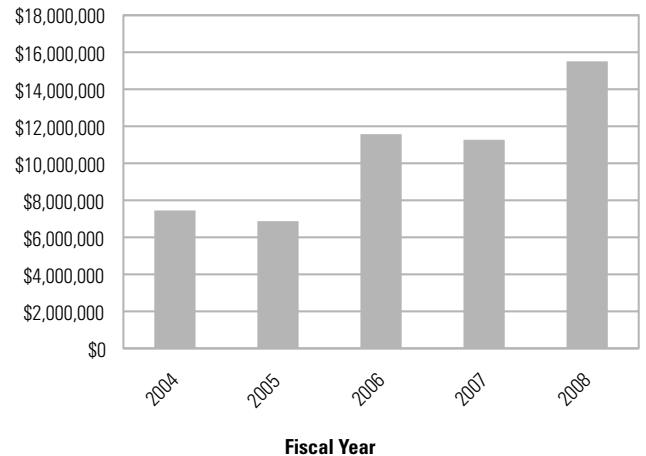
### Sponsored Funding Awards Received



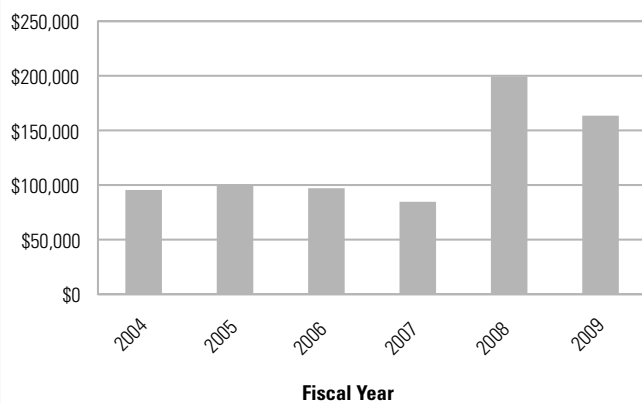
### Private Giving: Total Gift Production



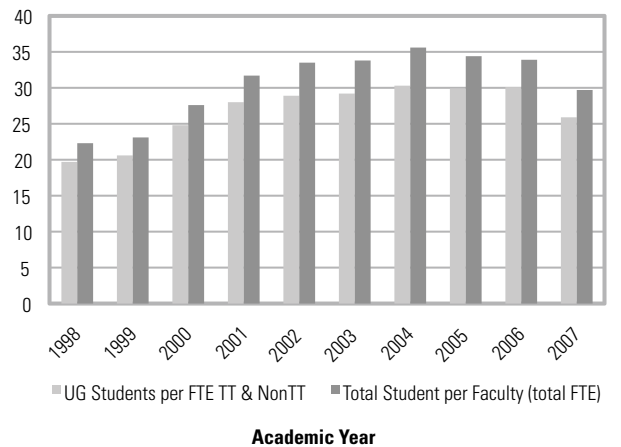
### Research Expenditures



### Private Giving: Black-Hilstrom Gift Production



### Undergraduate Student-Faculty Ratio





## Personnel (FTE)

Tenure and tenure-track faculty: 26.8  
Non-tenure eligible lecturers: 5.8  
P&S and merit staff: 15.3  
Center directors: 3

## Endowed Faculty Positions

*Anson Marston Distinguished Professor*

James Bernard  
Robert Brown

*Art and Priscilla Bergles Professor of  
Thermal Science*

Ted Heindel

*Gary and Donna Hoover Chair in Mechanical  
Engineering*

Robert Brown

*James and Katherine Melsa Professor in  
Engineering*

Jonathan Wickert

*Larry and Pam Pithan Professor of  
Mechanical Engineering*

Jim Oliver

*William and Virginia Binger Assistant  
Professor of Mechanical Engineering*

Song-Charng Kong

*Schafer 2050 Challenge Professor*

Valery Levitas

## Professional Society Fellows

*American Institute of Aeronautics and  
Astronautics*

Terry Meyer, associate fellow

*American Society of Mechanical Engineers*

Robert Brown  
Abhijit Chandra  
Atul Kelkar  
Jim Oliver  
Judy Vance  
Jonathan Wickert

## Research

Journal papers published: 73  
Conference papers published: 88  
Sections or chapters in books,  
monographs, or similar volumes: 6  
Patents awarded: 1  
Doctoral dissertations: 14  
Master's theses/projects: 36



# Undergraduate Program Highlights

## Programs

Along with a traditional bachelor's degree program, the mechanical engineering department offers a concurrent BS/MS program, which provides students with research experience as early as their junior year. In 2008–2009, the department enrolled eight new students to the program. Students can also concurrently earn a BS in mechanical engineering and an MBA. In addition, the department recently began offering a minor in nuclear engineering.



*Michael Olsen  
Associate Chair for  
Undergraduate  
Studies*

## Enrollment

During the 2008–2009 academic year, we awarded 185 bachelor's degrees. Enrollment in the undergraduate program was 1,014 students. Of this number, 7.4 percent of students were women and 7.4 percent were minorities. The incoming freshman class consisted of 220 students with a mean ACT score of 28.

## Industrial/Academic Partnership in Design

We have revamped our design courses throughout the curriculum to emphasize student interaction with industrial partners and charitable organizations. Our recent design projects have involved collaborations with companies as well as non-profit organizations.

## International Study and Travel Opportunities

The undergraduate program offers opportunities for students to study abroad in Wales, Australia, Germany, Spain, and Mexico. In addition, students can participate in student exchanges within the U.S. We also have courses in sustainable engineering that culminate in class trips to underdeveloped countries such as Mali and Nicaragua, allowing students to directly apply their knowledge to real situations. Twenty-two percent of spring 2009 graduates had international educational or work experience.

## Mechanical Engineering Beyond the Classroom

Our program provides many educational opportunities that extend beyond the classroom. These include national design competitions such as Mini Baja, Formula SAE, and the solar car team PrISUm. Our students are also able to gain work experience through internships and co-ops with industries in Iowa and across the nation. Eighty-five percent of spring 2009 graduates had co-op, intern, or summer work experience.



*Janelle Miranda, undergraduate program assistant, and Courtney Hazlett, a freshman ME student discuss outreach opportunities for the WiME program.*

## Women in Mechanical Engineering (WiME) Program

The goal of the Women in Mechanical Engineering program is to provide resources to recruit and retain women to prepare for a career in the mechanical engineering profession. The program provides female students with scholarship opportunities; hosts social events and networking opportunities with students, faculty, and representatives from the industry; and facilitates a mentor program with women engineers in industry. The program has been a success with the number of incoming freshman women increasing from 7 in fall 2008 to 18 in fall 2009.

