Iowa State University
Department of Mechanical Engineering

Annual Report
2011-2012

November 2012

Contents

Cover Image: Judy Vance, right, demonstrates a virtual factory in Iowa State University's METaL virtual reality facility. Working in the virtual factory are ME graduate students, left to right, Leif Berg, Meisha Rosenberg and Ryan Pavlik. Photo by Bob Elbert.

Year in Review

Another year has gone by with many more exciting changes in the Department of Mechanical Engineering. I am honored to begin my tenure as the new chair for the outstanding Department of Mechanical Engineering. In my new position, I will continue improving the already excellent education students receive here by exploring ways to better house our growing community of students, faculty, and staff; by updating and improving the teaching laboratories; by increasing internships and international experiences; by recruiting additional excellent faculty, and by increasing diversity at all levels.

The department experienced record enrollment of 1503 undergraduate students, again making mechanical engineering the most popular degree on campus that results in a diploma. With an ever-increasing number of undergraduate students, the need arose for more efficient use of the space in Black Engineering to improve the student experience. Gap-Yong Kim, now promoted to associate professor, served as the ME-lead on the joint IMSE-ME collaborative manufacturing teaching laboratories, created with funding provided by the College of Engineering Dean's Educational Initiative. As a result, 1600 square feet were freed up between the ME and IMSE departments, and the students' hands-on time in the laboratories more than doubled.

Many faculty members were honored this year. James Oliver, who is already the Larry and Pam Pithan Professor of Mechanical Engineering and Director of the Virtual Reality Applications Center, was named a University Professor. Michael Olsen and Xinwei Wang were promoted to full professor, and Terry Meyer was promoted to associate professor with tenure. Song Zhang was named the William and Virginia Binger Assistant Professor of Mechanical Engineering. Assistant Professors Baskar Ganapathysubramaniam and Song Zhang have each received a National Science Foundation CAREER award, and Associate Professor Daniel Attinger was honored with the ASME International Conference on Nanochannels, Microchannels and Minichannels 2012 Outstanding Research Award.

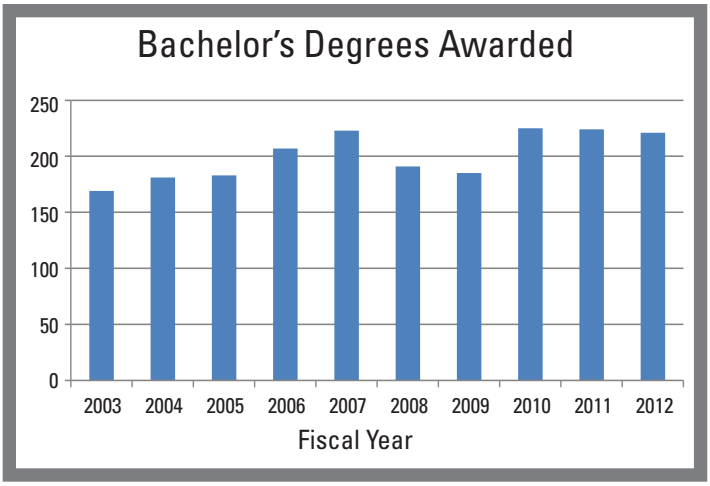
In addition to a new chair, we have many new faces this year in the department. Assistant Professor Ganesh Balasubramanian joins us from Virginia Tech, with research interests in nanoscale transport phenomena, which enables the development of new materials, that store energy or provide exceptional elasticity; these materials are inspired by proteins in insects that help them jump or fly. Assistant Professor and Henry Black Faculty Fellow in Mechanical Engineering Sourabh Bhattacharya comes to the department from the University of Illinois at Urbana-Champaign. His research interests include control of small robots that can roll or fly for use in purposes ranging from security surveillance to crop inspection. Assistant Professor Alberto Passalacqua was a post-doctoral research associate at Iowa State in the Chemical and Biological Engineering Department before coming to the ME Department. He works in the area of computational fluid dynamics of multiphase flows, which assist in understanding phenomena such as how pollutants are dispersed in the environment, or how drugs are delivered in the bloodstream. Associate Professor Cris Schwartz came to ME from Texas A&M, and his research involves biotribology, polymer tribology, wear of biomaterials and the effects of wear debris in vivo. Assistant Professor Mark Mba Wright came from the Department of Chemical Engineering at the Massachusetts Institute of Technology, and his research interests include biofuels as sustainable fuels for cars and trucks, and their economics.

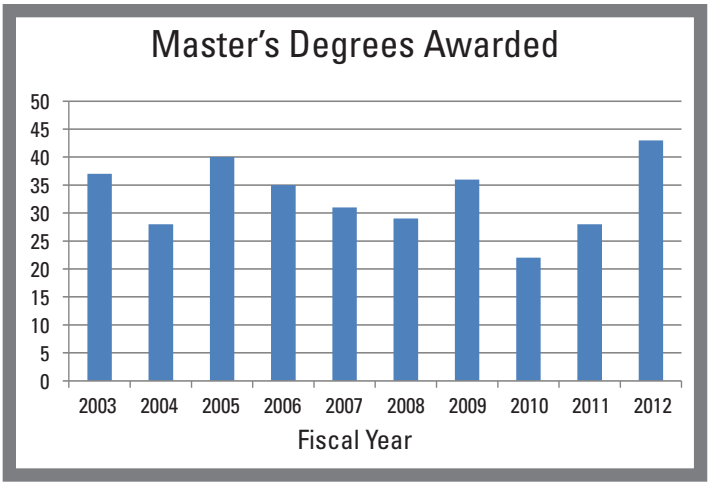
I look forward to tackling the challenges ahead and building on our successes. Thank you to our generous supporters; your investment ensures the continued excellence of our great department. Please stay in touch on our website at www.me.iastate.edu or send us a note.

