

# ANNUAL REPORT

2007–2008

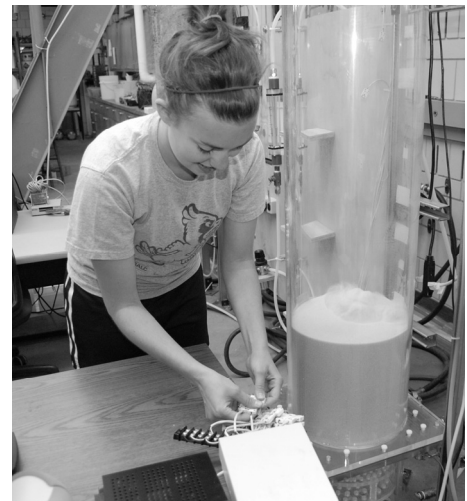
ACADEMIC YEAR

IOWA STATE UNIVERSITY

**Department of Mechanical Engineering**



KNOWLEDGE. INNOVATION. LEADERSHIP.



[WWW.ME.IASTATE.EDU](http://WWW.ME.IASTATE.EDU)

AUGUST 2008

# 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

*Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Diversity, 3680 Beardshear Hall, 515 294-7612.*



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# YEAR IN REVIEW

At Iowa State's Department of Mechanical Engineering, we strive to keep those invested in our department informed about our programs and activities. Each semester, we distribute the newsletter *Dimensions*, which contains articles about recent accomplishments of our faculty, staff, students, and alumni. Our programs can also be viewed in terms of indicators such as enrollment, degrees awarded, extramural research support, research publications, student credit hours taught, student scholarships, and number of faculty. This annual report is intended to capture that data concisely and disseminate it to the department's community with a view toward describing the state of the department, our challenges, and our progress. This document is our inaugural annual report, and we will issue one each summer at the conclusion of the academic year as a means to gauge our progress.



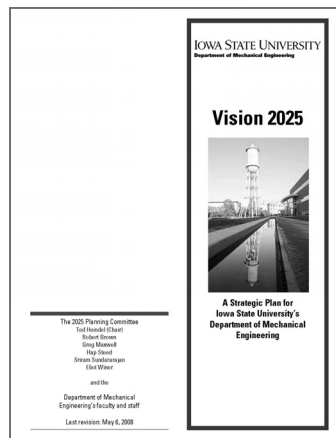
Mechanical engineering is the most popular major at Iowa State, as it has been for the past three years, and our impact continues to grow. The American Society for Engineering Education ranks the department among the top ten programs nationally in terms of bachelor's degrees awarded. In 2004, enrollment in the department reached an all-time high, but it has flattened since then and is now trending slightly downward. Our enrollment pattern mirrors the national trend in mechanical engineering education, where an ebb-and-flow exists between mechanical and electrical engineering enrollments. You may have read in the popular press that this year represented the peak for the "baby boomlet" generation entering universities. The state of Iowa's Department of Education forecasts a decline of some 10 percent in high school graduation rates over the next seven years.

At the departmental level, those demographic trends will be moderated by slight increases we are beginning to see in enrollment of out-of-state and international students. We began a new initiative directed at recruiting and retaining women in the mechanical engineering program, including social networking functions, professional development opportunities, mentorship, proactive recruiting, and new scholarships. We are collaborating with the National Academy of Engineering on this focused effort to attract top talent to our program. To further strengthen our undergraduate program, the department hired two full-time academic advisers, Johna Wolfe and Kevin Osgerby, and a program assistant for undergraduate study, Janelle Miranda. Senior adviser Doug Beck was promoted, and he now leads our advising program. Professor Greg Maxwell spearheaded creating a new minor degree in nuclear engineering, which will be offered in collaboration with other Big 12 universities. This exciting minor will have its center of gravity in the mechanical engineering department but will be available to any student in the college, and we are already seeing significant interest from students and the nuclear power industry.

With an eye to the future, this year the department completed a broad strategic planning initiative to define our roadmap to 2025. You may ask, why the year 2025? Children born today will enter our department at that time. Why will they choose to study mechanical engineering at Iowa State? As a community of scholars, how do we envision the department's research and educational programs evolving? How will our department adapt to emerging demographic, globalization, technological, and financial trends? Professor Ted Heindel was appointed associate chair for academic affairs last fall, and he and an appointed strategic planning committee engaged our faculty, staff, students, alumni, external advisory council, and other campus units in developing this shared vision. The recommendations of this important report lay the groundwork for us to continue delivering superior performance, making a distinctive impact, and being known for enduring contributions. In brief, the department's top priorities are to

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

You can download the plan at [www.me.iastate.edu/strategicplan.html](http://www.me.iastate.edu/strategicplan.html).



This year was also one of transition. We said goodbye to Professor Dick Pletcher, who retired after having served on the Iowa State faculty for 41 years, and to Professor Mike Pate, who retired after two decades of service. Professors Shankar Subramaniam and Sriram Sundararajan were promoted to the rank of associate professor with tenure. Professor Sundararajan was also appointed as the department's inaugural associate chair for graduate studies and research, and new initiatives are already underway for proactive recruiting and improving the admissions process for master's and doctoral students. Gloria Starns was promoted and now serves as the department's first senior lecturer. She brings a wealth of experience and a passion for world-class teaching to the classroom.

We have welcomed several new faces to our faculty and staff. Assistant Professor Gap Kim and Associate Professor Xinwei Wang joined the department, and they strengthen our signature research programs in both design and manufacturing innovation and biological and nanoscale sciences. In addition to the staff hired for the undergraduate program, six additional staff members joined our team: Mary Bilstad, program coordinator; Amy Carver, graduate program assistant; Janet Huggard, department secretary; Hyemi Sevening, director of development; Jessi Strawn, communications specialist; and Denise Wright, assistant to the chair. We had an active spring semester, which was directed at interviewing and recruiting faculty members

for next year through both a departmental search and the college's cluster hire search. We look forward to several new colleagues joining our ranks in the coming year.

As the department grows, our faculty continues to be recognized for its excellence. For instance, Professor Robert Brown received the Impact Award from the Iowa State University Alumni Association, Professor Song-Chang Kong received the Society of Automotive Engineering's Ralph R. Teetor Educational Award, and Professor Sriram Sundararajan received the College of Engineering's Young Engineering Faculty Research award and Iowa State's award for Early Achievement in Teaching. Our faculty members, and the students who study with them, are creative researchers with an eye for bringing the principles of mechanical engineering to bear on technologies that meet important societal needs—energy and our environment, national security, health care, and cyberinfrastructure. Just in the past year, we collaborated in research across 24 departments on campus, all seven university colleges, 17 research institutes and centers, and 150 organizations outside of Iowa State. Mechanical engineering faculty members lead major research enterprises including the Bioeconomy Institute, the CyberInnovation Institute, the Virtual Reality Applications Center, and the Industrial Assessment Center. The department boasts internationally acclaimed programs in biological and nanoscale sciences, clean energy technologies, complex fluid systems, design and manufacturing innovation, and simulation and visualization.

In the past, at Iowa State and other public institutions, it was sufficient to expect that state allocations would fully cover operations and new initiatives. State funding now accounts for some 27 percent of Iowa State University's total budget and 55 percent of the general fund operating budget. Indeed, looking at public universities nationally, such percentages



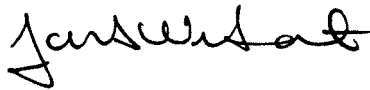
are today the norm. The department has become increasingly proactive in responding to this new financial climate. Our research expenditures last year exceeded \$11M—a remarkable level of activity and innovation on the part of our faculty. We are grateful for the generous support of our alumni, friends, and industrial partners who share our vision and enthusiasm for moving the department forward.

We are honored to report that private gifting from individuals and corporations reached an all-time high this year. Our alumni and their families kindly established three new named faculty positions in the department: the Gary and Donna Hoover Chair, the Larry and Pam Pithan Professorship, and the William March Scholar. Our industrial partners are working with us to establish the nuclear engineering minor, enhance our students' capstone design experiences, and improve our advising, orientation, and recruiting services. Through the generosity of our community, we were able to award

more than \$200,000 in scholarships and fellowships, which have become indispensable for attracting and retaining the best and brightest students. There is much work to be done in implementing our plans for the future. These investments by our many friends—and their embrace of our high goals—are wonderful commitments to the impact that we can make together, and their support of our students and faculty is sincerely appreciated.

We finished the year in a strong and favorable financial position with respect to both our state budget allocation and private gift development. Planning has begun at the departmental level to align our fiscal procedures with the university's transition to a new budgeting system, which will move revenues and costs to the local unit level, rather than be centrally vested. This budget model frames a new incentive structure for each department and college at the university, and with our strong enrollment and active research programs, we are well-positioned for adapting to these changes.

I think you will find our department continues the tradition of excellence you have come to expect and is well poised for many more advances and accomplishments to come. Should you wish to share your personal thoughts about the department's future, please do not hesitate to contact me by e-mail at [wickert@iastate.edu](mailto:wickert@iastate.edu) or phone at 515 294-7121.