# Senior Design Projects

## Fall 2008

### *CIRAS Sponsored Projects*

Farmers Corrugated, LLC: Cardboard pallet manufacturing fixture design

- Jared Cave\*, Lee Christensen, Charlie Dvorak, Sara Luke, Daniel Mattox
- Anthony Lanphier\*, Nathan Jensen, Kyle Howell, Justin Callies

TPI Composites of Iowa, LLC: Racking design, cutting room material handling equipment

- Nicholas Cullinan, Mitchell Horstman, Jacob Olberding\*, Patrick O'Shea
- Kevin Deiter\*, Alec Marshall, Bryan Revard, Henry Pham

TPI Composites of Iowa, LLC: Resin process design, resin injection process improvement

- Michael Schuller\*, Dustin Knight, Bharat Goel
- David Asplund, Jeff Boger\*, Cody Cook, Scott Van Gilder

John Deere Des Moines Works: Cotton wrap, cotton bale plastic wrap recycling process design

- Jeff Utter\*, Tyler Tegtmeyer, Shuang Gao
- Cory Ott\*, Joseph Herrera, Paul Letsche, James Stauch

John Deere Des Moines Works: Sprayer, sprayer box changeover time improvement design

- Eric Green, Gregory Harris, Michael Sheehan, Jeff Thomas\*
- Malachi Roth, Andrew Sabo\*, Matthew Schroeder, Nicholas Skripinsky

Superflow Technologies, Inc.: TCRS vertical welder upgrade

- Travis Presto, Jeff Garrett, Andrew Johnson\*, Joshua Warner
- Janelle Byer, Brian Lapcewich\*, Stephen Travis

### *Corporate Project*

Bell Water Systems, LLC: Ocean wave power generation design

- Brandon Gill, Michael Gill\*, Nicole Gassman
- Keegan Gartner, Tom Cunningham, Darren McGregor, Daniel Short\*

### *Service Project*

Harmony House of Iowa: Recumbent bicycle chariot design and build

- Brett Hartman, Nathan Evers\*, Daniel Swales, Ryan Finke

### *ME Department Project*

ME 421 lab apparatus design and build

- Jason Knipper, Robert Reischl, Mark Van Thomme\*, Rachael Waggoner

### *Student Projects*

SAE Baja transmission design

- Justin Gross, Nicholas Heine\*, Jonathan Howard, Reid Schenk

Leg rehabilitation machine design

- Daniel Eaton\*

## Spring 2009

### *CIRAS Sponsored Project*

Vermeer Corporation: Horizontal drill head navigation

- Jonathan Berrie\*, Lee Doeden, Phil Mann, Eric Almeida
- Rich Adams, Steve Chase, Chad Hageman, Brandon Hunold, Saengmany Khotsombath\*

S&R Manufacturing: Silage bag unloader

- Jason DeZwarte\*, Tom Turner, David Baker, Neal Schurr
- Curtis Spence, Justin Leonard\*, James Rendall, Robert Cooper, Christopher Hadden

### *Corporate Projects*

Bell Water Systems, LLC: Ocean wave power generation design

- Kyle Anderson, John Dunham, Joseph Boline, Dale Hodgell, Justin Lisk
- Paul Cise\*, Tae Jun Kim, Cody Leveke, Abraiz Sajjad

NuScale Power, Inc./Kiewit Power, Inc.: Nuclear power pressure vessel assembly

- Kyle Burlage\*, Lan Boutdara, Mark Cecconi, Kevin Wang
- Brad Thomas\*, Mollie Marken, Kyle Burnham, Nick Creager

Ewing Family Farms, LLC: Hay drying and processing design

- Jeff Stegeman\*, Trent Payne, Eric Roquet
- Sam Failla, Thomas Rohlfing, Suhaidi Sumsudin, Loren Zabel\*

### *Service Projects*

Harmony House of Iowa: Recumbent bicycle chariot design and build

- Hilda Garma\*, Chad Larish, Scott Kraus, Payton Schirm, Ryan Even
- Daniel Boger, Danielle Douskey, Kate Fiedler, Merritt Tennison\*, Jordan Watkins

Camp Courageous of Iowa: Railway bridge feasibility study

- Brent Metz\*, Christopher Brennan, Graham Zrostlik, Thomas Grote, Carl Amundson
- Daniel Norwood, Liu Rong, Josh Hockett, Zachary Huemann, Brett Randall

City of Ames: Refuse Derived Fuel processing

- Michelle Allen\*, Whitney Bynum, Ashley Carter, Kelly Hall
- Heidi Hageman, Kyle Halligan, Drew Robinson\*, Carmi Spicer

### *ME Department Project*

Biofuels emulsifier

- Noah Van Dam\*, Daniel Eivins, Kevin Zenz, Jason Parkes, Cuong Huynh
- Simon Nielsen, Colleen O'Brien, Aaron Rodriguez, Justin Niewoehner

### *Student Project*

"Cozy" commuter vehicle transmission design

- Brian Householder, Benjamin Kingland, Tyler Martin, Dain Sires\*, Mark Vestweber

## \*Team leader

# Graduate Program Highlights

## Programs

Our department offers both master's and doctoral degrees in mechanical engineering, as well as a master's of engineering in mechanical engineering, which is a professional coursework-only program that can be completed through distance education. We support interdisciplinary programs including human-computer interaction, biorenewable resources and technology, as well as systems engineering, which is a master's of engineering program.



*Sriram Sundararajan  
Associate Chair for  
Graduate Studies and  
Research*

## Enrollment

We had 169 graduate students enrolled in the department, of which 88 were master's students and 81 PhD students. Of our graduate students, 14 students were women and 10 were minority students. These enrollment numbers include 30 students who are pursuing their master's degrees through distance education.

## Degrees

The department granted 29 master's degrees and 14 doctorate degrees in 2008–2009. Upon graduation, four graduate students received research excellence awards and three graduate students received teaching excellence awards.

## Recruitment and Support

During 2008–2009, 190 students applied for admission into our graduate program. Of these applicants, 60 students were admitted and 40 students enrolled. Overall, the department supported 37 students through teaching assistantships and 81 students through research assistantships. In addition, 10 students were awarded fellowships, including one student who received the prestigious National Defense Science and Engineering Graduate (NDSEG) Fellowship.

## Career Paths

Our graduates enjoy tremendous visibility amongst industry and academia. A large number of our graduates pursue positions in industry with renowned companies such as John Deere, Caterpillar, 3M, Intel, and Garmin. Graduates have also found post-doctoral opportunities with leading institutions including Stanford University and Princeton University.



*Joseph Miller, advised by Assistant Professor Terry Meyer, received the NDSEG Fellowship.*

## Recent developments

We have developed and deployed an aggressive recruitment program to expand the quantity and quality of our applicant pool. These efforts, led by Program Assistant Amy Carver, focus on increasing publicity and promotion of our program at the regional, national, and international levels, as well as maintaining follow-up communication with applicants throughout the application process. We have instituted an online application and admissions system and are working with faculty to establish long-term relationships with regional and international institutions. We have also successfully obtained fellowship monies to help recruit women and minority students.