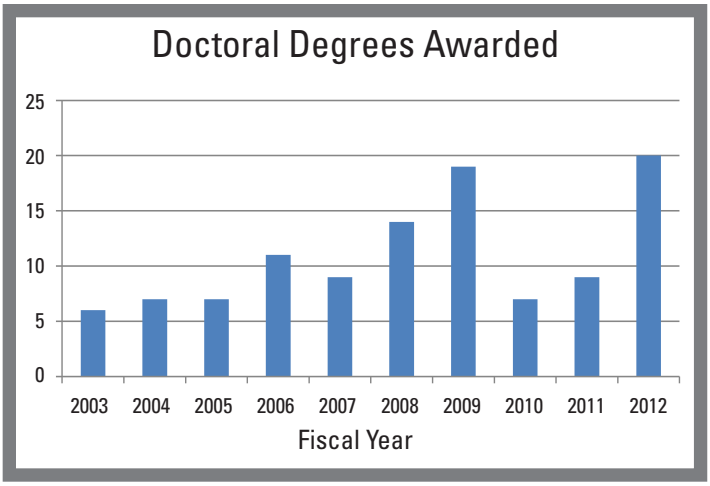
Caroline Hayes
Department Chair
Lynn Gleason Professor of Interdisciplinary Engineering
Department of Mechanical Engineering