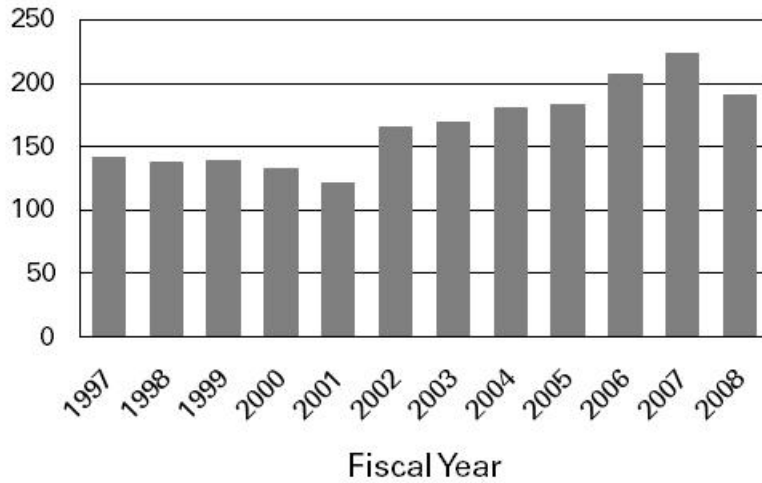
Jonathan Wickert  
Chair, Department of Mechanical Engineering  
Larry and Pam Pithan Professor of Mechanical Engineering