# Doctoral Dissertations

*Satyam Kumar Bhuyan*

Dissertation: Investigation of tribological properties of biobased polymers and polymeric composites

Major Professor: Sriram Sundararajan

*Jung Leng Foo\**

Dissertation: A framework for tumor segmentation and interactive immersive visualization of medical image data for surgical planning

Major Professor: Eliot Winer

*Vijay Kiran Kalivarapu*

Dissertation: Improving solution characteristics of particle swarm optimization through the use of digital pheromones, parallelization, and graphical processing units (GPUs)

Major Professor: Eliot Winer

*Pavan Karra\**

*Modeling and control of material removal and defectivity in chemical mechanical planarization*

Major Professor: Abhijit Chandra

*Kyong Soo Kim*

Dissertation: Feedforward control approach to precision trajectory design and tracking: Theory and application to nano-mechanical property mapping using scanning probe microscope

Major Professor: Qingze Zou

*Jae Joong Ryu*

Dissertation: Surface damage of metallic implants due to mechanical loading and chemical reactions

Major Professor: Pranav Shrotriya

*Som Shrestha\*\**

Dissertation: Performance evaluation of carbon-dioxide sensors used in building HVAC applications

Major Professor: Greg Maxwell

*Kanaga Karuppiah Kanaga Subramanian\**

Dissertation: Effect of conformational change on nanoscale friction behavior of organic thin films

Major Professor: Sriram Sundararajan

*Dinesh Kalyana Sundaram*

Dissertation: Mechanics guided design of hybrid laser/waterjet system for machining hard and brittle materials

Major Professor: Pranav Shrotriya

*Kevin Jay Timmer*

Dissertation: Carbon conversion during bubbling fluidized bed gasification of biomass

Major Professor: Robert Brown

*Wen Wang*

Dissertation: A non-body conformal grid method for simulation of laminar and turbulent flows with a compressible large eddy simulation solver

Major Professor: Richard Pletcher

*Ryan Duwain Warren*

Dissertation: A feasibility study of stationary and dual-axis tracking grid-connected photovoltaic systems in the Upper Midwest

Major Professor: Michael Pate

*Hua Xu\*\**

Dissertation: Quenching of particle-gas combustible mixtures using the electric particulate suspension (EPS) method

Major Professor: Gerald M. Colver

*Ying Xu\**

Dissertation: Modeling and direct numerical simulation of particle-laden turbulent flows

Major Professor: Shankar Subramaniam

\*Research Excellence Award

\*\*Teaching Excellence Award



# Research Portfolio

Through our research programs, we bring the principles of mechanical engineering to bear on important technologies that improve our society, and we benefit from a research climate that is forward looking and interdisciplinary. We collaborate with two dozen other departments, with every college on campus, with 17 research institutes and centers, and with 150 organizations outside of Iowa State. By any measure—patents, textbooks, awards, start-up companies, publications—the excellence of the department’s faculty and students is widely recognized throughout the mechanical engineering community.

## Biological and Nanoscale Sciences

*Pranav Shrotriya, Program Director*

The biological and nanoscale sciences program investigates problems at the interface of engineering, biology, and nanotechnology, enabling us to apply the fundamental principles of mechanical engineering to expand opportunities for new science and engineering breakthroughs. By merging the engineering fields of dynamics, materials, mechanics, fluid flow, and heat transfer with the scientific fields of chemistry, materials science, and biology, we pursue experimental and computational strategies to understand the physical principles specific to small scale and biological phenomena. This enabling research uses unique physics at the nanometer scale with a view toward revolutionizing areas such as biomedicine and biotechnology.



*Assistant Professor LeAnn Faidley works with smart materials.*



*Mark Mba Wright is a doctoral student in mechanical engineering with a chemical engineering minor.*

## Clean Energy Technologies

*Terry Meyer, Program Director*

The clean energy technologies program investigates alternative energy, energy efficiency, and advanced processes and materials that have reduced resource demand and environmental impact. The fast-growing needs of emerging economies cannot be met over the long term without advances in the energy sciences. Driven by the escalating price of fuel, geopolitical instability, and air and water pollution, we are developing a new technological paradigm to power the world’s economy. Our research on alternative energy encompasses

solar, wind, biomass, geothermal, and advanced nuclear energy systems, and our work on energy efficiency technologies encompasses building energy use, fuel cells and distributed power systems, advanced hybrid vehicles and transportation systems, and low carbon emission power systems. Our work is directed at innovations that reduce carbon emissions and water consumption, while providing low-cost, high-performance substitutes for depleting natural resources.

## Research

## Sponsors

Aesculp AG & Co.

Air Force Office of Scientific  
Research  
Ames Lab  
Army Research Office

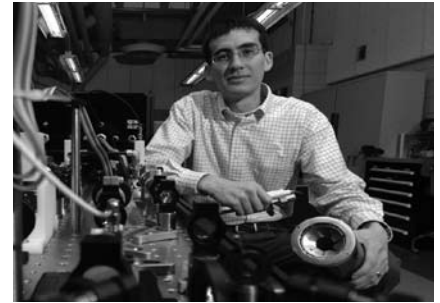
ConocoPhillips  
Department of Energy  
Department of Education  
Fisher Control

Ford Motor Company  
Fuel Tech NV  
Grow Iowa Values Fund  
Innovative Scientific

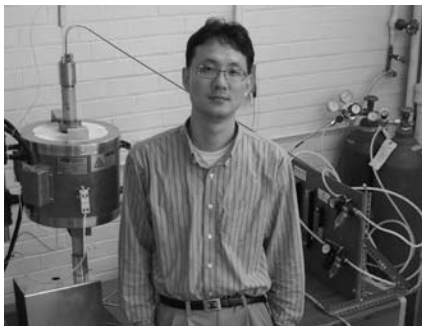
## Complex Fluid Systems

*Shankar Subramaniam, Program Director*

The complex fluid systems program investigates non-Newtonian, multiphase, turbulent, and/or chemically reacting flows over multiple length and time scales. We develop unique experimental and computational techniques that advance our understanding of fluid flow phenomena and enable engineering applications, including fuel and chemical production; biomass transport; particle dispersion; and heat exchangers in evaporators, boilers, and condensers. The efforts of this program pioneer new theories and models of complex fluid processes and validate these processes through novel experimental techniques and exploration tools.



*Assistant Professor Terry Meyer's work crosses several disciplines including clean energy technology and complex fluid systems.*



*Assistant Professor Gap-Yong Kim researches fabrication processes.*

## Design and Manufacturing Innovation

*Abhijit Chandra, Program Director*

The design and manufacturing innovation program centers on transforming resources into useful and desirable products, cutting across all phases of the design and manufacturing cycle. In each phase, the transformation process is characterized in terms of innovation, quality, and efficiency, as well as meeting the needs of consumers and aligning the design and manufacturing process with economic and regulatory structures. Novel experimental, computational, and analytical techniques are developed to advance

our understanding of these transformation processes, as well as to study practical applications, including chemical mechanical planarization, laser processing, tribology at the micro/nanoscale, surface engineering, and characterization for biomedical applications. The interplay among engineering, the marketplace, and the regulatory environment influences design and manufacturing decisions. Our efforts contribute to better theories, models, and technologies that improve the realization of products.

## Simulation and Visualization

*Eliot Winer, Program Director*

The simulation and visualization program investigates advanced computational and experimental techniques to understand and predict physical phenomena, as well as unique image rendering methods to enhance the interpretation of complex systems and data sets. This program develops and advances simulation and visualization capabilities and applies them in a societal context. One goal is to enable scenarios for products or processes to be altered and tested in a virtual environment before any physical models are created. Such capability will significantly reduce the time and cost associated with product development, while improving the accuracy, efficiency, and robustness of a product or manufacturing process.