ME Statistics

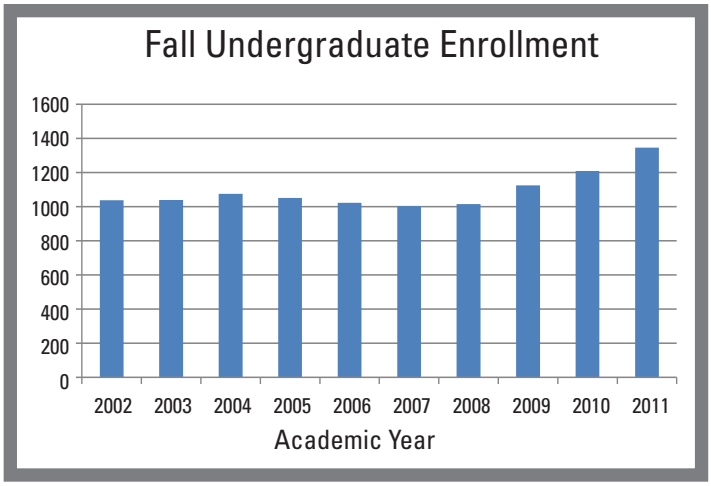
Degrees Awarded

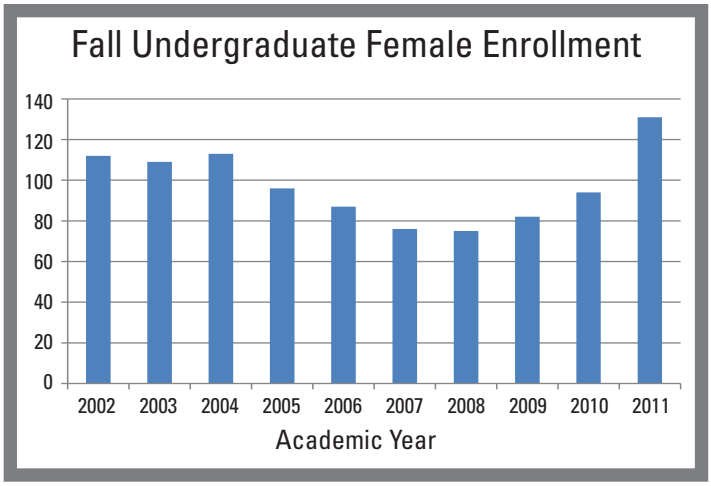


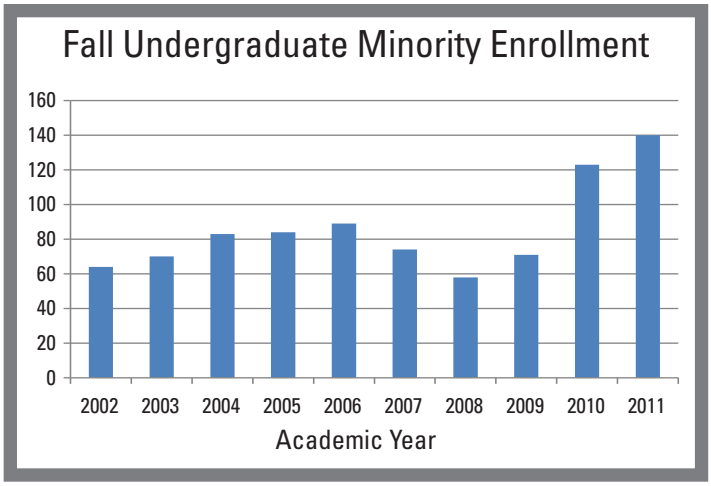




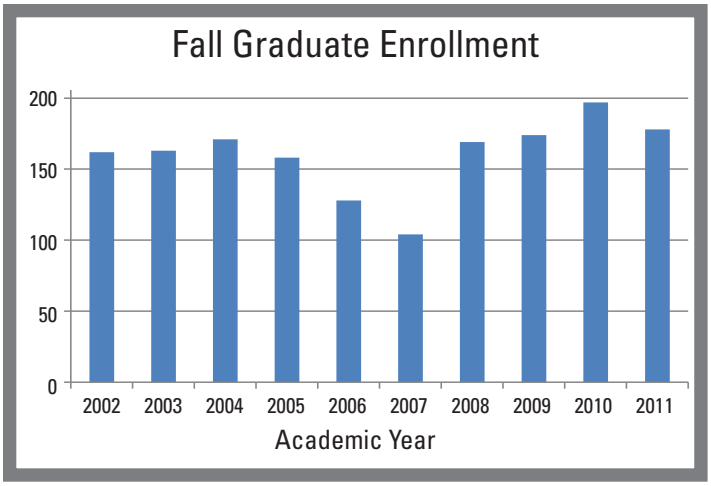
Undergraduate Enrollment

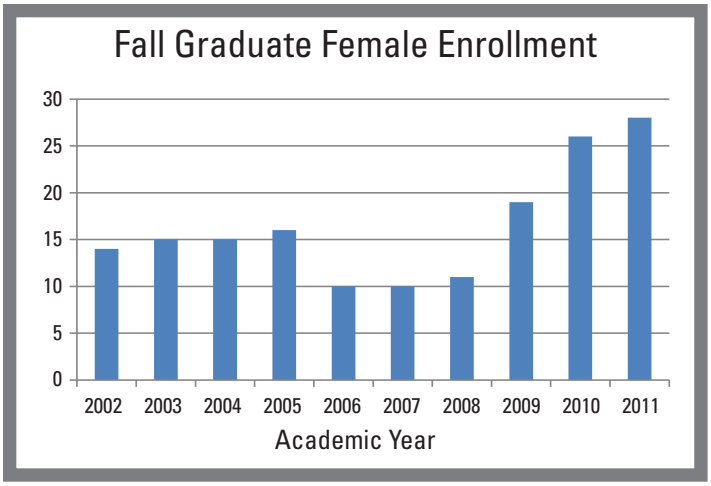


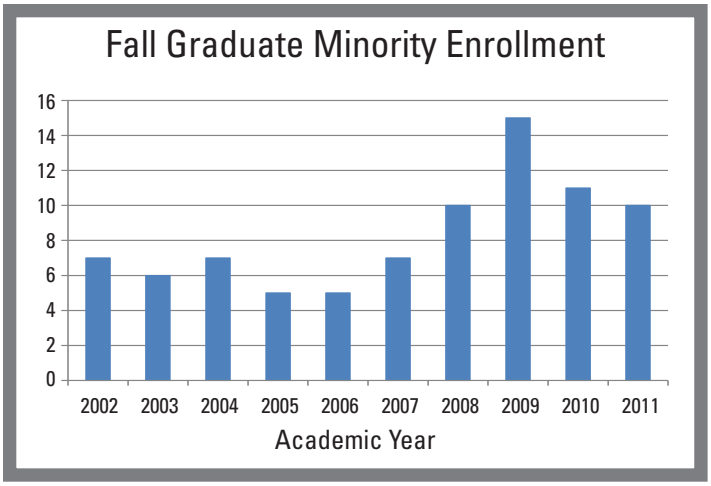




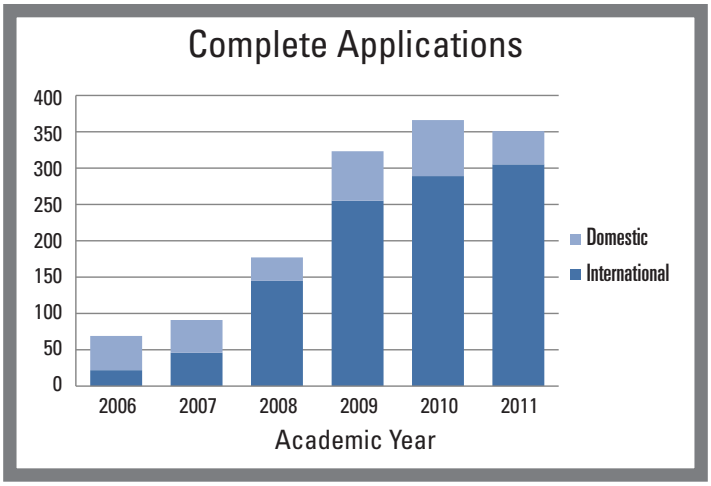
Graduate Enrollment

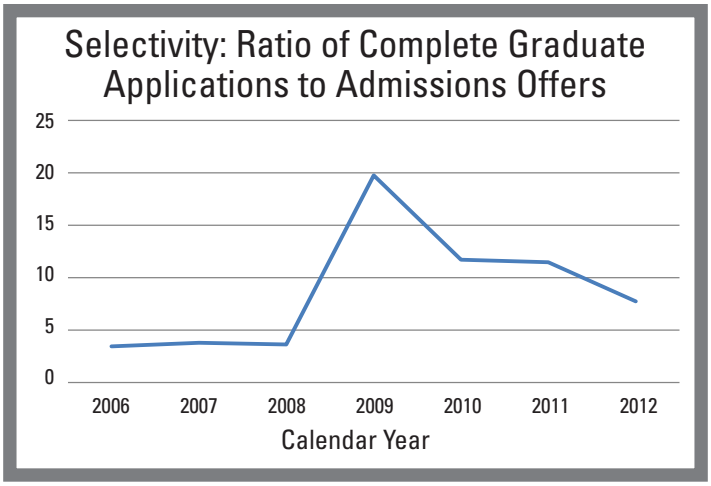


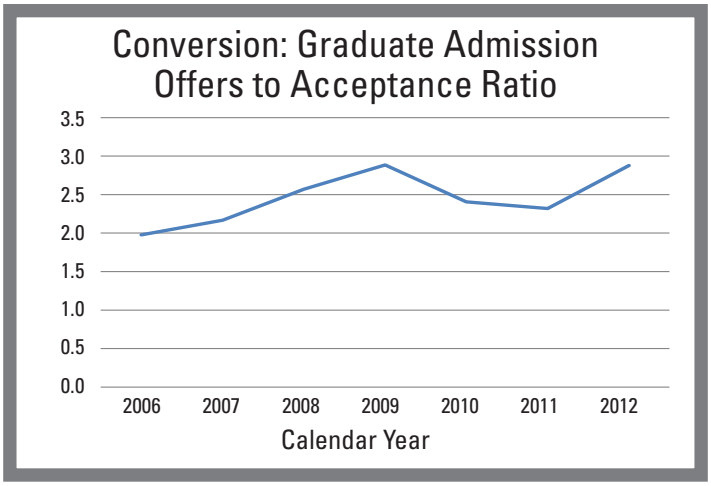




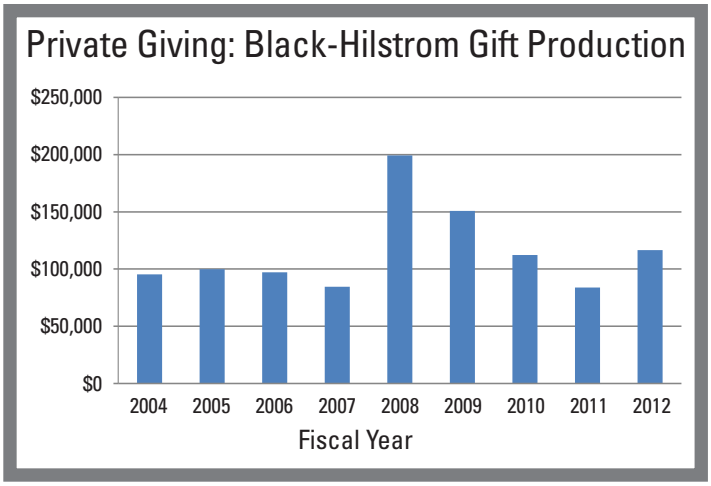
Graduate Program Recruitment

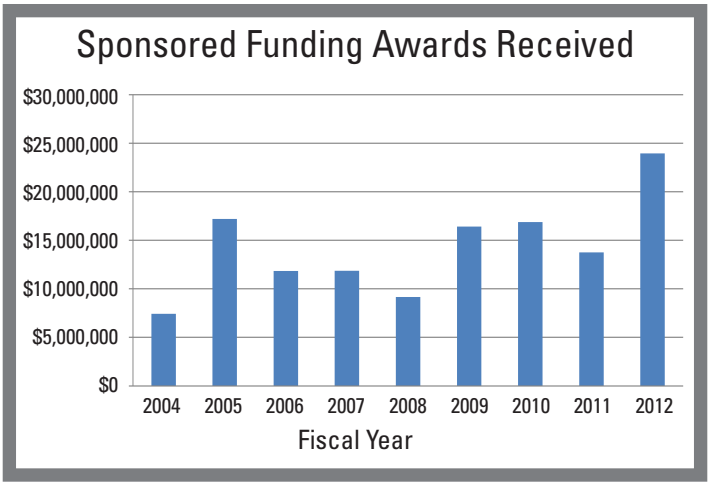


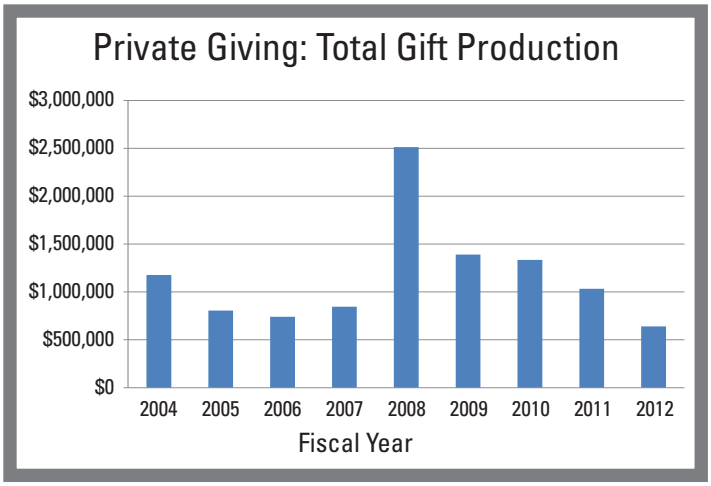


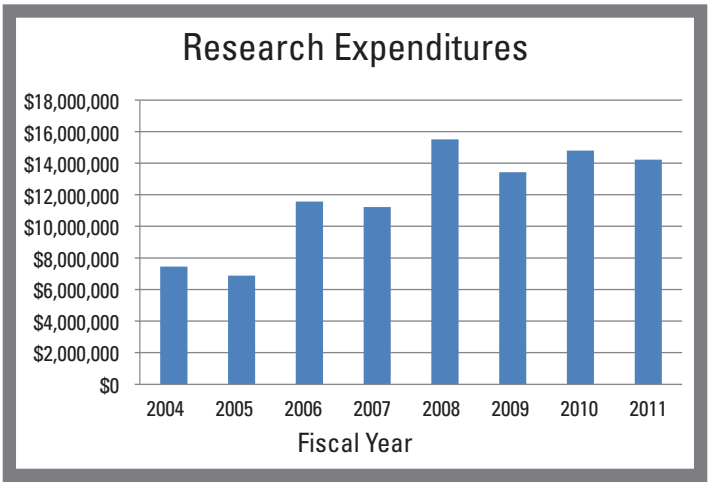


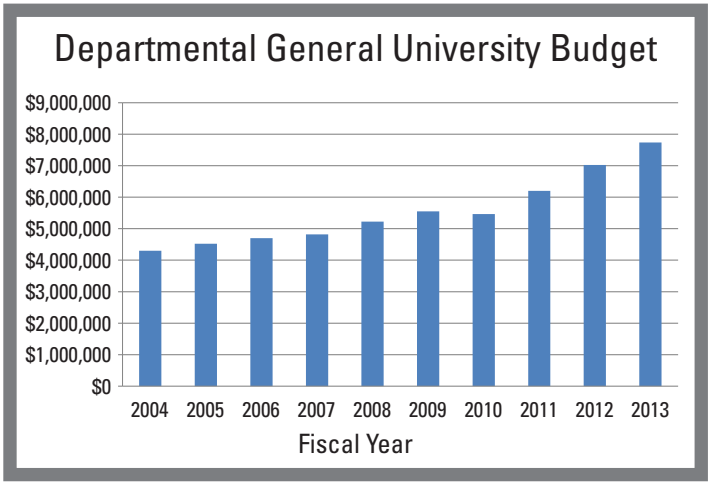
Department Operations











Research

Journal Papers Published	110
Conference Papers Published	65
Doctoral Dissertations	20
Master's Theses/Projects	43

Personnel *(Full-Time Equivalent)*

Tenure and Tenure-Track Faculty	32.03
Non-Tenure Eligible Lecturers	6.67
P&S and Merit Staff	16.06

Professional Society Fellows

American Society of Mechanical Engineers

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

Named Faculty Positions

Anson Marston Distinguished Professor of Engineering
Robert Brown

Bergles Professor of Thermal Science
Ted Heindel

Gary and Donna Hoover Chair in Mechanical Engineering
Robert Brown

Henry Black Faculty Fellow in Mechanical Engineering
Sourabh Bhattacharya

James and Katherine Melsa Professor in Engineering
Jonathan Wickert

Joseph and Elizabeth Anderlik Professor in Engineering
Judy Vance

Larry and Pam Pithan Professor of Mechanical Engineering
Jim Oliver

Lynn Gleason Professor of Interdisciplinary Engineering
Caroline Hayes

Schafer 2050 Challenge Professor
Valery Levitas

William and Virginia Binger Assistant Professor of Mechanical Engineering
Song Zhang

William March Scholar in Mechanical Engineering
Nastaran Hashemi

Research Sponsors

Air Force Office of Scientific Research
Air Force Research Laboratory
American Professional Quilting Systems, Carroll, IA
Ames National Laboratory
Army Research Office
Avello Bioenergy
Bailey Foundation
Bee-Line Equipment
Boeing
California Energy Commission
Conductix-Wampfler, Omaha, NE – Council Bluffs, IA
ConocoPhillips
Deere & Company
Delta Sports Products, Dike, IA