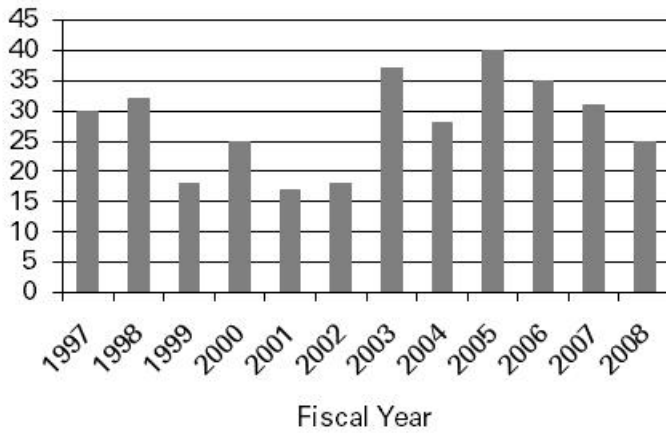
# PERFORMANCE INDICATORS

## DEGREES AWARDED

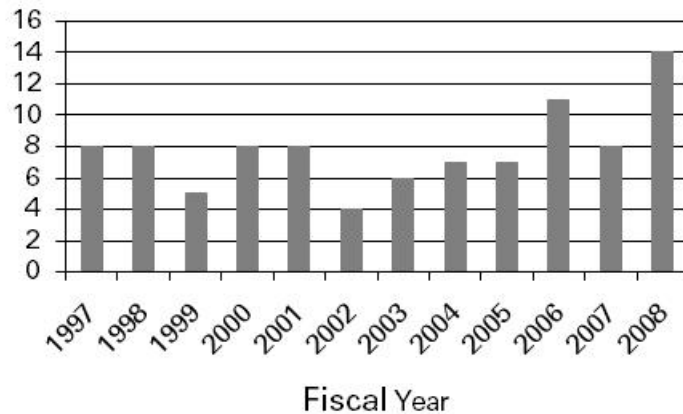
### Bachelor's Degrees Awarded



### Master's Degrees Awarded

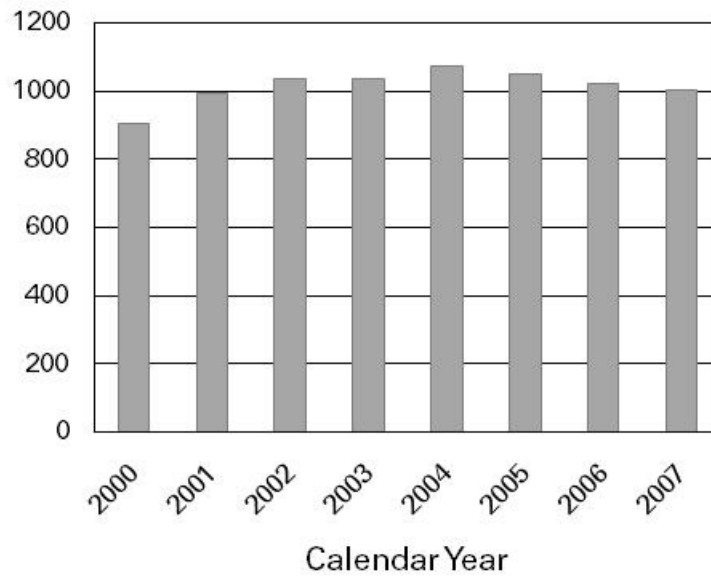


### Doctoral Degrees Awarded

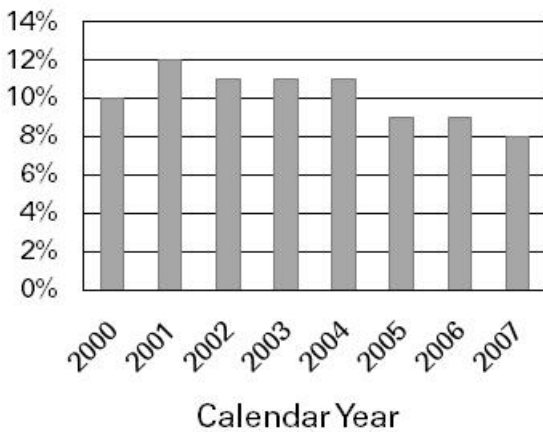


## UNDERGRADUATE ENROLLMENT

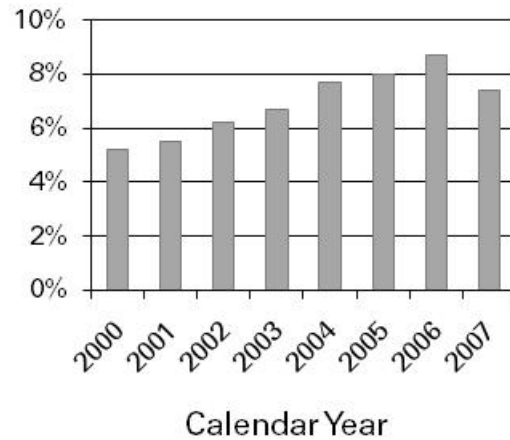
### Fall Undergraduate Enrollment



### Fall Undergraduate Female Enrollment

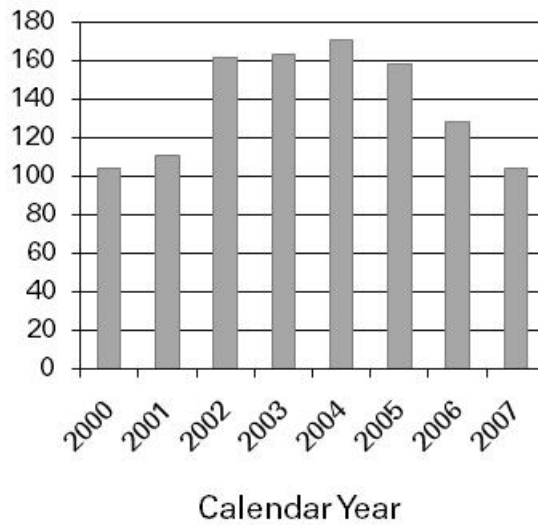


### Fall Undergraduate Minority Enrollment

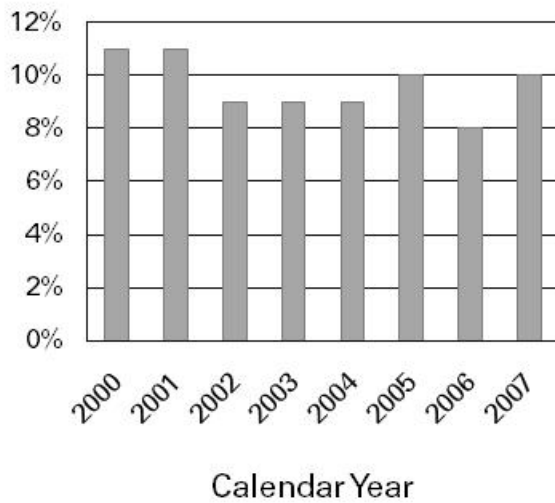


## GRADUATE ENROLLMENT

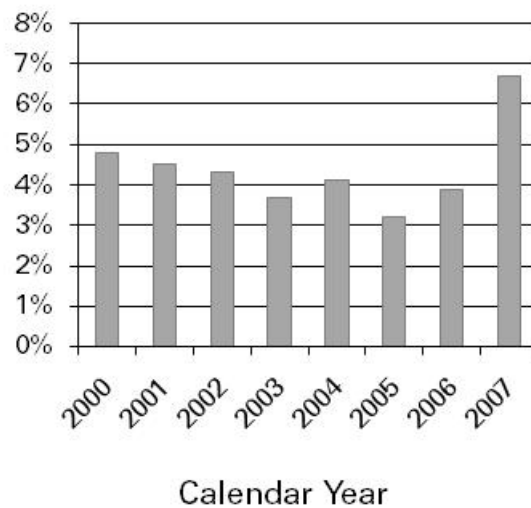
### Fall Graduate Enrollment



### Fall Graduate Female Enrollment

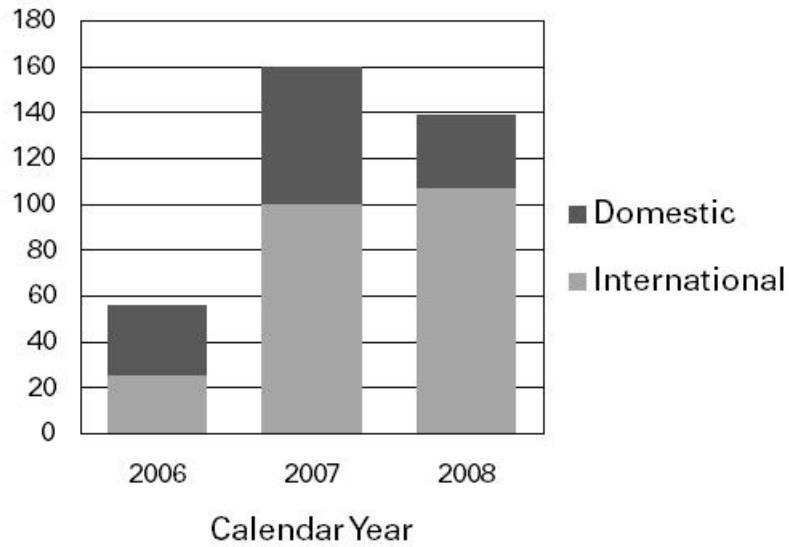


### Fall Graduate Minority Enrollment

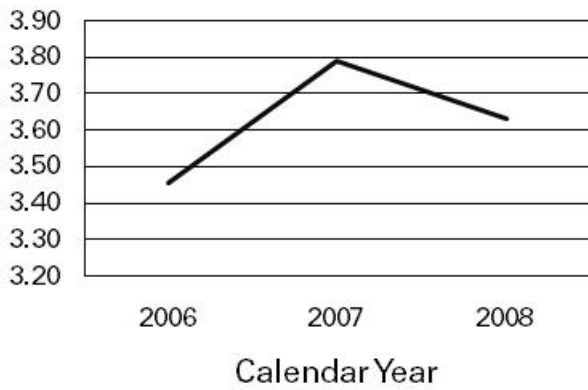


## GRADUATE PROGRAM RECRUITING

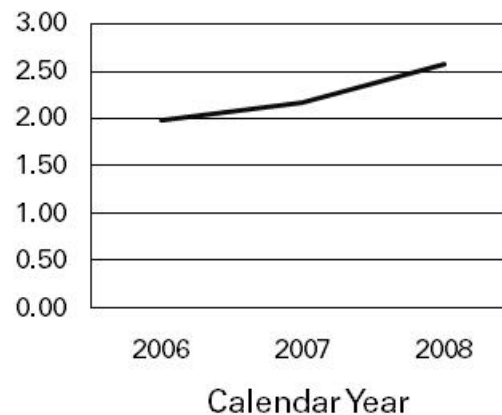
### Complete Graduate Applications



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

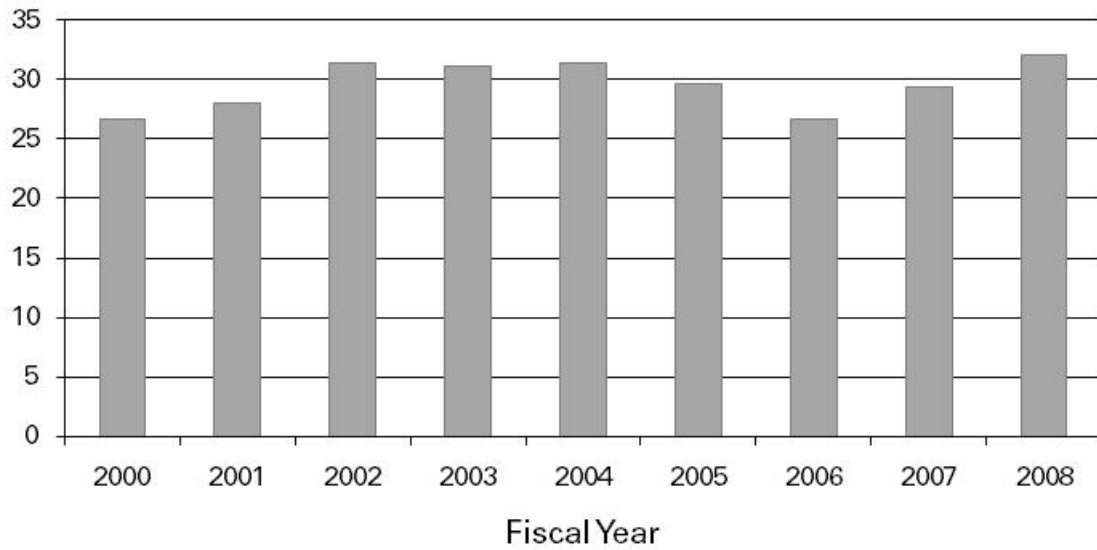


### Conversion: Graduate Admission Offers to Acceptance Ratio

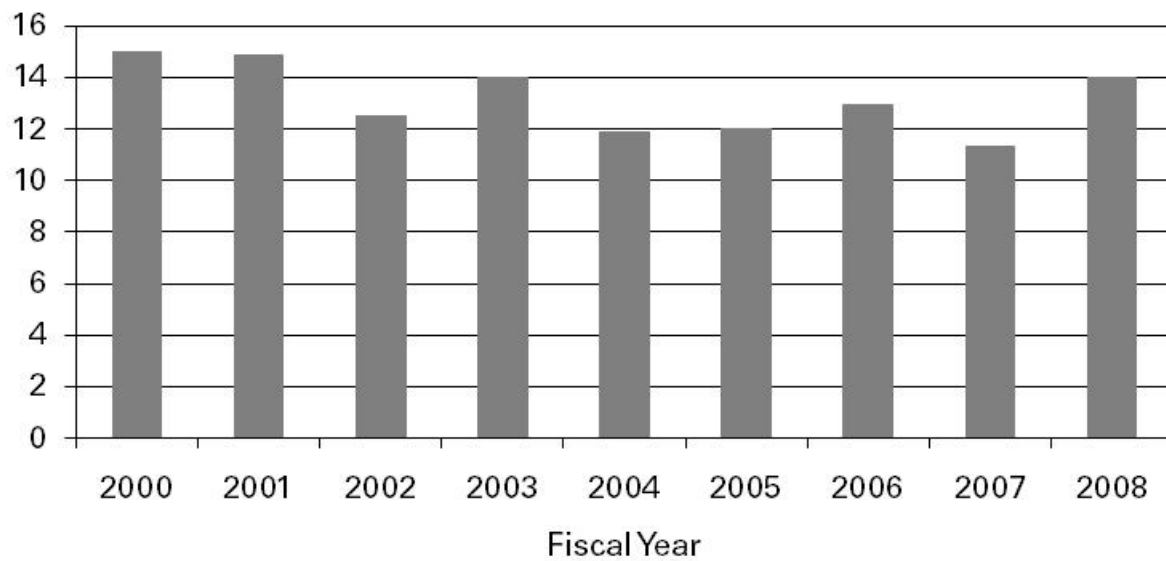


## FACULTY AND STAFF

### Full-Time Equivalent Faculty

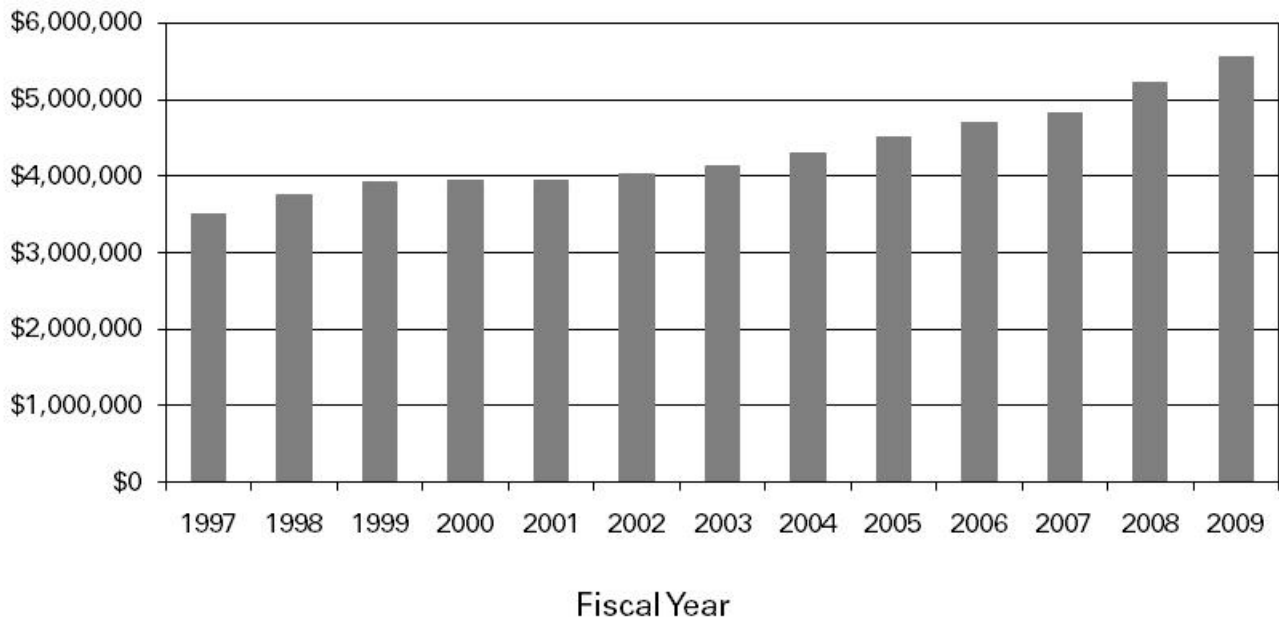


### Full-Time Equivalent Staff

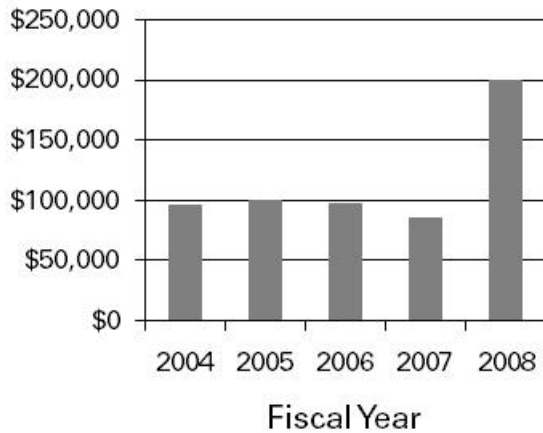


## OPERATIONS

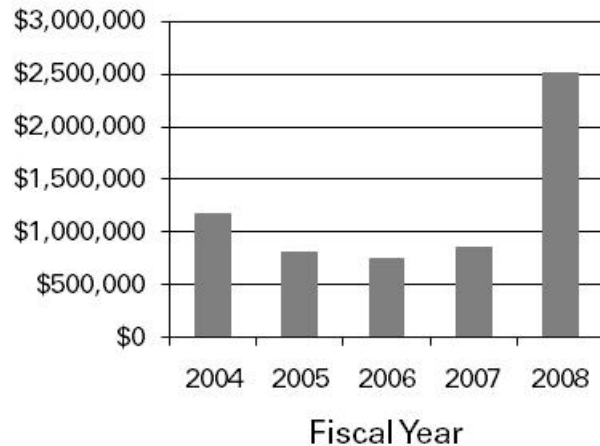
### Departmental General University Budget