*Catherine Peloquin is a graduate student working on a medical imaging project in the Virtual Reality Applications Center.*

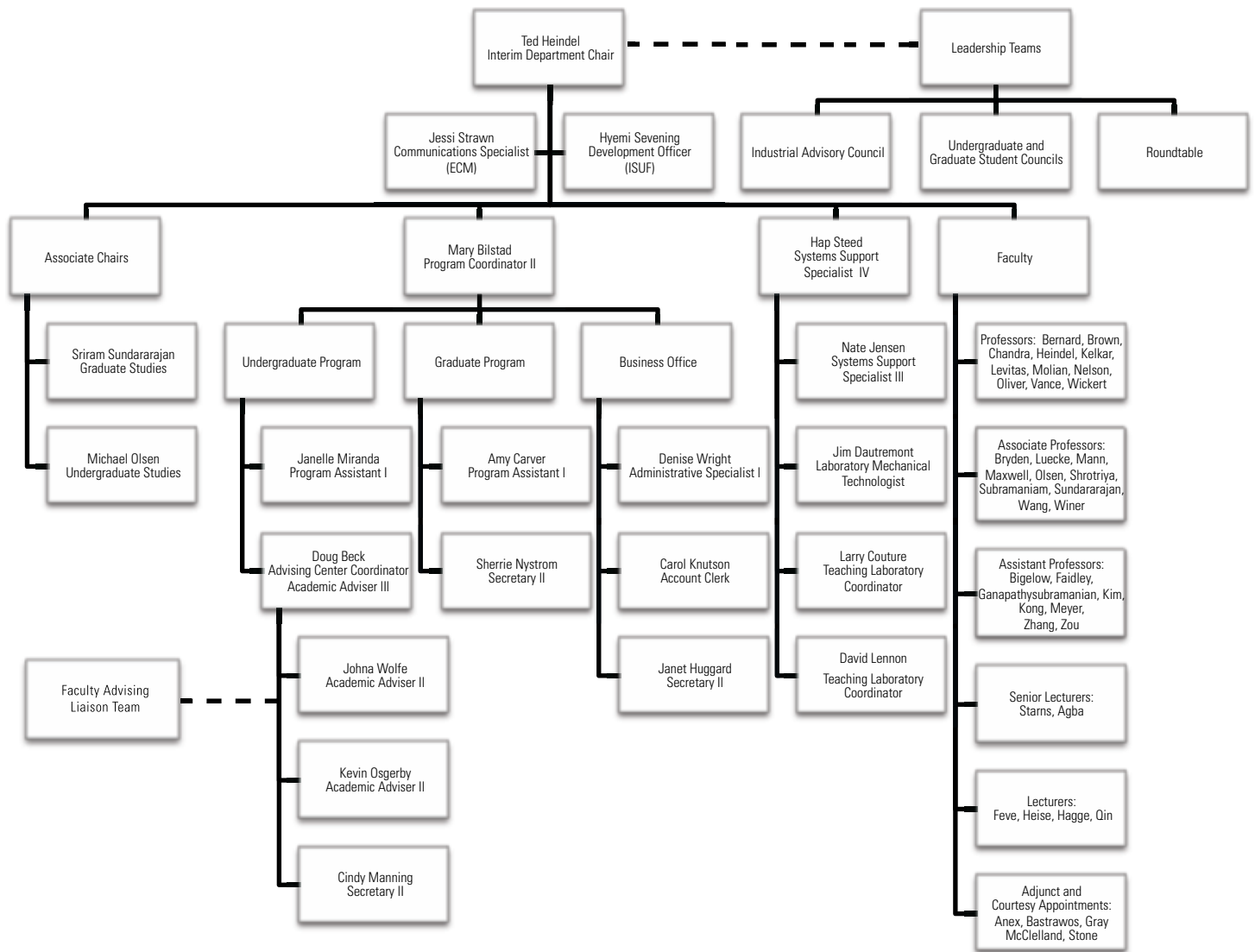
Solutions, Inc.  
Iowa Department of Natural  
Resources  
Iowa Energy Center

Iowa Power Fund  
John Deere & Co.  
NASA  
National Institute of Justice

National Science Foundation  
Office of Naval Research  
Pioneer  
Reaction Engineering

Renewable Energy Group  
Siemens Westinghouse  
US Army  
Veeco

# Department Organization



## Industrial Advisory Council

Brett L. Anderson  
Boeing

Larry Bodensteiner  
IBM

Scott Bowman  
KJWW

Craig Connell  
Black & Veatch  
Corporation

Mike Hilby  
John Deere

Mike Jensen  
Caterpillar, Inc.

Brad Knous  
LyondellBasell

Cynthia J. Lord  
Alliant Energy

John Mammoser  
Rolf Jensen &  
Associates, Inc.

Jason Olberding  
Emerson Process  
Management

Bob Taylor  
Kiewit Power, Inc.

Sheryl Wreghitt  
SLW Quality  
Consulting, LLC

# Staff

## *Business Office*



**Mary Bilstad**  
Program Coordinator



**Amy Carver**  
Program Assistant for  
Graduate Education



**Janet Huggard**  
Department Secretary



**Carol Knutson**  
Account Clerk



**Sherrie Nystrom**  
Educational Programs  
Secretary



**Janelle Miranda**  
Program Assistant for  
Undergraduate Education



**Jessi Strawn**  
Communications  
Specialist



**Denise Wright**  
Administrative Specialist  
Assistant to the Chair

## *Kiewit Undergraduate Student Services Center*



**Doug Beck**  
Academic Adviser  
Center Coordinator



**Cindy Manning**  
Secretary



**Kevin Osgerby**  
Academic Adviser



**Johna Wolfe**  
Academic Adviser

## *Laboratory and Information Technology*



**Larry Couture**  
Teaching Laboratory  
Coordinator



**Jim Dautremont**  
Laboratory Mechanical  
Technologist



**Nate Jensen**  
System Support  
Specialist



**Hap Steed**  
Manager, Technical  
Services



## Professors

**James Bernard**  
**Anson Marston Distinguished**  
**Professor**



BS, Engineering Mechanics,  
University of Michigan, 1965  
MS, Engineering Mechanics,  
University of Michigan, 1967  
PhD, Engineering Mechanics, University of  
Michigan, 1971

Professor Bernard works with real-time applications of computer modeling and simulation, particularly vehicle dynamics applications, and interactions between technology and globalization.

**Timothy Bigelow,**  
**Assistant Professor,**  
**Mechanical Engineering and**  
**Electrical and Computer**  
**Engineering**



BS, Electrical Engineering,  
Colorado State University, 1998  
MS, Electrical Engineering, University of  
Illinois at Urbana-Champaign, 2001  
PhD, Electrical Engineering, University of  
Illinois at Urbana-Champaign, 2004

Professor Bigelow researches systems to use ultrasound to treat cancer, quantifying physical properties of tissue using backscattered ultrasound signals, applying ultrasound to treat infections, and exploring ultrasound-induced bioeffects for ultrasound safety and therapy applications.