Department of Education
Department of Energy
Department of Energy, National Energy Technology Laboratory
Department of the Army
DuctSox Corporation
Fisher Controls Division, Emerson Process Management
Fraunhoufer Center for Sustainable Research
Honeywell Federal Manufacturing & Technologies
Hy-Capacity, Inc.
Iowa Energy Center
Iowa Office of Energy Independence
Iowa Power Fund
Iowa State University
ISU Research Foundation
Jancy Engineering
John Deere
Kansas City Plant
Midwest Forensic Resources Center (MFRC)
Mobile Track Solution
Montezuma Manufacturing
National Institute of Health
National Institute of Justice
National Science Foundation
Nova-Tech Engineering LLC
NSF CMMI EDI (Engineering Design and Innovation)
Office of Naval Research
Opportunity Village
Paragon International
Physical Optics Corporation
Rockwell Collins
ROUND2 Inc.
State of Iowa Department of Administrative Services
Thombert, Inc.
U.S. DOE EERE
University of Northern Iowa
US Army RDECOM
US Army, Armament Research, Development, and Engineering Center (ARDEC)
US Dept of Energy, Idaho National Laboratory
US Dept of Energy, National Energy Technology Laboratory
US Dept of Energy, Wind and Hydropower Technology Program
USDA NIFA
Winegard Company

Undergraduate Program Highlights

Sriram Sundararajan
Associate Chair for
Undergraduate Studies

Key program indicators
Mechanical Engineering continues to be the most popular major on campus with a record enrollment of 1338 students during the 2011-2012 academic year. The student body profile was 54% Iowans, 36% out-of-state and 10 % international. Of this number, 10% were women and 8% were minorities, both representing increases over the last year. During the 2011-2012 academic year, 229 BSME degrees were awarded. About 83% of our graduates had coop, intern, or summer work experience and about 20% of our students had international study experiences, highlighting real world learning opportunities within our program. The demand for students graduating from the program continues to be strong with more than 92% of our students typically being placed within six months of graduation. The program continues to strengthen its academic offerings with the offering of the Nuclear Engineering Minor and the newly launched Energy Systems Minor.