### Private Giving: Black-Hilstrom Production



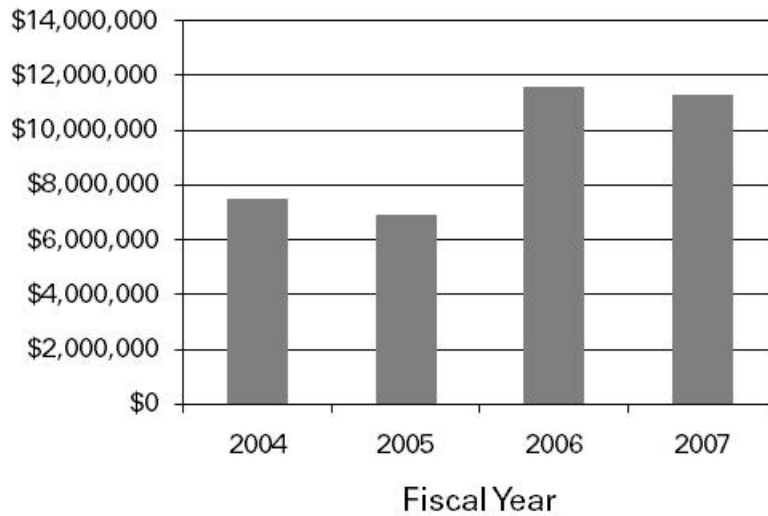
### Private Giving: Total Production



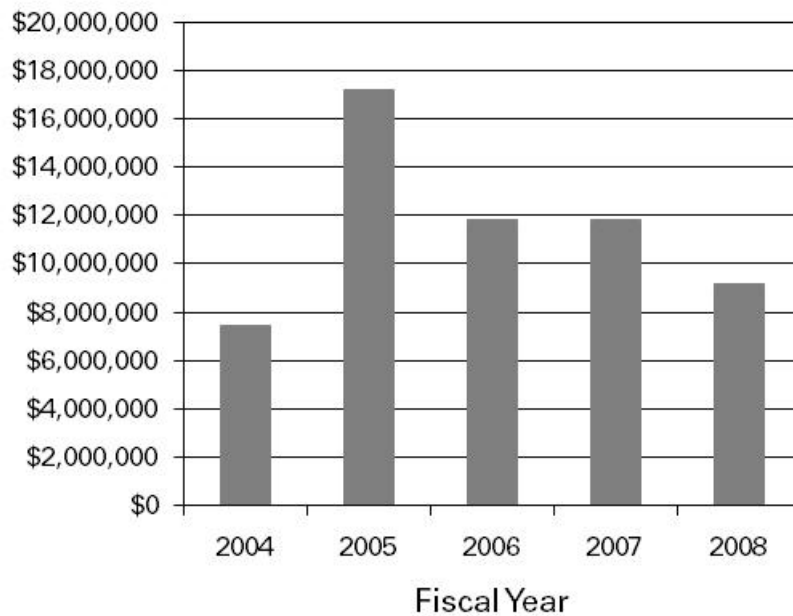
## RESEARCH

Doctoral dissertations.....	8
Master's theses/projects.....	31
Journal publications.....	66
Conference publications.....	51
Patents.....	2

### Research Expenditures



### Sponsored Funding Awards Research



## NATIONAL BENCHMARKS

<b>Metric</b>	<b>Iowa State Mechanical Engineering</b>	<b>ASME Benchmark Group<sup>1</sup></b>
Student credit hours taught	13,731	12,828
BS degrees awarded	223	151
MS degrees awarded	31	40
PhD degrees awarded	8	15
Full professors	12	16
Associate professors	6	9
Assistant professors	9	8
Lecturers and instructors	6	2
Adjunct or courtesy faculty	4	4
External sponsored research expenditures per tenured or tenure track faculty member	\$387,000	\$185,000
Fraction of academic year salary required to buyout one course section	11%	14.8%
Academic year salary recovery through research grants and contracts per tenured or tenure track faculty member	\$2,900	\$6,900
Endowed faculty positions for tenured or tenure track faculty members	5	3.4
Fraction of overhead returned to faculty members	15%	9.1%
Graduate research stipend for calendar year	\$14,575	\$15,300
Half-time graduate teaching assistants supported per tenured or tenure track faculty member	0.48	0.4
University supported staff	15	13

<sup>1</sup>Carnegie classification peer group for very high research activity public universities

## AMERICAN SOCIETY FOR ENGINEERING EDUCATION'S LEADING DEPARTMENTS FOR BACHELOR'S DEGREES IN MECHANICAL ENGINEERING

<b>University</b>	<b>Degrees Awarded</b>
1. Purdue	277 (tie)
2. Virginia Tech	277 (tie)
3. Georgia Institute of Technology	273
4. Pennsylvania State University	261
5. Kettering University	257
6. University of Michigan	223
7. Michigan Technological University	222
8. California Polytechnic State University, SLO	209
<b>9. Iowa State University</b>	<b>207</b>
10. University of Illinois, Urbana-Champaign	205



# EDUCATIONAL PROGRAM HIGHLIGHTS

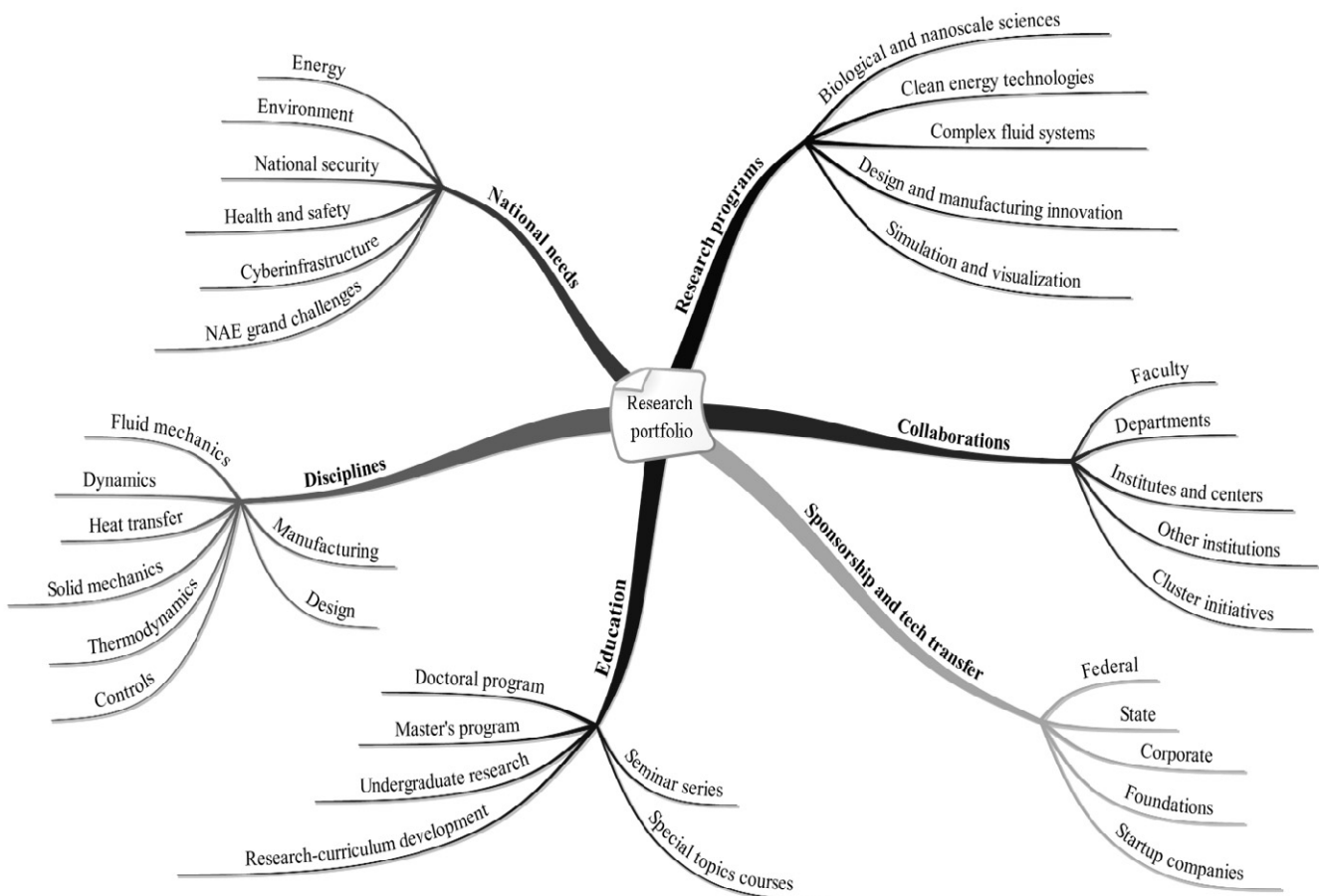
National Merit Scholars .....	2
Students in co-ops and internships .....	240
Scholarship recipients .....	202
Scholarships awarded to students .....	\$256,658

- The Women in Mechanical Engineering program began with the goals of better explaining the rewards and excitement of careers in mechanical engineering and better retaining and recruiting women to the field.
- The nuclear engineering minor was approved by the College of Engineering.
- Iowa State’s ethanol-powered formula car raced to an 18th-place finish against 130 student-designed and student-built cars at the 2007 Formula SAE (Society of Automotive Engineers) competition.
- The department’s students collaborated with Camp Courageous of Iowa to design a train for the enjoyment of children and adults with disabilities.
- Mechanical engineering faculty and students are key members of the Iowa State team selected to compete in the Department of Energy’s fourth Solar Decathlon to be held in Washington, D.C., in the fall of 2009.
- Inspired by the One Laptop Per Child program, an international movement to provide laptops for children in developing countries, sophomore students designed, built, and tested a human-powered battery charger that, with one minute of charging time, would power a laptop for 10 minutes.
- Samantha Hanson was selected to serve as the College of Engineering’s student marshal during undergraduate commencement on December 15, 2007.
- Chris Deal was one of five Iowa State students who received the 2007 Wallace E. Barron All-University Senior Award.
- Rachael Waggoner interned with KÀ, a Cirque du Soleil production at the MGM Grand in Las Vegas.
- ME 389X, Applied Methods in Sustainable Engineering and International Development, was taught on-location in rural Africa over the summer of 2008.
- The human-powered vehicle team designed and built a multi-rider vehicle named Cyclocity for competition in the American Society of Mechanical Engineers East Coast Challenge in Wisconsin during April 2008. The team finished first overall in the tandem and second overall in the utility rider categories.
- Sol Invictus, Iowa State University’s solar race car, completed the 2,400-mile North American Solar Challenge in July 2008 and finished in eighth place overall with a time of 91 hours and 12 minutes.
- Steve Corns and Stephen Gent received the College of Engineering’s Teaching Excellence Award.
- Hemanth Porumamilla and Doug McCorkle received the College of Engineering’s Research Excellence Award.

# RESEARCH PORTFOLIO

## STRATEGY

We have successfully identified research niches where 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 interdisciplinary research institutes and centers, and with 150 organizations outside of Iowa State. Mechanical engineering faculty members lead major research enterprises including the Bioeconomy Institute, the CyberInnovation Institute, the Industrial Assessment Center, and the Virtual Reality Applications Center. With research supported by industry and governmental agencies, the department boasts internationally acclaimed programs in biological and nanoscale sciences, clean energy technologies, complex fluid systems, design and manufacturing innovation, and simulation and visualization. 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.