**Robert Brown**  
**Anson Marston**  
**Distinguished Professor**  
**Gary and Donna Hoover Chair**  
**in Mechanical Engineering**  
**Director, Bioeconomy**  
**Institute**  
**Director, Center for Sustainable**  
**Environmental Technologies**



BS, Physics, University of Missouri, 1976  
BA, Mathematics, University of Missouri,  
1976  
MS, Mechanical Engineering, Michigan State  
University, 1977  
PhD, Mechanical Engineering, Michigan  
State University, 1980

Professor Brown studies the conversion of biorenewable resources into bioenergy and biobased products, combustion, gasification, fast pyrolysis, hydrogen energy, hydrodynamics, and heat transfer in fluidized beds.

**Mark Bryden**  
**Associate Professor**



BS, General Engineering, Idaho  
State University, 1977  
MS, Mechanical Engineering,  
University of Wisconsin,  
Madison, 1993  
PhD, Mechanical Engineering, University of  
Wisconsin, Madison, 1998

Professor Bryden researches the virtual engineering of fluids and heat transfer systems within collaborative, immersive, and synthetic environments.

## Faculty Highlights

**Robert Brown** twice served as panelist for the Iowa State Engineering Policy and Leadership Institute Thematic Year in Energy. He also assisted in securing the Cargill Endowed Chair in Energy Economics, a \$1.5m endowment established in the Department of Economics. Brown was named as the first Gary and Donna Hoover Chair in Mechanical Engineering.



## Faculty Highlights

**Mark Bryden** started an Iowa State student chapter of Engineers Without Borders. The chapter has approximately 100 active members and is working to become chartered.

In July 2008, **Abhijit Chandra** and collaborators launched a Web site based on their research of multi-scale modeling of the chemical mechanical planarization process: [www.cmpsim.com](http://www.cmpsim.com).

### **Abhijit Chandra** Professor

BTech, IIT, Kharagpur, India, 1978  
MS, University of New Brunswick, Canada, 1980  
PhD, Cornell University, 1983



Professor Chandra's research interests include mechanics of manufacturing processes, nanoscale surface modification, multiscale and multiphysics modeling, renewable energy, and the boundary element method.

### **LeAnn Faidley** Assistant Professor

BS, Physics, Iowa State University, 1999  
BS, Engineering Science, Iowa State University, 1999  
MS, Engineering Mechanics, Iowa State University, 2001  
MS, Mechanical Engineering, The Ohio State University, 2005  
PhD, Mechanical Engineering, The Ohio State University, 2006



Professor Faidley studies active/smart materials, structures and systems, the characterization, modeling, application, and control of magnetically activated materials, magnetorheological elastomers, and smart materials for medical devices.

### **Baskar Ganapathysubramanian** William March Scholar in Mechanical Engineering Assistant Professor

Indian Institute of Technology, Madras, B. Tech., Mechanical Engineering, 2003  
Cornell University, MS, Mechanical and Aerospace Engineering, 2006  
Cornell University, PhD, Mechanical and Aerospace Engineering, 2008



Professor Ganapathysubramanian researches computational physics, computational mechanics (fluid mechanics and heat transfer), stochastic analysis, uncertainty quantification and propagation, multiscale modeling, control and optimization of complex systems, materials-by-design, and parallel computing and inverse problems.

### **Ted Heindel** Interim Chair Art and Priscilla Bergles Professor of Thermal Science

BS, Mechanical Engineering, University of Wisconsin, Madison, 1988  
MS, Mechanical Engineering, Purdue University, 1990  
PhD, Mechanical Engineering, Purdue University, 1994



Professor Heindel works with x-ray flow visualization, fluid mechanics, multiphase flow hydrodynamics, and gas-liquid mass transfer.

**Atul Kelkar**  
**Professor**

BS Mechanical Engineering,  
University of Poona, Pune,  
India, 1984

MS, Mechanical Engineering,  
Old Dominion University, Norfolk, VA, 1990  
PhD, Mechanical Engineering, Old Dominion  
University, Norfolk, VA, 1993



Professor Kelkar researches control theory, robust and nonlinear control, acoustic noise control, vibration control, flexible multibody dynamics, integrated design via multiobjective optimization, robotics, and neural networks.

**Gap-Yong Kim**  
**Assistant Professor**

BS, Mechanical Engineering,  
Yonsei University, 1997

MS, Mechanical Engineering,  
University of Michigan, 2003  
PhD, Mechanical Engineering, University of  
Michigan, 2005



Professor Kim works with manufacturing science at the microscale, microscale deformation processes, semisolid forming, modeling and fabricating microreactors, and energy conversion devices.

**Song-Charng Kong**  
**Assistant Professor**

BS, Power Mechanical  
Engineering, National Tsing-  
Hua University, Taiwan, 1987  
MS, Mechanical Engineering,  
University of Wisconsin, Madison, 1992  
PhD, Mechanical Engineering, University of  
Wisconsin, Madison, 1994



Professor Kong researches experimental engine combustion and emissions studies,

biorenewable energy utilization in internal combustion engines, numerical combustion study and model development using detailed chemical kinetics with computational fluid dynamics, and optimization of engine performance via experiments and numerical models.

**Valery I. Levitas**  
**Schafer 2050 Challenge**  
**Professor**  
**Department of Mechanical**  
**Engineering and of Aerospace**  
**Engineering**  
**Courtesy appointment with**  
**Department of Materials Science and**  
**Engineering**



Kiev Polytechnic Institute, Kiev, USSR, MS (Honors) in Mechanical Engineering, 1978  
Institute for Superhard Materials, Kiev, USSR, Candidate of Sciences in Materials Science, 1981  
Institute of Electronic Machinebuilding, Moscow, USSR, Dr. of Sciences in Continuum Mechanics, 1988  
University of Hannover, Germany, Doctor-Engineer habil. in Continuum Mechanics, 1995

Professor Levitas studies stress- and strain-induced phase transformations, high pressure mechanics and mechanochemistry, structural changes in materials via virtual melting, multiscale modeling, strain-induced chemical reactions, large inelastic deformation of solids, continuum thermodynamics and kinetics, instabilities in materials and structures, micromechanics and nanomechanics, energetic and nanoenergetic materials, superhard materials, and smart materials.

**Faculty Highlights**

**LeAnn Faidley** received her first grant from the National Science Foundation and also became a full member of Sigma Xi.

## Faculty Highlights

**Baskar Ganapathysubramanian** joined the ME department as the inaugural William March Scholar in Mechanical Engineering.

### **Greg Luecke** Associate Professor

BS, Mechanical Engineering,  
University of Missouri,  
Columbia, 1979  
MS, Engineering and Applied  
Science, Yale University, 1987  
PhD, Mechanical Engineering, Pennsylvania  
State University, 1992



Professor Luecke's research interests include robotics and control, multibody dynamics and simulation, and artificial neural networks for control.

### **Adin Mann** Associate Professor

BS, Engineering Science, Iowa  
State University, 1984  
PhD, Acoustics, Pennsylvania  
State University, 1998



Professor Mann works with acoustics, noise control, and design optimization.