Industrial/Academic partnerships through design experiences
The senior capstone design course continues to build connections with industrial partners and charitable organizations thereby emphasizing student interaction with professional engineers and clients. Each semester about 15 companies work with student groups on projects. Recent design project have involved collaborations with Iowa companies such as Paragon International, Hy-Capacity Inc., Mobile Track Solutions and Delta Sports Products as well as non-profit organizations including Camp Courageous and Harmony House. The ME Design Expo, organized by the design faculty, continues to provide students with the opportunity to showcase their design projects through poster presentations and demonstrations to the University community and general public.

Recent developments and recognition
With the growing enrollments, the department has strengthened the Kiewit Undergraduate Student Services Center by adding two new staff this past year. Jill Batten brings 3 years of student advising experience at Central College to the position of academic advisor while Mallory McCarty brings student and client interaction skills as a peer mentor and Wells Fargo employee to the position of Program Assistant. Carl Kirpes, a senior in Mechanical Engineering, was selected as a Tau Beta Pi Laureate – one of five selected nationwide. Brent Smith and four other ME students improved upon their ME 270 design for a seed cleaner and deployed it to Uganda to be tested and used by local farmers. The Lunabotics club earned first place in the categories of on-site mining, outreach and communications with their robot ART-E III at the 2012 NASA Lunabotics Mining Competition. The solar car team finished second in the 2012 American Solar Challenge and The BSME program is accredited by the Engineering Commission of ABET and will undergo a review in Fall 2012. The department will report its continuous improvement processes, resulting changes to the curriculum and its procedures, policies and infrastructure in place to deliver its program. The department has completed a year of offering a mechanical engineering version of the freshman engineering class (160), with a focus on mechanical engineering topics and MATLAB as a programming vehicle.

Senior Design Projects

Fall 2011 - ME 415

CIRAS Sponsored Projects

Paragon International – *Electric "Bubble Car"*
- Travis Almond, Nitin Jagwani, Allen Kassen*, Joe Nielsen, Kevin Welsh
- Aaron Bertram, Chloe Dedic*, Mitch Crawford, Stephen Laskowski, Alex Preston
- Mehawesh Alkhalil*, Nick Greif, Jacob Karasch, Anna Pavlou, Abdu Shaikh, Luke Wegner

Mobile Track Solutions, Inc. – *CAT 740 Quick Connect Adaptor*
- Yunzhou Feng, Hao Liu, Aaron Halstrom, Brandon Malaise, Brandon Mogensen*, Steven Wetherell
- Jake George, Jordan Jobes, Stefanie Schwalbe*, Neal Walters

Delta Sports Products – *Bag Target Process*
- Cody Huedepohl, Louis Nauditt, Logan Smith*, Michael South, Erin Toohey
- Mike Eldridge, Brandon Kiel, Blake McClaflin, Kody Oppedahl*

Hy Capacity, Inc – *Thermoplastic Process Design*
- Kris Ahrens, Ahmed Alnosair, Edward Malek, Almir Melkic*, Nan Zhang

APQS, Inc. – *Quilting System Vibration Elimination*
- Ahmed Al-Qashem, Ben Britz, Mark DeShaw, Kevin Hancock*, Jason Rueschhoff
- Adam Bissen*, Li Wei Hoi, Nathan Kotz, Jordan Pascale, Ryan Pecinovsky

Industry Projects

Nova Tech Engineering- *Poultry Handling System*
- Dennis Miller, Brandon Murphy*, William Roberts, Jonathan Walter, Kurt Willms
- Chris Quinnett, Ryan Ogren*, Anders Skaar, Tyler Swenson

Service Projects

Opportunity Village – *Powerlift Walker*
- Hao Bai, Jordan Desmarais, Brian Snider, Kyle White, Kevin Williamson*

ME Department Projects

Dr. Chandra – *CMPG Machine and Controls*
- Wenbin Chen, Marcus Hansen, Seth Nelson*, Stuart Soorholtz, Paul Zunkel

Dr. Luecke – *CAFÉ'2 Smoke Ring Cannon*
- Adam Clark, Evan Cox, Jordan Ruby, Tanner Vos

Student Club Projects

ISU Lunabotics Club – *Mining System Design*
- Saleh Aldawood, Micayla Haugen*, Will Emerson, Spencer Pfeifer, Jue Wang, Johanna Wubbena

SAE Formula – *Data Collection/Telemetry System*
- Kyle Dickinson, Jon Leonard, Greg Tri*, Jay Vreeland, James Whisler

SAE Baja – *Powertrain Design*
- John Graeve, Eric Schluttner, Lowell Stutzman, Justin Upah, Waylon Walker*

Fall 2011 – ENGR 466

CIRAS Sponsored Projects

Bee-Line Equipment – *Vision System Design*
- Austin Cudworth(Mat E), Nathan Leners(AerE), Chadd McCaw*(ME), Michael O'Brien(ME), Ben Tan(AerE)

Student Club Projects

ISU Lunabotics Club – *Lunar Rover Track System*
- Amy Buttolph*(I E), Maxwell McCorkell(AerE), Priscila Torres(AerE), Ward Van Hout(ENGR S), Shun Yoshida(AerE)

SAE Formula – *Driver Aid System*
- Kyle Dickenson(ME), Morteza Khosravi(AerE), Igor Torres(ENGRS), Gregory Tri*(ME), Jay Vreeland(ME)

ISU MAVRIC – *Mars Rover Mechanical Arm*
- Sebastian Golletz(ENGR S), Jacob Monat(AerE), Michael Odarczenko(AerE), Roshani Patel(AerE), Troy Zimmerman*(AerE)

ISU Anglestrike – *Autonomous UAV Design*
- Tor Finseth* (AerE) (Working with Dusty Gutzman)