## PROGRAMS

### *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.



### *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.

### *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

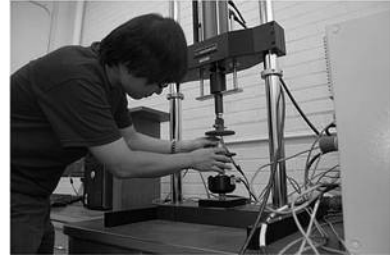


chemical production; biomass transport; particle dispersion; and heat exchangers in evaporators, boilers, and condensers. The efforts of this program pioneer new theories and models of complex fluid processes and validate these processes through novel experimental techniques and exploration tools.

### ***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.



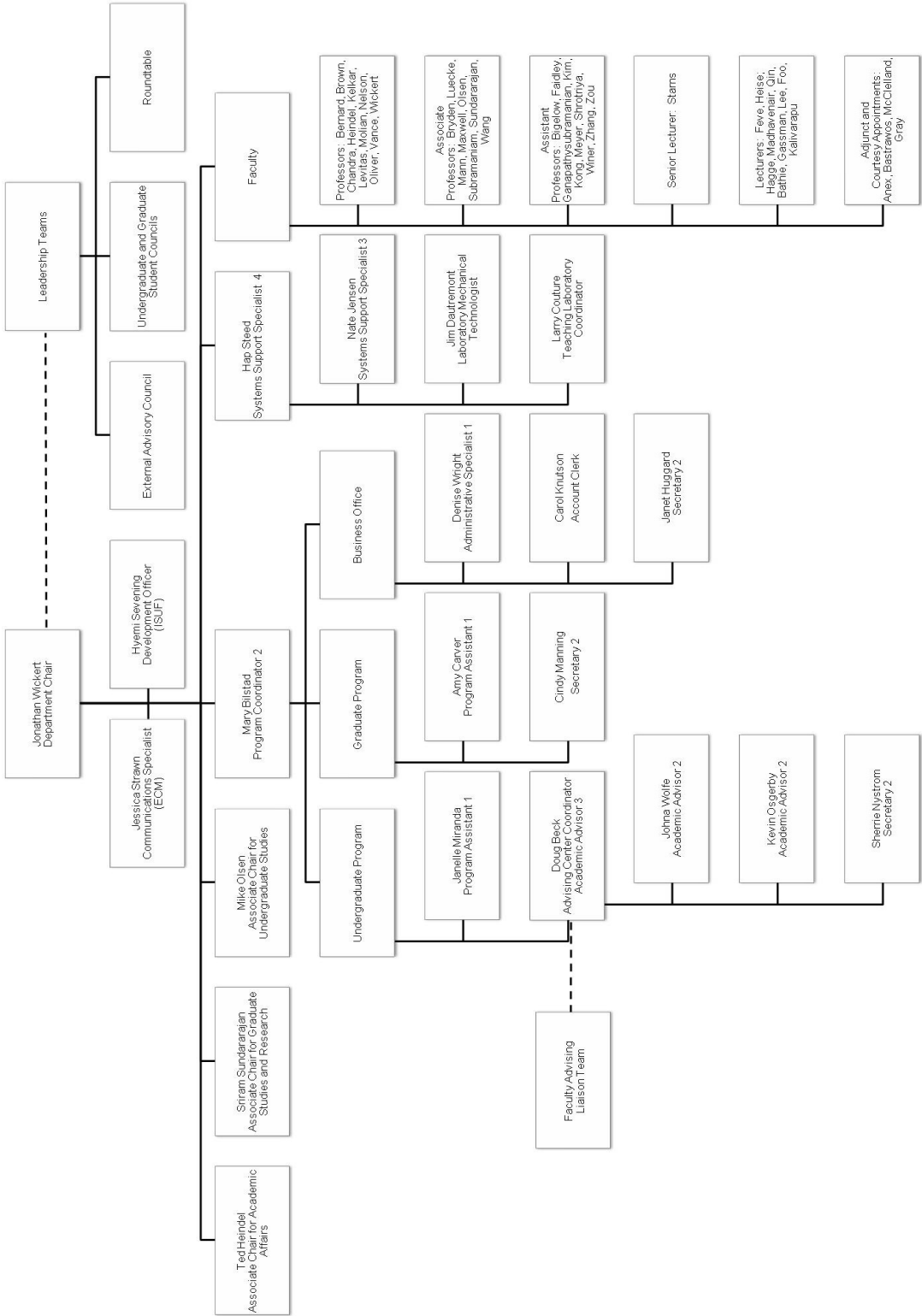
### ***Simulation and Visualization***



#### **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.

# DEPARTMENT ORGANIZATION



## EXTERNAL ADVISORY COUNCIL

Brett L. Anderson, PE  
Structures Technology Leader  
The Boeing Company

Larry Bodensteiner  
Senior Engineering Manager  
IBM Mechanical Design & Integration

Scott Bowman, PE  
Principal, KJWW

Craig Connell  
VP—Application Development  
Black & Veatch

Bruce Gibson  
Air Products & Chemicals, Inc

Mike Hilby  
Manager of Manufacturing  
John Deere Des Moines

Mike Jensen  
Automation Program Manager  
Technology & Solutions Division  
Caterpillar, Inc.

Brad Knous  
LyondellBasell

Cynthia J. Lord, PE  
Manager—Fossil Fuel Procurement  
Alliant Energy

John Mammoser  
Consulting Engineer  
Rolf Jensen & Associates, Inc.

Celeste Six  
Account Manager  
Altec Industries

Bob Taylor  
Vice President  
Kiewit Power, Inc.

Sheryl Wreghitt  
SLW Quality Consulting, LLC

## FACULTY

### *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.



**Robert Brown**

Anson Marston Distinguished Professor  
Bergles Professor in Thermal Science  
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 is interested in 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.



**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.



**Ted Heindel**

Professor

Associate Chair for Academic Affairs

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

Professor Heindel is interested in 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-Chang 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.



**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  
Director of Graduate Education through January 2008

BS, Engineering Science, Iowa State University, 1984  
PhD, Acoustics, The 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.



**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.



**Jim Oliver**  
Professor  
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.



**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.



**Pranav Shrotriya**

Virginia and William Binger Assistant 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.



**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

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**

Department Chair  
Larry and Pam Pithan Professor 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**

Assistant 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.



**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.

### *Senior lecturer*



**Gloria Starns**

### *Lecturers*



**Bill  
Bathie**



**Sebastien  
Feve**



**Max  
Gassman**



**Matt Hagge**



**Jim  
Heise**



**Rajeiv  
Madhavan  
Nair**



**Zhaohui  
(George) Qin**

### *Adjunct and courtesy appointments*

**Robert Anex**, Adjunct Associate Professor  
Associate Professor, Agricultural and Biosystems Engineering

**Ashraf Bastawros**, Adjunct Associate Professor  
Associate Professor, Aerospace Engineering

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

**John McClelland**, Adjunct Associate Professor  
Senior Physicist, Ames Laboratory

## STAFF

### *Business office*



**Mary Bilstad**  
Program  
Coordinator



**Amy Carver**  
Program  
Assistant for  
Graduate  
Education



**Janet Huggard**  
Department  
Secretary



**Carol Knutson**  
Account Clerk



**Cindy Manning**  
Educational  
Programs  
Secretary



**Janelle Miranda**  
Program  
Assistant for  
Undergraduate  
Education



**Jessi Strawn**  
Communications  
Specialist



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

### *Kiewit Undergraduate Student Services Center*



**Doug Beck**  
Academic Adviser  
Center Director



**Sherrie Nystrom**  
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



# HONORS

## ENDOWED FACULTY POSITIONS

Anson Marston Distinguished Professor .....	James Bernard Robert Brown
Bergles Professor of Thermal Science .....	Robert Brown
Larry and Pam Pithan Professor of Mechanical Engineering ..	Jonathan Wickert
Virginia and William Binger Assistant Professor.....	Pranav Shrotriya
Gary and Donna Hoover Chair in Mechanical Engineering.....	Open
William March Scholar of Mechanical Engineering .....	Baskar Ganapathysubramanian (Beginning AY 2008–2009)
Schaefer 2050 Challenge Professor .....	Valery Levitas (Beginning AY 2008–2009)

## 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

## ISU HONORS AND AWARDS

Superior Engineering Teaching Award .....	Sriram Sundararajan
ISU Alumni Association Impact Award .....	Robert Brown
Young Engineering Faculty Research Award .....	Pranav Shrotriya
Staff Exceptional Performance Award .....	Nate Jensen
Learning Community Scholarship Award.....	Doug Beck

## NATIONAL AWARDS AND HONORS

SAE Ralph R. Teetor Educational Award.....	Song-Charng Kong
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# FACULTY HIGHLIGHTS

**Robert Brown** was named Anson Marston Distinguished Professor in the College of Engineering. He was also appointed Director of the Bioeconomy Institute, newly established by the Iowa Board of Regents this past fall. The institute will be housed in the Biorenewables Research Laboratory Building to be constructed in the College of Engineering with \$32 million provided by the state legislature.

**Mark Bryden** taught ME 389X, Applied Methods in Sustainable Engineering and International Development, in rural Mali with seven undergraduate

students. The class worked on engineering design of water systems valve, household cook stoves, and village lighting. It was the first mechanical engineering class to be taught in rural Africa.

**Ted Heindel** led the 2025 Committee in developing the department's most comprehensive strategic plan. One of his graduate students, Nathan Franka, and his Experimental Multiphase Flow Laboratory were featured in the March, 28, 2008, issue of *U.S. News & World Report* on graduate education. Based on research performed in his laboratory, a Freshmen Honors student, Timothy Morgan, received an honorable mentioned at an ASME student paper competition where all other student entries were seniors or graduate students.

**Jim Heise** received an Engineering Leadership Award at the 8<sup>th</sup> Annual Engineering Student Council Banquet after being nominated by the SAE Student Branch. He was appointed design projects coordinator for the department.

**Song-Chang Kong's** engine research laboratory examined innovative uses of biodiesel by using it to dissolve waste plastics. The fuel mixture of biodiesel and plastic was burned in an internal combustion engine. This study continues to investigate the combustion characteristics of such fuel mixtures as a means for energy recovery from waste.