### **Greg Maxwell** Associate Professor Director, Industrial Assessment Center

BS, Physics, Purdue University,  
1973  
MS, Nuclear Engineering, Purdue University, 1977  
PhD, Mechanical Engineering, Purdue  
University, 1984



Professor Maxwell's research interests include energy usage in buildings and HVAC systems, industrial energy efficiency, and nuclear energy.

### **Terry Meyer** Assistant Professor

BS, Mechanical Engineering,  
University of Minnesota, 1993  
MS, Mechanical Engineering,  
University of Illinois at Urbana-  
Champaign, 1997  
PhD, Mechanical Engineering, University of  
Illinois at Urbana-Champaign, 2001



Professor Meyer's areas of interests are laser imaging and spectroscopy for reacting fluid flow and sprays, biorenewable fuels, combustion, power and propulsion, gas-turbines, scramjets, hypersonic vehicles, and internal combustion engines.

### **Pal Molian** Professor

BE, Indian Institute of  
Science, 1975  
ME, Indian Institute of  
Science, 1977  
PhD, Oregon Graduate Institute of Science  
and Technology, 1982



Professor Molian works with materials and manufacturing with a focus on laser processing, nanotechnology, microelectromechanical systems, and solid freeform fabrication.

## Faculty Highlights

**Atul Kelkar** was the third place winner in the John Pappajohn Iowa Business Plan Competition.

**Gap-Yong Kim** received a grant from the National Science Foundation and had two articles published in the *ASME Journal of Manufacturing Science and Engineering*.

**Ron Nelson**  
Professor

BS, Mechanical Engineering,  
Iowa State University, 1970  
MS, Mechanical Engineering,  
Iowa State University, 1972  
PhD, Mechanical Engineering,  
Stanford University, 1981

Professor Nelson's interests include energy conversion and utilization, environmental control, thermal system optimization, and applied artificial intelligence.



**Mike Olsen**  
Associate Professor  
Associate Chair for  
Undergraduate Studies

BS, Mechanical Engineering,  
University of Illinois at Urbana-  
Champaign, 1992  
MS, Mechanical Engineering, University of  
Illinois at Urbana-Champaign, 1995  
PhD, Mechanical Engineering, University of  
Illinois at Urbana-Champaign, 1999

Professor Olsen is active in experimental fluid mechanics and microelectromechanical systems.



**Jim Oliver**  
Larry and Pam Pithan  
Professor of Mechanical  
Engineering  
Director, CyberInnovation  
Institute  
Director, Virtual Reality  
Application Center

BS, Mechanical Engineering, Union College, 1979  
MS, Mechanical Engineering, Michigan State  
University, 1981  
PhD, Mechanical Engineering, Michigan  
State University, 1986

Professor Oliver's areas of interest include design and manufacturing process automation using geometric modeling, computer graphics, visualization, simulation, optimization, virtual reality, and human-computer interaction.



**Pranav Shrotriya**  
Associate Professor

BT, Mechanical Engineering,  
Indian Institute of Technology,  
1995  
MS, Theoretical and Applied  
Mathematics, University of  
Illinois at Urbana-Champaign, 1997  
PhD, Theoretical and Applied Mathematics,  
University of Illinois at Urbana-Champaign, 2001

Professor Shrotriya researches the mechanical response of micro- and nanoscale structures, experimental and computational mechanics at small-length scales, mechanics of surface stress sensors and molecular adsorption, stress-assisted dissolution and damage of biomedical implants, and mechanics of manufacturing processes.



## Faculty Highlights

**Song-Charng Kong** initiated a major research project on biomass gasification for power generation. The project has been approved by the Iowa Power Fund board and the contract signing is in process.

**Valery Levitas** developed the first theory for sublimation inside elastoplastic materials and formulated and solved several new conceptual problems. His findings were published in *Physical Review Letters*.

**Adin Mann** became the faculty director of the Iowa Alliance for Graduate Education and Professoriate (AGEP), a group that coordinates programs with Iowa State, the University of Iowa, and the University of Northern Iowa.

## Faculty Highlights

**Terry Meyer** was elected as general co-chair for the Optical Society of America.

**Ron Nelson** held positions for two ASHRAE technical committees. He is a member and was research chair for thermodynamics and psychrometrics, and he is a member and was webmaster for computer applications.

**Michael Olsen** was the principle investigator on a Grow Iowa Values Fund grant in collaboration with J-Tec Corporation.

**Pranav Shrotriya** was promoted to associate professor.

**Shankar Subramaniam** served as the Women in Mechanical Engineering faculty adviser and was awarded a grant from the Department of Energy.

### **Shankar Subramaniam** **Associate Professor**

BT, Aeronautical Engineering,  
Indian Institute of Technology, 1988  
MS, Aerospace Engineering,  
University of Notre Dame, 1990  
PhD, Mechanical and Aerospace Engineering,  
Cornell University, 1997



Professor Subramaniam's research interests include spray modeling, modeling and simulation of gas-particle flows and granular flows, combustion, turbulent reactive flows, mixing, stochastic models, particle methods, and computational fluid dynamics.

### **Sriram Sundararajan** **Associate Professor** **Associate Chair for Graduate** **Studies and Research** **Director of Graduate Education**

BE, Mechanical Engineering,  
Birla Institute of Technology and Science, 1995  
MS, Mechanical Engineering, The Ohio State  
University, 1997  
PhD, Mechanical Engineering, The Ohio State  
University, 2001



Professor Sundararajan's research areas of interest are surface engineering, micro- and

nanoscale tribology, multiscale mechanical behavior of materials, scanning probe microscopy, and thin film characterization using three dimensional atom probe microscopy.

### **Judy Vance** **Professor**

BS, Mechanical Engineering,  
Iowa State University, 1980  
MS, Mechanical Engineering,  
Iowa State University, 1987  
PhD, Mechanical Engineering, Iowa State  
University, 1992



Professor Vance works with virtual reality applications in mechanical engineering including virtual assembly, virtual manufacturing and mechanism synthesis, optimization, and the fundamentals of engineering design including ideation and concept generation.



**Xinwei Wang**  
**Associate Professor**

BS, Thermal Science and Energy Engineering, University of Science and Technology of China, 1994

MS, Thermal Science and Energy Engineering, University of Science and Technology of China, 1996  
PhD, Mechanical Engineering, Purdue University, 2001



Professor Wang's areas of interests are laser-assisted bio-imaging, thermal transport in nanoscale and nanostructured materials, novel technique developments for thermal conductivity measurement of films, coatings and micro- and nanoscale wires/rubes, and laser-assisted nanostructuring.

**Jonathan Wickert**  
**Dean, College of Engineering**  
**James and Katherine Melsa**  
**Professor in Engineering**  
**Professor, Department of**  
**Mechanical Engineering**



BS, Mechanical Engineering, University of California at Berkeley, 1985  
MS, Mechanical Engineering, University of California at Berkeley, 1987  
PhD, Mechanical Engineering, University of California at Berkeley, 1989

Professor Wickert's research interests include mechanical vibration and noise control, continuous and multibody systems dynamics, applied mechanics, applications in computer data storage, flexible web material manufacturing, and friction-vibration interaction.