Team PrISUm – *Vehicle Telemetry System*
- Vishal Bakshi*(CE), Jordan Deutsch(AerE), Sean Pierce(AerE), Brian Rauwald(AerE), Sandra Sunnegardh(ENGRS), Jue Wang(ME)

** Denotes Team Leader*

Spring 2012 – ME415

CIRAS Sponsored Projects

Paragon International – *Electric "Bubble Car"*
- Oleseun Aremu, Tannon Daugaard, Peter Dubenco*, Brett Ebert, Paras Shah, Yi Zhang
- Tricia Salinas, Hedison Doe, Michael Romey, Ann Klein, A.J. Brothersen*, Justin Umlandt
- Craig Janssen, Colton Kennedy, Dan Garvin*, Peter Maki
- Jake Tillotson*, Ben Starits, Muhammid Amir, Ellen Davis
- Alex Ruggenberg, Tim Mildenberger, Alex Fullenkamp, Zach Marcus, Ethan Brinegar, Matthew Titus*

Ag Leader Technologies – *Ramsey Valve Test Stand*
- Tom Naert*, Scott Pape, Nick Gerard, Jordan Calpus, Xingchen Liu (Bruce), Brody Upah
- Jay Ellis*, Xiaochen Liu, Curtis Meier, Jens Pedersen, Abdul Ghani Soufi

Ag Leader Technologies – *Bin Sensor Test Stand*
- Jacob Manken, Nicholas Ludwik, Adam Walker, Dan Newkirk, Anh Ho Qitto, Kyle Longnecker*

Ag Leader Technologies – *Load Pin Sensor System*
- Ryan Uphoff, Ryan Kaufman, Tyler Crowe, Derek Bagley, Evan Zepp*
- Dan Baldwin, Erin Gavin, Tim Jackels, Nick Miller, Eric Trautz, Sarah Wilson*

Ag Leader Technologies – *Wheel Position Sensor*
- Ben Allen*, Lei Huang, Bobby Weinberger, Yik Liang Heng

ConAgra Foods – *Stars and Bars Reclaim*
- Anthony Escher*, Patrick Flaherty, Nathan Risius, Jake Trullinger, Yan Bin Fu
- Travis Larson, Matt Montalbano*, Brandan Sorgatz, Mark Shehata, Heidi Turner

Industry Projects

Caterpillar – *C15 Rocker Arm Assembly Process*
- Bieu Ieong, Josh Ihm, Aaron Kilstofte, Nicole Milliron, Matt Yandell*, Kendall Yeager
- Ben Franzen*, Sonia Jose, Yixin Li, Michael Rasmussen, Ruisi Zhang

Robert Bosch Tool Corporation – *Impact Hammer*
- Jill Middendorf, Ryan Pickens, Leah Merner*, Yvan Gugler, Carl Kirpes
- Cassandra Becker, Dan Forsman*, Barbara Corpman, Jake Streif, Jon Anderegg
- Ross Albert, Anthony Carter, Bryan Krivo, Ben Shander, Songzhe Xu, Josh Knust*

Service Projects

Harmony House – *Recumbent Bicycle for the Blind*
- Derek Roncaioli, Max Perkins, Daniel Schnier, Eric Vos, Trevor Heithoff, Mike Hoff*, Kiley Versluys

Opportunity Village – *Powerlift Walker*
- John Masinick, Holden Sorem, Josh Lau, Kah Wei Chan, Austin Boege*

Student Club Projects

ISU Lunabotics Club – *Mining Systems Integration*
- Aren Hill*, Chris Miller, Mark Friel, Jared Peterson

Spring 2012 – ENGR 466

CIRAS Sponsored Projects

Ag Leader Technologies – *Bin Sensor System*
- Will Edgemond(ME), Vince Ewald(Ag E), Chris Quinnett(ME), Brian Snider*(ME), Ben Starits(ME)

Ag Leader Technologies – *Wheel Position Sensor*
- Jeff Clark*(ME), Andrew Dennis(ME), John Majzner (E E)

Ag Leader Technologies – *Grain Camera System*
- Adam Brandt (I E), Adam Clark(ME), Evan Cox(ME), Justin Huntington*(ME)

Student Club Projects

ISU Lunabotics Club – *Autonomous Nav System*
- Luan Fontanella(ENGRS), Matt Graves (CprE), Daniel Lopes(ENGRS), Ben McNeil*(ME), Riley Thiesfeld(ME)

ISU MAVRIC – *Mars Rover Mechanical Arm*
- Ben Bramer(ME), Brian Hubbard*(ME), Jake Irwin(ME), Kevin Nennig (CprE), Chris Reis (E E)

ISU HABET– *High Altitude Balloon Gandola*
- Zach Carstensen(MatE), James Greco(ME), Kuan-Ruei Lai(ENGRS), Ian Moore*(ME)

Team PrISUm – *Vehicle Telemetry System*
- Jordan Dyar(ME), Evan Stumpges*(ME), Paola Furlanetto(ENGRS)

Student Projects

Amusement Park Ride *(Mentored by Chance Rides, Inc)*
- Hao Bai(ME), Eric Forbes*(ME), Jennifer Grubb (E E), Joshua Phipps(ME), Fatih Turkmen(ME), Karl Youngdahl(ME)

Graduate Program Highlights

Pranav Shrotriya
Associate Chair for Graduate Studies and Research
Director of Graduate Education

Enrollment
In the 2011-2012 academic year, the Department of Mechanical Engineering had 178 graduate students enrolled. The population is broken down as 90 Doctor of Philosophy (PhD), 57 Master of Science (MS) and 31 Master of Engineering (MEN) students. Of these 28 students were women and 10 were underrepresented minority students.

Degrees
The department granted 43 Master's degrees and 20 Doctorate degrees 2011-2012. Upon graduation, 3 PhD students received graduate research excellence awards and 3 PhD students received graduate teaching excellence awards.

Recruitment and Support
351 students applied to our graduate program for admission in 2011-2012. Of these applicants, 71 students were admitted and 41 students enrolled. Overall the department supported 25 students through teaching assistantships and 98 students through research assistantships. In the incoming class, one student was awarded a Miller Fellowship, two were awarded Galloway Fellowships and three students were awarded College of Engineering Fellowships. Chloe Dedic was awarded the prestigious National Science Foundation Fellowship.

Career paths
Our graduates enjoy tremendous visibility among industry and academia. A large fraction of our graduates pursue positions in industry with such renowned companies like John Deere, Caterpillar, 3M, Intel and Garmin, to name a few. Graduates have also found faculty and post-doctoral opportunities with institutions such as Massachusetts Institute of Technology (MIT), Australian National University, Oak Ridge National Lab and Trine University.