**Terry Meyer's** work on laser diagnostics and biorenewable fuels has appeared in publications ranging from *Mechanical Engineering Magazine* to the prestigious inaugural issue of *Annual Reviews in Analytical Chemistry*. He was recently named general co-chair of the next Optical Society of America's Conference on Laser Applications to Chemical, Security, and Environmental Analysis.

**Gloria Starns** was promoted to the rank of senior lecturer, appointed technology schedule coordinator, and began a project to teach mechanical engineering in a value-based societal context.

**Shankar Subramaniam** was promoted to associate professor and appointed director of the complex fluid systems research program. He also serves as director of the Women in Mechanical Engineering program.

**Sriram Sundararajan** was promoted to associate professor and named the associate chair for graduate studies and research.

**Jonathan Wickert** was elected to the executive committee for the ASME Department Chairs Forum and was awarded Iowa State's Larry and Pam Pithan Professorship. His most recent PhD graduates took positions at North Dakota State University and Sandia National Laboratories. He participated in planning and developing the data storage technology roadmap of the Information Storage Industry Consortium.

# DOCTORAL DISSERTATIONS

**Muhammad Ali**

Dissertation: Study of a compact energy absorber

Major Professor: Greg Luecke

**Mark Barker**

Dissertation: Predicting loads on ground engaging tillage tools using computational fluid dynamics

Major Professor: Adin Mann

**Steven Corns**

Dissertation: The role of information flow in engineering optimization

Major Professor: Mark Bryden

**Balasubramaniam Karthikeyan**

Dissertation: A virtual engineering framework to support progressive interaction in engineering design

Major Professor: Mark Bryden

**Douglas McCorkle**

Dissertation: Establishing an advanced engineering framework for engineering decision making

Major Professor: Mark Bryden

**Hemanth V. Porumamilla**

Dissertation: Modeling, analysis and nonlinear and nonlinear control of a novel pneumatic semi-active vibration isolator: A concept validation study

Major Professor: Atul Kelkar

**Aditya Choudary Velivelli**

Dissertation: Development of a multiblock solver utilizing the lattice Boltzmann and traditional finite difference methods for fluid flow problems

Major Professor: Mark Bryden

**Li Zhang**

Dissertation: Experimental and simulation study of demand controlled ventilation

Major Professor: Greg Maxwell

# JOURNAL PUBLICATIONS

Wright, M. and **R.C. Brown**, "Establishing the optimal sizes of different kinds of biorefineries," *Biofuels, Bioprocessing, and Biorefineries*, 1(3): 191-200, 2007.

Wright, M. and **R.C. Brown**, "Comparative economics of biorefineries based on the biochemical and thermochemical platforms," *Biofuels, Bioprocessing, and Biorefineries*, 1: 49-56, 2007.

**Brown, R.C.**, "Hybrid thermochemical/biological processing of biomass," *Applied Biochemistry and Biotechnology*, 137-140 (1-12): 947-956, 2007.

Lloyd, H., A.T. Cooper, M. Fan, **R.C. Brown**, J. Sawyer, J. van Leeuwen, Y. Shi, N. Li, and W. Zhang, "Pilot plant evaluation of PFS from coal-fired power plant waste," *Chemical Engineering and Processing*, 46(3): 257-261, 2007.

McCorkle, D.S. and **K.M. Bryden**, "Using the Semantic Web to Enable Integration with Virtual Engineering Tools," *Virtual Reality*, 11(4): 253-260, 2007.

Karthikeyan, B., D. A. Ashlock, and **K.M. Bryden**, "Automatically Balanced K-means for Non-photorealistic Rendering," *Smart Systems Engineering: Computational Intelligence in Architecting Complex Engineering Systems*, 17: 507-518, 2007.

Corns, S. M., D. A. Ashlock, and **K.M. Bryden**, "Optimizing Tartarus Controllers Using Graph Based Evolutionary Algorithms," *Smart Systems Engineering: Computational Intelligence in Architecting Complex Engineering Systems*, 17: 195-200, 2007.

**Chandra, A.**, A. Mitchell, P. Shrotriya, and D.A. Lucca, "Stress Assisted Dissolution of Biomedical Grade CoCrMo: Influence of Contact Loads and Residual Stresses," *Annals of CIRP*, 57(1): 565-568, 2007.

Zhang, R., X. Wang, **P. Shrotriya**, R. Biswas, A.F. Bastawros, and **A. Chandra**, "Molecular Approach to Material Detachment Mechanism During Chemical Mechanical Planarization," *International Journal of Machining Science & Technology*, 11(4): 515-530, 2007.

Ungerma, A.D. and **T.J. Heindel**, "Carbon Monoxide Mass Transfer for Syngas Fermentation in a Stirred Tank Reactor with Dual Impeller Configurations," *Biotechnology Progress*, 23(3): 613-620, 2007.

Do, Y.S., J. Smeenk, K.M. Broer, C.J. Kisting, **R.C. Brown**, **T.J. Heindel**, T.A. Bobik, and A.A. DiSpirito, "Growth of *Rhodospirillum rubrum* in Synthesis Gas: Catalyst of CO and H<sub>2</sub> and Poly-hydroxyalkanoate," *Biotechnology and Bioengineering*, 97(2): 279-286, 2007.

Tang, C. and **T.J. Heindel**, "Effect of Fiber Length Distribution on Gas Holdup in a Cocurrent Gas-Liquid-Fiber Bubble Column," *Chemical Engineering Science*, 62(5): 1408-1417, 2007.

**Kim, G.Y.**, M. Koc, and J. Ni, "Modeling of the Size Effects on the Behavior of Metals in the Microscale Deformation Processes," *Transactions of the ASME, Journal of Manufacturing Science and Engineering*, 129(3): 470-476, 2007.

Chen, P., **G.Y. Kim**, and J. Ni, "Investigation of Compaction and Sintering of Ceramic Parts," *Journal of Materials Processing Technology*, 190: 243-250, 2007.

**Kim, G.Y.**, R. Mayor, H. Kim, and J. Ni, "An Experimental Investigation on Semi-solid Forming of Micro/meso-scale Features," *Transactions of the ASME, Journal of Manufacturing Science and Engineering*, 129(2): 246-251, 2007.

**Kim, G.Y.**, M. Koc, R. Mayor, and J. Ni, "Modeling of the Semi-solid Material Behavior and Analysis of Micro/meso-scale Feature Forming," *Transactions of the ASME, Journal of Manufacturing Science and Engineering*, 129(2): 237-245, 2007.

**Kong, S.-C.**, "Drop/Wall Interaction Criteria and Their Applications in Diesel Spray Modeling," *Atomization and Sprays*, 17(6): 473-499, 2007.

**Kong, S.-C.**, "A Study of Natural Gas/DME Combustion in HCCI Engines Using CFD with Detailed Chemical Kinetics," *Fuel*, 86: 1483-1489, 2007.

**Kong, S.-C.**, Y. Sun, and R.D. Reitz, "Modeling Diesel Spray Flame Lift-Off, Sooting Tendency and NO<sub>x</sub> Emissions Using Detailed Chemistry with Phenomenological Soot Models," *Journal of Engineering for Gas Turbines and Power*, 129: 245-251, 2007.

**Kong, S.-C.**, H. Kim, R.D. Reitz, and Y. Kim, "Comparisons of Combustion Simulations Using a Representative Flamelet Model and Direct Integration of CFD with Detailed Chemistry," *Journal of Engineering for Gas Turbines and Power*, 129: 252-260, 2007.

Liang, L., **S.-C. Kong**, C. Jung, and R.D. Reitz, "Development of a Semi-Empirical Solver for Detailed Chemistry in I.C. Engine Simulations," *Journal of Engineering for Gas Turbines and Power*, 129: 271-278, 2007.

Zafer, N. and **G.R. Luecke**, "A geometric constraint-based approach to force and motion coupling between real and virtual mechanisms," *Advanced Robotics*, 21(12): 1393-1410, 2007.

Loutzenhiser, P.G., **G.M. Maxwell**, and H. Manz, "Empirical validation of the daylighting algorithms and associated interactions in building energy simulation programs using various shading devices and windows," *Energy*, 32: 1855-1870, 2007.

Loutzenhiser, P.G., H. Manz, C. Felsmann, P.A. Strachan, T. Frank, and **G.M. Maxwell**, "Empirical validation of models to compute solar irradiance on inclined surfaces for building energy simulation," *Solar Energy*, 18: 254-267, 2007.

Loutzenhiser, P.G., H. Manz, C. Felsmann, P.A. Strachan, and **G.M. Maxwell**, "An empirical validation of modeling solar gain through a glazing unit with external and internal shading screens," *Applied Thermal Engineering*, 27: 528-538, 2007.

**Meyer, T.R.**, S. Roy, and J.R. Gord, "Improving Signal-to-Interference Ratio in Rich Hydrocarbon-Air Flames Using Picosecond Coherent Anti-Stokes Raman Scattering," *Applied Spectroscopy*, 61(11): 1135-1140, 2007.

Corporan, E., M.J. DeWitt, V. Belovich, R. Pawlik, A.C. Lynch, J.R. Gord, and **T.R. Meyer**, "Emissions Studies of a Turbine Engine and Research Combustor Burning a Natural Gas-Derived Fischer-Tropsch Jet Fuel," *Energy and Fuels*, 21(5): 2615-2626, 2007.

**Meyer, T.R.**, G.B. King, M. Gluesenkamp, and J.R. Gord, "Simultaneous High-Speed Measurement of Temperature and Lifetime-Corrected OH Laser-Induced Fluorescence in Unsteady Flames," *Optics Letters*, 32(15): 2221-2223, 2007.

Barnes, C., **P. Shrotriya**, and **P. Molian**, "Water-assisted laser thermal shock machining of alumina," *International Journal of Machine Tools and Manufacturing*, 47(12-13): 1864-1874, 2007.

**Molian, P.**, "Laser nanostructuring of EB-PVD thermal barrier coatings for ultra-low thermal conductivity," *Journal of Materials Science*, 42: 9491-9494, 2007.

Vendan, M. and **P. Molian**, "Femtosecond pulsed laser microfabrication of SiC MEMS microgripper," *Journal of Laser Applications*, 19(3): 149-155, 2007.

Sadhukumar, A. and **P. Molian**, "Excimer laser annealing of quasicrystalline materials," *Lasers in Engineering*, 17(3-4): 135-155, 2007.