**Eliot Winer**  
**Associate Professor**

BS, Aeronautical and Astronautical Engineering, The Ohio State University, 1992  
MS, Mechanical Engineering, State University of New York at Buffalo, 1994  
PhD, Mechanical Engineering, State University of New York at Buffalo, 1999



Professor Winer is active in Internet technology for large-scale collaborative design; medical imaging, analysis and visualization, multidisciplinary design synthesis, computer aided design and graphics, application in optimal design, and scientific visualization and virtual reality for large-scale design.

## Faculty Highlights

**Judy Vance** finished her term as chair of the ASME Design Engineering Division and is now serving a one-year term as past chair.

**Xinwei Wang** developed a new micro wind turbine technology, WAND, that significantly improves the efficiency of small/micro wind turbines and reduces initial capital costs.

**Eliot Winer** was promoted to associate professor.

**Qingze Zou** was awarded two grants from the National Science Foundation, one of which was a CAREER award.

**Song Zhang**  
**Assistant Professor**

B.S., Precision Machinery & Precision Instrumentations, University of Science & Technology of China, China, 2000  
M.S., Mech. Eng., Stony Brook University, 2003  
Ph.D., Mech. Eng., Stony Brook University, 2005



Professor Zhang researches three-dimensional optical metrology, machine and computer vision, virtual reality, human-computer interaction, nondestructive evaluation, and biometrics.

**Qingze Zou**  
**Assistant Professor**

BS, Automatic Control, University of Electronic Science and Technology of China, 1994  
MS, Mechanical Engineering, Tsinghua University, 1997  
PhD, Mechanical Engineering, University of Washington, 2003



Professor Zou's research areas of interests include precision positioning, inversion-based control theory, scanning probe microscopy, and nanofabrication.

**Faculty Awards**

Mark Bryden received the Best Paper Award at the 18th annual Artificial Neural Networks in Engineering Conference (ANNIE 2008)

Judy Vance received the National Science Foundation Director's Award for Collaborative Integration for her contribution to the review of the cyber enabled discovery and innovation (CDI) proposals.

Eliot Winer was named the Human Computer Interaction faculty member of the year.

**Senior Lecturers**



Emmanuel Agba



Gloria Starns

**Lecturers**



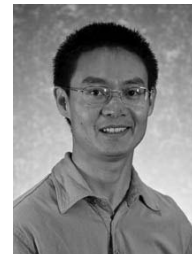
Sebastien Feve



Matt Hagge



Jim Heise



Zhaohui (George) Qin

**Adjunct and courtesy appointments**

Robert Anex, Adjunct Associate Professor (Agricultural and Biosystems Engineering)

Ashraf Bastawros, Adjunct Associate Professor (Aerospace Engineering)

Joseph N. Gray, Adjunct Associate Professor (Physicist, Center for Nondestructive Evaluation)

John McClelland, Adjunct Associate Professor (Senior Physicist, Ames Laboratory)

Richard Stone, Courtesy Assistant Professor (Industrial and Manufacturing Systems Engineering)

# Journal Publications

**Bigelow, T.A.** "Ultrasound attenuation estimation using backscattered echoes from multiple sources," *The Journal of the Acoustical Society of America*, 124(2): 1367-1373, 2008.

Hurd, H.S., C. Enøe, L. Sørensen, H. Wachmann, S.M. Corns, **K.M. Bryden**, and M. Greiner. "Risk-based analysis of the Danish pork Salmonella program: past and future," *Risk Analysis*, 28(2): 341-351, 2008.

**Chandra, A.**, P. Karra, A.F. Bastawros, R. Biswas, P.J. Sherman, S. Armini, and D.A. Lucca. "Prediction of scratch generation in chemical mechanical planarization," *CIRP Annals*, 58(1): 559-562, 2008.

Biswas, R., Y.Y. Han, P. Karra, P.J. Sherman, and **A. Chandra**. "Diffusion limited agglomeration and defect generation during chemical mechanical planarization," *Journal of the Electrochemical Society*, 155(8): D534-D537, 2008.

**Ganapathysubramanian, B.**, and N. Zabararas. "Modeling multiscale diffusion processes in random heterogeneous media," *Computer Methods in Applied Mechanics and Engineering*, 197(43-44): 3560-3573, 2008.

**Ganapathysubramanian, B.**, and N. Zabararas. "A seamless approach towards stochastic modeling: Sparse grid collocation and data driven input models," *Finite Elements in Analysis and Design*, 44(5): 298-320, 2008.

Zabararas, N., and **B. Ganapathysubramanian**. "A scalable framework for the solution of stochastic inverse problems using a sparse grid collocation approach," *Journal of Computational Physics*, 227(9): 4697-4735, 2008.

**Heindel, T.J.**, J.N. Gray, and T.C. Jensen. "An X-ray system for visualizing fluid flows," *Flow Measurement and Instrumentation*, 19(1): 67-78, 2008.

Ford, J.J., **T.J. Heindel**, T.C. Jensen, and J.B. Drake. "X-ray computed tomography of a gas-sparged stirred-tank reactor," *Chemical Engineering Science*, 63(8): 2075-2085, 2008.

Law, D., F. Battaglia, and **T.J. Heindel**. "Model validation for low and high superficial gas velocity bubble column flows," *Chemical Engineering Science*, 63(18): 4605-4616, 2008.

Zhu, H., B.H. Shanks, and **T.J. Heindel**. "Enhancing CO-water mass transfer by functionalized MCM41 nanoparticles," *Industrial and Engineering Chemistry Research*, 47(20): 7881-7887, 2008.

Porumamilla, H., **A. G. Kelkar**, and J. M. Vogel. "Modeling and verification of an innovative active pneumatic vibration isolation system," *ASME Journal of Dynamic Systems, Measurement, and Control*, 130(3): 031001{12 pages}, 2008.

Chen, P., **G.Y. Kim**, and J. Ni. "Fabrication of high aspect ratio porous microfeatures using hot compaction technique," *ASME Journal of Manufacturing Science and Engineering*, 130(3), 031103{8 pages}, 2008.