Recent developments
The department launched its new coursework-only professional Master's degree program (Master of Engineering) in fall 2009, this program now makes up close to 20% of our student population. Our aggressive recruiting to the graduate program continues to yield rich dividends. Our efforts at increasing the student diversity has also resulted in the program currently having the highest level of women and maintaining the minority student population over the last decade. We have established a Research Symposium which is held in conjunction with an Open House for prospective applicants in the spring semester. The Research Symposium coincides with a department wide graduate student paper competition and research image as art competition. We have also established a National Science Foundation supported REU site on microscale sensing, imaging and actuation (MoSAIc) to aid our efforts for recruiting students, which has resulted in a 10% yield. Graduate program staff has successfully pursued University grants to enhance regional recruitment efforts and increase fellowship monies to attract the best prospects for our program and presented our recruitment efforts at a national conference for graduate enrollment management professionals.

Doctoral Dissertations

Xiangwen Chen
Dissertation: laser-based thermophysical properties measurement and nanostructure diagnostics
Major professor: Xinwei Wang

† † Joshua Drake
Dissertation: hydrodynamic characterization of 3d fluidized beds using noninvasive techniques
Major professor: Ted Heindel

Xiaopeng Huang
Dissertation: thermal transport in low-dimensional complex structures
Major professor: Xinwei Wang

† † Nathan Johnson
Dissertation: village energy system dynamics of an isolated rural west African village
Major professor: K. Mark Bryden

Miao Li
Dissertation: a numerical and experimental study of in-situ no formation in laminar nh3-seeded syngas diffusion flames
Major professor: Terry Meyer

Kristopher Lineberry
Dissertation: the impact of household refrigerator storage conditions on the shelf life of fruits and vegetables
Major professor: Michael Pate, emeritus

§†† Lin Liu
Dissertation: solid oxide fuel cell reliability and performance modeling and fabrication by spray pyrolysis
Major professor: Gap-Yong Kim

William Marsh
Dissertation: identifying and mitigating the cognitive implications of semi-natural virtual locomotion techniques
Major professor: James Oliver

§ David Muth Jr
Dissertation: an investigation of sustainable agricultural residue availability for energy applications
Major professor: K. Mark Bryden

Christian Noon
Dissertation: a volume rendering engine for desktops, laptops, mobile devices and immersive virtual reality systems using gpu-based volume raycasting
Major professor: Eliot Winer and James Oliver

Rajashekhar Sharma
Dissertation: weldability of advanced high strength steels using yb:yag high power laser for tailor-welded blank applications
Major professor: Pal Molian

Adam Shuttleworth
Dissertation: multi-objective optimization based engineering decision tool
Major professor: Atul Kelkar

Vishwanath Somashekar
Dissertation: application of experimental and numerical techniques to microscale devices
Major professor: Michael Olsen

Vidyapati
Dissertation: constitutive modeling of dense granular flow based on discrete element method simulations
Major professor: Shankar Subramaniam

Jia Wang
Dissertation: nonlinear modeling and h-infinity model reference control of pneumatic suspension system
Major professor: Atul Kelkar

Yufeng Wu
Dissertation: fabrication of metal matrix composite by semi-solid powder processing
Major professor: Gap-Yong Kim

Jin Xu
Dissertation: mechanical destruction of biological tissue by high intensity focused ultrasound histotripsy
Major professor: Timothy Bigelow

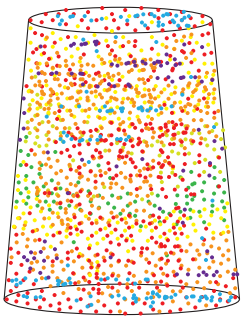
Zhonghua Xu
Dissertation: control tools for rapid broadband nanomechanical spectroscopy using scanning probe microscope
Major professor: Pranav Shrotriya

Yanan Yue
Dissertation: raman spectroscopy-based micro/nanoscale thermal characterization
Major professor: Xinwei Wang

§ Lei Zhang
Dissertation: multicomponent drop vaporization modeling of petroleum and biofuel mixtures
Major professor: Song-Charng Kong

§ Research Excellence Award
† † Teaching Excellence Award

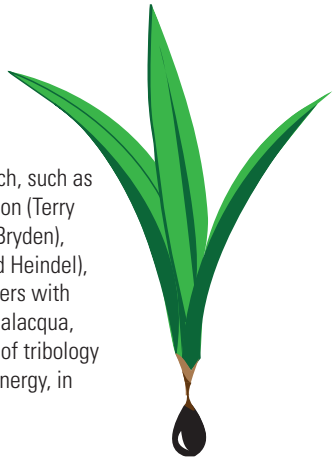
Research Portfolio



Biological and Nanoscale Sciences

Pranav Shrotriya, Faculty Contact

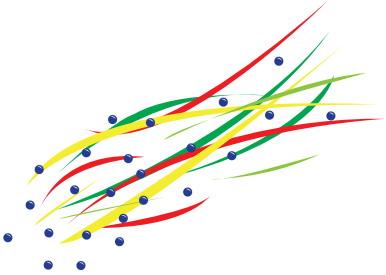
BNS faculty had an extremely productive year for research with numerous journal publications and invited presentations. Prof. Song Zhang and Baskar Ganapathysubramanian were awarded the national science foundation CAREER development award. Prof. Wang and coworkers published the results of their research in Advanced Materials. Prof. Levitas work appeared in the Proceedings of National Academy of Sciences. Prof. Bigelow was appointed as the Harpole-Pentair Assistant Professor and made a presentation at the highly selective 32nd Annual Meeting of the Society for Maternal-Fetal Medicine in Dallas, Texas. In the summer, National Science Foundation supported Microscale Sensing, Imaging and Actuation (MoSAIc) Research Experience for Undergraduates (REU) site hosted the third cohort of ten highly talented undergraduate students from all over the country.



Clean Energy Technologies

Terry Meyer, Faculty Contact

The Clean Energy Technologies (CET) program investigates alternative energy, energy efficiency, and advanced processes and materials that have improved economic and environmental sustainability. Faculty members have been busy with many areas of research, such as the study of fluid flow in algal photobioreactors (Mike Olsen), ultralow emissions diesel engines (Song-Charng Kong), biofuel combustion (Terry Meyer), biochar and algae cultivation (Robert Brown), lipid extraction from microalgae (Tim Bigelow), power plant optimization (Mark Bryden), nanoscale heat transfer (Xinwei Wang), bio-oil gasification (Song-Charng Kong, Robert Brown, and Eliot Winer), biomass pyrolysis (Ted Heindel), organic solar cells (Baskar Ganapathysubramanian), among many others. Mechanical engineering also added three new faculty members with research interests in clean energy, including Mark Wright, who is studying sustainable biomass conversion technologies, Alberto Passalacqua, who is using applying computational fluid dynamics for studies of multiphase flows, and Cris Schwartz, who is looking at applications of tribology to energy conversion. The department has also helped to establish college-wide minors in Energy Systems, Sustainability, and Wind Energy, in addition to growing its departmental Nuclear Energy Minor in collaboration with other Midwest schools.