**Molian, P.**, "Short-Pulsed Laser Nanomachining: Emerging Techniques," *Manufacturing Technology and Research* 3(3-4): 1-10, 2007.

Shehata, G., **P. Molian**, A. Bastawros, and **P. Shrotriya**, "Surface finish and flexural strength of CO<sub>2</sub> laser-cut alumina by evaporative and thermal stress fracture modes," *Transactions of North American Manufacturing Research Institution*, Society of Manufacturing Engineers, 35: 391-401, 2007.

**Olsen, M.G.** and C.J. Bourdon, "Random error due to Brownian motion in particle image velocimetry," *Measurement Science and Technology*, 18: 1963-1972, 2007.

Feng, H., **M.G. Olsen**, R.O. Fox, and J.C. Hill, "Conditional statistics for passive-scalar mixing in a confined rectangular turbulent jet," *Physics of Fluids*, 19: 155401, 2007.

Feng, H., **M.G. Olsen**, J.C. Hill, and R.O. Fox, "Simultaneous velocity and concentration field measurements of passive-scalar mixing in a confined planar jet," *Experiments in Fluids*, 42: 847-862, 2007.

Joshi, S. N., **M.B. Pate**, **R.M. Nelson**, J.H. House, and C.J. Klaassen, "An Experimental Evaluation of Response Times for Duct-Mounted Relative Humidity Sensors," *ASHRAE Transactions*, 113: 2007.

Lee, J.S. and **R. H. Pletcher**, "LES of Variable Property Turbulent Flow in Horizontal and Vertical Channels with Buoyancy and Heat Transfer Effects," *Journal of Mechanical Engineering Science*, 221(4): 429-441, 2007.

Qin, Z. and **R. H. Pletcher**, "The Velocity Field and Instability of Rotating Duct Flow," *Physics of Fluids*, 19: 104-106, 2007.

Liu, K. and **R. H. Pletcher**, "A Fractional Step Method for Solving the Compressible Navier-Stokes Equations," *Journal of Computational Physics*, 226: 1930-1951, 2007.

Liu, K. and **R. H. Pletcher**, "Compressibility and Variable Density Effects in Turbulent Boundary Layers," *Journal of Heat Transfer*, 129: 441-448, 2007.

Zhou, J., J. Mah, **P. Shrotriya**, C. Mercer, and W.O. Soboyejo, "Contact damage in an yttria stabilized zirconia: Implications," *Journal of Materials Science-Materials in Medicine*, 18(1): 71-78, 2007.

Yu, H.H., **P. Shrotriya**, Y.F. Gao, and K.S. Kim, "Micro-plasticity of surface steps under adhesive contact: Part I - Surface yielding controlled by single-dislocation nucleation," *Journal of the Mechanics and Physics of Solids*, 55(3): 489-516, 2007.

Ryu, J.J., V. Dayal, and **P. Shrotriya**, "Onset of surface damage in modular orthopedic implants: Influence of normal contact loading and stress-assisted dissolution," *Experimental Mechanics*, 47(3): 395-403, 2007.

Mitchell, A. and **P. Shrotriya**, "Onset of nanoscale wear of metallic implant materials: Influence of surface residual stresses and contact loads," *Wear*, 263: 1117-1123, 2007.

Pai, M.G., and **S. Subramaniam**, "Modeling Droplet Dispersion and Interphase Turbulent Kinetic Energy Transfer Using a New Dual-Timescale Langevin Model," *International Journal of Multiphase Flow*, 33(3): 252-281, 2007.

Xu, Y. and **S. Subramaniam**, "Consistent Modeling of Interphase Turbulent Kinetic Energy Transfer in Particle-Laden Turbulent Flows," *Physics of Fluids*, 19(8): 085101, 2007.

Sun, J., F. Battaglia, and **S. Subramaniam**, "Hybrid Two-Fluid DEM Simulation of Gas-Solid Fluidized Beds," *ASME Journal of Fluids Engineering*, 129(11): 1394-1403, 2007.

Garg, R., C. Narayanan, D. Lakehal, and **S. Subramaniam**, "Accurate Numerical Estimation of Interphase Momentum Transfer in Lagrangian-Eulerian Simulations of Dispersed Two-Phase Flows," *International Journal of Multiphase Flow*, 33 (12): 1337-1364, 2007.

Bhuyan, S., L.S. Holden, **S. Sundararajan**, D. Andjelkovic, and R. Larock, "Effect of crosslinking on the wear behavior of soy-bean oil-based polymeric materials," *Wear*, 263: 965-973, 2007.

Zhang, Y. and **S. Sundararajan**, "A method to generate surfaces with desired roughness parameters," *Langmuir* 23: 8347-8351, 2007.

Howard, B. M. and **J.M. Vance**, "Desktop haptic virtual assembly using physically-based modeling," *Virtual Reality*, 11(4): 207-215, 2007.

Duncan, T. J. and **J.M. Vance**, "Interactive interrogation of computational mixing data in a virtual environment," *ASME Journal of Mechanical Design*, 129(3): 361-367, 2007.

Zhong, Z., **X. Wang**, and X. Feng, "Effects of pressure and temperature on  $sp^3$  fraction in diamond-like carbon materials," *Journal of Materials Research*, 22: 2770-2775, 2007.

Feng, X. and **X. Wang**, "Nanodomain Shock Wave in Near-field Laser-material Interaction," *Physics Letters A*, 369: 323-327, 2007.

Xie, H., A. Cai, and **X. Wang**, "Thermal diffusivity and conductivity of multiwalled carbon nanotube arrays," *Physics Letters A*, 369(1-2): 120-123, 2007.



Guo, J., **X. Wang**, L. Zhang, and T. Wang, "Transient thermal characterization of micro/submicroscale polyacrylonitrile wires," *Applied Physics A, Rapid Communications* 89: 153-156, 2007.

Guo, J., **X. Wang**, and T. Wang, "Thermal Characterization of Microscale Conductive and Nonconductive Wires Using Transient Electro-thermal Technique," *Journal of Applied Physics*, 101: 063537, 2007.

Wang, T., **X. Wang**, J. Guo, Z. Luo, and K. Cen, "Characterization of thermal diffusivity of micro/nanoscale wires by transient photo-electro-thermal technique," *Applied Physics A*, 87: 599-605, 2007.

Kartik, V. and **J.A. Wickert**, "Surface Friction Guiding for Reduced High Frequency Lateral Vibration of Moving Media," *ASME Journal of Vibration and Acoustics*, 129(3): 371-379, 2007.

Ervin, E. and **J.A. Wickert**, "Repetitive Impact Response of a Beam Structure Subjected to Harmonic Base Excitation," *Journal of Sound and Vibration*, 307(1-2): 2-19, 2007.

Ervin, E. and **J.A. Wickert**, "Experiments on a Beam-Rigid Body Structure Repetitively Impacting a Rod," *Nonlinear Dynamics*, 50(3), 2007.

Beck, J.G., S.A. Palyo, **E. Winer**, B. Schwagler, and E.J. Ang, "Virtual Reality Exposure Therapy for PTSD symptoms after a Road Accident: An Uncontrolled Case Series," *Behavior Therapy*, 38(1): 39-48, 2007.

Wu, Y. and **Q. Zou**, "Iterative Control Approach to Compensate for the Hysteresis and the Vibrational Dynamics Effects of Piezo Actuators," *IEEE Transactions on Control Systems Technology*, 15: 936-944, 2007.

**Zou, Q.** and S.Devasia, "Review-Based Stable-Inversion for Output Tracking of Nonlinear Nonminimum-Phase Systems: The VTOL Example," *Automatica*, 43 (1): 117-127, 2007.

# CONFERENCE PUBLICATIONS AND PROCEEDINGS

Na, S., B. Williams, R.A. Dennis, **K.M. Bryden**, and T.I-P. Shih, "Internal and Film Cooling of a Flat Plate and Conjugate Heat Transfer," Proceedings of the 54<sup>th</sup> ASME Gas Turbine and Aeroengine Technical Conference, Exposition, and User Symposium, Montreal, Canada, May 2007.

Yu, M., A. Gupta, and **K.M. Bryden**, "Sensor Response and Sensor Network Development for Practical Combustors," Proceedings of the 16<sup>th</sup> International Conference on Computer Communications and Networks, Honolulu, HI, 2007.

Bastawros, A.F. and **A. Chandra**, "Role of Multi-scale Polishing Pad Response on Evolution of Scratches during CMP," Proceedings of the 12<sup>th</sup> International Conference on Chemical-Mechanical Polish (CMP) Planarization for ULSI Multilevel Interconnection (CMP-MIC), Fremont, CA, 2007.

Wang, X., P. Karra, **A. Chandra**, A.F. Bastawros, R. Biswas, P. Sherman, and L. Yao, "A Multi-scale Predictive Model for Wafer Surface Evolution During CMP Process Incorporating Slurry Evolution," Proceedings of the 12<sup>th</sup> International Conference on Chemical-Mechanical Polish (CMP) Planarization for ULSI Multilevel Interconnection (CMP-MIC), Fremont, CA, 2007.

Law, D., F. Battaglia, and **T.J. Heindel**, "Stability Issues for Gas-Liquid Flows in Bubble Columns," Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, November 10–16, 2007, IMECE2007-43517, 2007.

Deza, M., F. Battaglia, and **T.J. Heindel**, "Computational Modeling of Biomass in a Fluidized Bed Gasifier," Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition, November 10–16, 2007, Seattle, WA, IMECE2007-43097.

Franka, N.P., **T.J. Heindel**, and F. Battaglia, "Visualizing Cold-Flow Fluidized Beds with X-rays," Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition, November 10–16, 2007, Seattle, WA, IMECE2007-43073, 2007.

Morgan, T.B. and **T.J. Heindel**, "Observations of Dense Particle Motion in a Vibration-Excited Granular Bed," Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition, November 10–16, 2007, Seattle, WA, IMECE2007-42306.

Ford, J.J., **T.J. Heindel**, and T.C. Jensen, "Imaging a Gas-Sparged Stirred-Tank Reactor with X-rays," Proceedings of the 2007 ASME/JSME Fluids Engineering Division Summer Meeting, July 30–August 2, 2007, San Diego, FEDSM2007-37022.

**Heindel, T.J.**, T.C. Jensen, and J.N. Gray, "Visualizing Fluid Flows with X-rays," Proceedings of the 2007 ASME/JSME Fluids Engineering Division Summer Meeting, July 30–August 2, 2007, San Diego, CA FEDSM2007-37023.