- Kim, G.Y.**, M. Koc, and J. Ni. "Experimental and numerical investigations on microcoining of stainless steel 304," *ASME Journal of Manufacturing Science and Engineering*, 130(4): 041017{6 pages}, 2008.
- Genzale, C.L., **S.-C. Kong**, and R.D. Reitz. "Modeling the effects of variable intake valve timing on diesel HCCI combustion at varying load, speed and boost pressures," *ASME Journal of Engineering for Gas Turbines and Power*, 130(5): 1-8, 2008.
- Li, Y.H., and **S.-C. Kong**. "Diesel combustion modelling using LES turbulence model with detailed chemistry," *Combustion Theory and Modelling*, 12(2): 205-219, 2008.
- Karra, P.K., M.K. Veltman, and **S.-C. Kong**. "Characteristics of engine emissions using biodiesel blends in low temperature combustion regimes," *Energy & Fuels*, 22(6): 3763-3770, 2008.
- Reiter, A.J., and **S.-C. Kong**. "Demonstration of compression-ignition engine combustion using ammonia in reducing greenhouse gas emissions," *Energy & Fuels*, 22(5): 2963-2971, 2008.
- Idesman, A.V., J.-Y. Cho, and **V.I. Levitas**. "Finite element modeling of dynamics of martensitic phase transitions," *Applied Physics Letters*, 93(4): 043102{3 pages}, 2008.
- Levitas, V.I.**, M.L. Pantoya, and B. Dikici. "Melt-dispersion versus diffusive oxidation mechanism for aluminum nanoparticles: Critical experiments and controlling parameters," *Applied Physics Letters*, 92(1): 011921, 2008.
- Levitas, V.I.**, M.L. Pantoya, and K.W. Watson. "Melt dispersion mechanism for fast reaction of aluminum particles: Extension for micron scale particles and fluorination," *Applied Physics Letters*, 92(20): 201917{3 pages}, 2008.
- Levitas, V.I.**, and N. Altukhova. "Sublimation inside an elastoplastic material," *Physical Review Letters*, 101(14): 145703{4 pages}, 2008.
- Watson, K.W., M.L. Pantoya, and **V.I. Levitas**. "Fast reactions with nano and micron aluminum: A study on oxidation versus fluorination," *Combustion and Flame*, 155(4): 619-634, 2008.
- Mann, J.A. III**. "Rapporteur's report: Education issues in prevention through design," *Journal of Safety Research*, 39: 165-170, 2008.
- Gord, J.R., **T.R. Meyer**, and S. Roy. "Applications of ultrafast lasers for optical measurements in combusting flows," *Annual Review of Analytical Chemistry*, 1: 663-687, 2008.
- Jiang, N., W.R. Lempert, G.L. Switzer, **T.R. Meyer**, and J.R. Gord. "Narrow-linewidth megahertz-repetition-rate optical parametric oscillator for high-speed flow and combustion diagnostics," *Applied Optics*, 47(1): 64-71, 2008.
- Jiang, N., W.R. Lempert, M.N. Slipchenko, J.D. Miller, **T.R. Meyer**, and J.R. Gord. "Tunable ultraviolet burst-mode laser system produces high-energy pulses," *Laser Focus World*, 44(8): 79-83, 2008.



Kalyanasundaram, D., and **P. Molian**. "Electrodeposition of nanodiamond particles on aluminium alloy A319 for improved tribological properties," *Micro & Nano Letters*, 3(4): 110–116, 2008.

Ali, M., T. Wagner, M. Shakoob, and **P. Molian**. "Review of laser nanomachining," *Journal of Laser Applications*, 20(3): 169-184, 2008.

Chen, W., and **P. Molian**. "Dual-beam laser welding of ultra-thin AA 5052-H19 aluminum," *The International Journal of Advanced Manufacturing Technology*, 39(9-10): 889-897, 2008.

Dong, Y., R. Nair, R. Molian, and **P. Molian**. "Femtosecond-pulsed laser micromachining of a 4H-SiC wafer for MEMS pressure sensor diaphragms and via holes," *Journal of Micromechanics and Microengineering*, 18: 035022{9 pages}, 2008.

**Molian, P.**, Z. Lin, and **Q. Zou**. "Nano-holes in silicon wafers using laser-induced surface plasmon polaritons," *Journal of Nanoscience and Nanotechnology*, 8(4): 2163-2166, 2008.

Nair, R., R. Molian, and **P. Molian**. "Effect of nanoscale thin films of  $Dy_2Fe_{14}B$  on the magnetic hysteresis characteristics of melt-spun ribbons of  $Nd_2Fe_{14}B$ ," *Journal of Magnetism and Magnetic Materials*, 320(6): 957-965, 2008.

Nair, R., W. Jiang, and **P. Molian**. "Preparation and characterization of diamond-like carbon coating on aluminum 6061 using laser sintering of nanodiamond powders," *Surface & Coatings Technology*, 202: 2935–2944, 2008.

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P'ng, D., and **P. Molian**. "Q-switch Nd:YAG laser welding of AISI 304 stainless steel foils," *Materials Science and Engineering: A*, 486(1-2): 680-685, 2008.

Pecholt, B., M. Vendan, Y. Dong, and **P. Molian**. "Ultrafast laser micromachining of 3C-SiC thin films for MEMS device fabrication," *The International Journal of Advanced Manufacturing Technology*, 39(3-4): 239-250, 2008.

Feng, H., **M.G. Olsen**, R.O. Fox, and J.C. Hill. "Conditional statistics of passive-scalar mixing in a confined wake flow," *Physics of Fluids*, 20: 077105, 2008.

Kalyanasundaram, D., G. Shehata, C. Neumann, **P. Shrotriya**, and **P. Molian**. "Design and validation of a hybrid laser/water-jet machining system for brittle materials," *Journal of Laser Applications*, 20(2): 127-134, 2008.

Kalyanasundaram, D., J. Wille, **P. Shrotriya**, and **P. Molian**. "CO<sub>2</sub> laser/waterjet cutting of polycrystalline cubic boron nitride," *Transactions of North American Manufacturing Research Institution of SME*, 36: 517-524, 2008.

Kang, K., M. Nilsen-Hamilton, and **P. Shrotriya**. "Differential surface stress sensor for detection of chemical and biological species," *Applied Physics Letters*, 93(14): 143107{3 pages}, 2008.

- Kim, K.S., Z. Lin, **P. Shrotriya**, **S. Sundararajan**, and **Q. Zou**. "Iterative control approach to high-speed force-distance curve measurement using AFM: Time dependent response of PDMS example," *Ultramicroscopy*, 108(9): 911-920, 2008.
- Mitchell, A., and **P. Shrotriya**. "Mechanical load-assisted dissolution of metallic implant surfaces: Influence of contact loads and surface stress state," *Acta Biomaterialia*, 4(2): 296-304, 2008.
- Molian, R., **P. Shrotriya**, and **P. Molian**. "Improved method of CO<sub>2</sub> laser cutting of aluminum nitride," *ASME Journal of Electronic Packaging*, 130(2): 024501{3 pages}, 2008.
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## Patent Awarded

**A. Chandra**, S. Eamkajornsiri, and M.S. Kadavasal  
United States Patent No. 7,544,617  
June 9<sup>th</sup>, 2009  
Die Scale Control of Chemical Mechanical Polishing



# Responsibilities

The Department of Mechanical Engineering at Iowa State University is a community of faculty, staff, students, and alumni—and industrial and governmental partners—working together to improve the state of Iowa and society in the broadest terms through mechanical engineering research, education, and service.

# Vision

Through the excellence of its people, the Department of Mechanical Engineering will be recognized as a leader of its discipline in a manner that exemplifies the land-grant traditions of learning, discovery, and engagement. The department will be a desirable place to study and work, with its community comprising the best and brightest, and with research and educational programs grounded in the mechanical engineering sciences and set within the context of meeting important societal needs.

# Mission

The mission of the Department of Mechanical Engineering has three tenets centered on the principle of improving lives and livelihoods: to create knowledge through research in the science and technology of mechanical engineering; to share knowledge through educational programs and the dissemination of new discoveries; and to develop the professional potential of faculty, staff, and students.

# Priorities

We will pursue the following priorities to reinforce our recognized strengths and advance our vision for 2025.

- Extend our pillars of research excellence
- Strengthen our graduate program
- Enrich our undergraduate program
- Develop our people
- Build our community

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