Jones, S.T. and **T.J. Heindel**, "The Influence of External Loop Airlift Bioreactor Configuration on Bioreactor Hydrodynamics," Proceedings of the 2007 ASABE Annual International Meeting, June 17–20, 2007, Minneapolis, MN, Paper Number: 077069, ASABE Press, St. Joseph, MI, 2007.

Jones, S.T. and **T.J. Heindel**, "A Review of Dissolved Oxygen Concentration Measurement Methods for Biological Fermentations," Proceedings of the 2007 ASABE Annual International Meeting, June 17–20, 2007, Minneapolis, MN, Paper Number: 077117, ASABE Press, St. Joseph, MI, 2007.

Waite, T. and **A. Kelkar**, "System Identification Using Enhanced SOCIT Algorithms, Advances in Control and Optimization of Dynamical Systems (ACODS)," IISc, Bangalore, India, February 1–2, 2007.

**Kim, G.Y.**, M. Koc, and J. Ni, "Modeling of Size Effects on the Flow Stress of Type 304 Stainless Steel and Application in Coining Process," Proceedings of IMECE2007, ASME International Mechanical Engineering Congress and Exposition, Seattle, WA., November 11–15, 2007.

Park, K., **G.Y. Kim**, and J. Ni, "Design and Analysis of Ultrasonic Assisted Friction Stir Welding," Proceedings of IMECE2007, ASME International Mechanical Engineering Congress and Exposition, Seattle, WA., November 11–15, 2007.

Chen, P., **G.Y. Kim**, and J. Ni, "Forming of Porous Micro-features Using Hot Compaction," ASME International Conference on Manufacturing Science and Engineering, Atlanta, GA, October 15–18, 2007.

Feng, J., **G.Y. Kim**, A. Shih, and J. Ni, "Investigation of the Micro-end Grinding of Ceramics Using a Sintered Metal-bonded Microgrinding Wheel", 10th International Symposium on Advances in Abrasive Technology, Dearborn, MI, September 26–28, 2007.

Feng, J., **G.Y. Kim**, A. Shih, and J. Ni, "Investigation of Tool Wear in Microgrinding of Ceramic Materials with Sintered Metal-bonded Wheel," 2nd International Conference on Manufacturing Science and Engineering, Clemson, SC, September 10–13, 2007.

**Kong, S.-C.**, "Predicting Effects of DME in the Operating Range of Natural Gas-Fueled Compression-Ignition Engines," SAE 2007-01-0620, 2007.

**Molian, P.**, Z. Lin and **Q. Zou**, "Plasmonics nanomanufacturing of silicon," 3<sup>rd</sup> Annual Minnesota Nanotechnology Conference, November 13–14, 2007, University of Minnesota, Minneapolis.

Seth, A., **J.M. Vance**, and **J.H. Oliver**, "Combining Geometric Constraints with Physics Modeling for Virtual Assembly using SHARP," ASME 2007 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Las Vegas, NV, September 2007, Paper No. DETC07/CIE-34681.

Zhang, R., C. Noon, **E. Winer**, **J.H. Oliver**, J. Duncan, and B. Gilmore, "Immersive Product Configurator for Conceptual Design," ASME 2007 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Las Vegas, NV, September 2007, Paper No. DETC07/DAC-35390.

Kadavasal, M.K. and **J.H. Oliver**, "Toward Sensor Enhanced Virtual Reality Teleoperation in a Dynamic Environment," ASME 2007 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Las Vegas, NV, September 2007, DETC/CIE07-34695.

Zhang, R., C. Noon, **J.H. Oliver**, **E. Winer**, B. Gilmore, and J. Duncan, "Development of a Software Framework for Conceptual Design of Complex Systems," 3rd Annual AIAA Multidisciplinary Design Optimization Specialists Conference, Waikiki, HI, April 2007, Paper No. AIAA-2007-1931.

Foo, J.L., J.S. Knutzon, **J.H. Oliver**, and **E. Winer**, "Three-Dimensional Multi Objective Path Planner for Unmanned Aerial Vehicles Using Particle Swarm Optimization," 3rd Annual AIAA Multidisciplinary Design Optimization Specialists Conference, Waikiki, HI, April 2007, Paper No. AIAA-2007-1881.

Kadavasal, M.K. and **J.H. Oliver**, "Sensor Enhanced Virtual Reality Teleoperation in Dynamic Environment," Proc.IEEE Virtual Reality Conference, Charlotte, NC, March 2007, ISBN 1-4244-0905-5.

Shehata, G., **P. Shrotriya**, and **P. Molian**, "Laser/waterjet cutting of alumina ceramics for improved flexural strength," North American Manufacturing Research Conference, University of Michigan, Society of Manufacturing Engineers, May 23–25, 2007.

Kim, K.S., Z. Lin, **P. Shrotriya**, **S. Sundararajan**, and **Q. Zou**, "Iterative Control Approach to High-Speed Force-Distance Curve Measurement Using AFM for Biological Applications," CASE 2007. IEEE International Conference on Automation Science and Engineering, Scottsdale, AZ, September 2007.

Zhang, Y. and **S. Sundararajan**, "A method to generate biomimetic superhydrophobic engineering surfaces," Proceedings of the 2007 Spring Meeting of the Materials Research Society, San Francisco, CA, April 2007, MRS.

Faas, D., A. Fischer, and **J.M. Vance**, "Interactive mesh-free stress analysis for mechanical design assembly with haptics," ASME 2007 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, September 4–7, 2007, Las Vegas, NV, DETC2007-34660.

Guo, J., **X. Wang**, and T. Wang, "Thermal Characterization of Micro/Nanoscale One-dimensional Structures Using Transient Electro-thermal Technique," 2007 MRS Spring Meeting, April 9–13, 2007, San Francisco, CA.

Feng, X. and **X. Wang**, "Effects of laser fluence on surface nanostructuring with a laser-assisted scanning tunneling microscope," Proceedings of MNC2007, MicroNanoChina07, January 10–13, 2007, Sanya, Hainan, China.

Collinger, J.C. and **J.A. Wickert**, "Adaptive Piezoelectric Vibration Control With Synchronized Switching," ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, November 10–16, 2007, IMECE 2007-41427.

Tangpong, X.W., **J.A. Wickert**, and A. Akay, "Finite Element Model for Hysteretic Friction Damping of Traveling Wave Vibration in Axisymmetric Structures," ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, November 10–16, 2007, IMECE 2007-41432.

Kartik, V. and **J.A. Wickert**, "Parametric Instability of a Traveling Plate Partially Supported by a Laterally Moving Foundation," ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, November 10–16, 2007, IMECE 2007-41875.

Choi, D.H., H.H. Yoo, and **J.A. Wickert**, "Tolerance Analysis of Dynamic Equilibrium Positions in Multibody Systems Undergoing Prescribed Rotational Motions," ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, November 10–16, 2007, IMECE 2007-42260.

Tangpong, X.W., **J.A. Wickert**, and A. Akay, "Distributed Friction Damping of Traveling Wave Vibration in Rods," ASME Biennial Vibration and Noise Conference, Las Vegas, NV, September 4–7, 2007, IDETC 2007-34135.

Brake, M.R. and **J.A. Wickert**, "Frictional Vibration Transmission from a Laterally Moving Surface to a Traveling Beam," ASME Biennial Vibration and Noise Conference, Las Vegas, NV, September 4–7, 2007, IDETC2007-34292.

Choi, D.H., H.H. Yoo, and **J.A. Wickert**, "Sensitivity Analysis of Dynamic Equilibrium Positions in Multibody Systems Undergoing Prescribed Rotational Motions," ASME Biennial Vibration and Noise Conference, Las Vegas, NV, September 4–7, 2007, IDETC 2007-35538.

Choi, D.H., S.J. Lee, **J.A. Wickert**, and H.H. Yoo, "Tolerance Analysis of a Robot Manipulator Having Uncertainties in Joint Clearance and Axis Orientation," ASME International Conference on Multibody Systems, Nonlinear Dynamics, and Control, Las Vegas, NV, September 4–7, 2007, IDETC 2007-34316.

Foo, J.L., G. Miyano, T. Lobe, and **E. Winer**, "Adaptive Fuzzy Segmentation of Tumors in Three-Dimensional Computed Tomography (CT) Image Data," ASME International Design Engineering Technical Conferences 27th Computers and Information in Engineering Conference, Las Vegas, NV, September 4–7, 2007, DETC2007-35413.

Kalivarapu, V. and **E. Winer**, "A Statistical Analysis of Particle Swarm Optimization with and Without Digital Pheromones," 3rd Annual AIAA Multidisciplinary Design Optimization Specialists Conference, Waikiki, HI, April 23–26, 2007, AIAA-2007-1882.

Waite, T., **Q. Zou**, and **A. Kelkar**, "Inversion-based Feedforward Approach to Broadband Acoustic Noise Reduction," American Control Conference, New York City, NY, pp. 3795-3800, July 2007.

Kim, K. and **Q. Zou**, "Iterative-based Scan-Trajectory Design and Control with Output-Oscillation Minimization: Adhesion Force Measurement Example," American Control Conference, New York City, NY, July 2007.

Kim, K.S., Z. Lin, **P. Shrotriya**, **S. Sundararajan**, and **Q. Zou**, "Iterative Control Approach to High-Speed Force-Distance Curve Measurement Using AFM for Biological applications," IEEE Conference of Automation and System Engineering Scottsdale, AZ, September 2007.

Wu, Y. and **Q. Zou**, "Robust-Inversion-Based 2DOF-Control Design for Output Tracking: Piezoelectric Actuator Example," IEEE Conference on Decision and Control (CDC), New Orleans, LA, December 2007.

**Zou, Q.** "Optimal Preview-Based Stable-Inversion for Output Tracking of Linear Systems," IEEE Conference on Decision and Control (CDC), New Orleans, LA, December 2007.

# PATENTS AWARDED

**K.M. Bryden**, K.A. Bryden, and D.A. Ashlock

United States Patent No. 7,304,228

December 4, 2007

*Creating Realtime Data Driven Music Using Context Sensitive Grammars and Fractal Algorithms*

**Robert C. Brown**, C.R. Wistrom, and J.L. Smeenk

United States Patent No. 7,309,384

December 18, 2007

*Method and Apparatus for Filtering Gas with a Moving Granular Filter Bed*