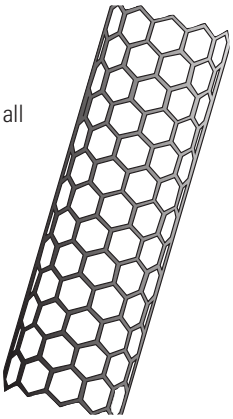
Complex Fluid Systems

Shankar Subramaniam, Faculty Contact

The Complex Fluid Systems (CFS) group is coordinated since Fall 2011 by Associate Professor Daniel Attinger. The CFS group engaged a reflection process to map the existing capabilities of the group according to two aspects of the research of each of its faculty members: (1) the experimental, theoretical or numerical nature of the research and (2) the length scales investigated. Six areas of research were identified where additional hires could be made to strengthen the CFS group. This reflection process was organized to support the large faculty search ongoing in the mechanical engineering department.

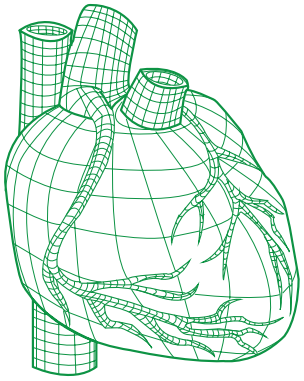
Design and Manufacturing Innovation

Abhijit Chandra, Faculty Contact



The design and manufacturing innovations (DMI) program centers on transforming resources into useful and desirable products cutting across all phases of the design and manufacturing cycle. Novel experimental, computational, and analytical techniques are developed to advance our understanding of these transformation processes, as well as to study practical applications of the fundamental science.

Faculty members in the DMI program have been actively involved in various research areas, which include advanced laser-based manufacturing, sustainable design of products, chemical mechanical polishing of wafers, virtual manufacturing, manufacturing automation, and advanced composite materials. The manufacturing laboratories of DMI program continuous to get better by newly adding a materials testing system and several hardness testing machines. In addition, a Dean's Education Initiative was awarded to the manufacturing program to improve student hands-on learning experiences and to accommodate large class sizes in labs.



Simulation and Visualization

Song-Charng Kong, Faculty Contact

Two assistant professors from Simulation and Visualization Program receive the prestigious NSF CAREER Award this year. Song Zhang's project is aimed at developing a platform for 3D sensing technology. His goal is to achieve "dense superfast 3D sensing of extremely rapidly changing mechanical and biological scenes." One example of application is to use his technology to visualize a live, three-dimensional video of a beating heart and utilize the data derived from the dynamic images to evaluate diseases or even perform surgery. The project by Baskar Ganapathysubramanian is to develop "a predictive modeling framework for exploring process-structure-property relationships in organic solar cells."

Research on organic solar cells has taken off over the past decade due to the affordability of the technology compared to silicon-based solar cells. The proposed computational tools will help classify and characterize the way the plastic thin film cells respond to different conditions and configurations. The success of this research will have great impacts on renewable energy. Other activities of the Simulation and Visualization Program also involves VRAC. VRAC hosted its annual Deere Day which brings scores of representatives from Deere & Co to share ideas and review progress on research projects. VRAC also hosted a Technology Summit that was attended by several industry partners to develop and deploy virtual reality applications within their organizations.

Department Organization

Industrial Advisory Council

The ME Industrial Advisory Council meets in the fall and spring each year. This photo was taken at the Spring 2012 meeting in Ames.

Brett Anderson
Boeing
Brett is an Iowa State BSAE alum and has been with The Boeing Company since 1989. He coordinates with internal and external technology experts to identify short and long term roadmaps to match business unit needs with strategic direction for both technology development and business opportunities.

Scott Bowman
KJWW
Scott is an alum of the ME department and has worked at KJWW Engineering in Des Moines since 1989. His specialties include project delivery, project management, contracts, direct digital controls, energy efficiency, sustainable design, LEED, and commissioning.

Greg Brown, IAC Vice Chair
Orthopedic Surgery, Park Nicollet Clinic
Greg received his BSME at Iowa State and went on to get graduate degrees at MIT and was accepted into Harvard Medical School. Dr. Brown currently serves as the Associate Chief of Surgery for Outcomes for Park Nicollet Services in St. Louis, MN. His current orthopedic practice includes adult reconstruction (joint replacements), trauma (fracture care), and sports medicine.

Craig Connell
Black & Veatch
Craig is a BSME graduate of Iowa State University. Upon graduation, he joined the global engineering and construction company, Black & Veatch. He is currently a Vice President and the director of the Corporate Project Management Office, responsible for establishing policies, practices, systems and tools for management and project controls globally.

Mike Hilby
John Deere
An alum of the department, Mike leads the Operations organization at John Deere Product Engineering Center. He is responsible for the efficient planning and growth of all Global Tractor Platform PV&V facilities.

Mike Jensen
Caterpillar
Mike is a BSME graduate of Iowa State and serves as a Senior Engineering Tech Team Leader at Caterpillar. His activities encompass working enterprise-wide new product development program challenges related to updating the Caterpillar machine product line to meet upcoming diesel engine emissions regulations.

Al Johnson
Cargill
Al is an alum of the department after receiving his BS degree. He joined Cargill in 1987 and has had many positions within the company. He currently serves as Process Improvement Lead for the Tartan program.

Mike Kugel
Pella
Mike is an ISU alum has been employed at Pella since 1997 where he is the engineering manager, leading a team of product design and manufacturing engineers with sustaining engineering and new product development responsibilities.

Cynthia Lord, IAC President
Alliant Energy
Cynthia is a BSME alum of Iowa State and has spent over 27 years in the energy industry. She is a manager in the Generation Engineering department for Alliant Energy, and is responsible for supporting the engineering needs of 15 power plants across Iowa, Wisconsin, and Minnesota.

David O'Brien
Lyondellbasell
Dave is a BSME alum and started at Lyondellbasell as a co-op engineering in 1990. He is currently the Machinery Group Lead and helps perform troubleshooting, executes upgrades, and provides technical support for the operation and maintenance of rotating equipment such as steam turbines, centrifugal compressors, and pumps.

Robin O'Callaghan
Kiewit Power, Inc.
Robin graduated from the ISU ME program and is employed as an operational mechanical engineering at Kiewit Power in Lenexa, KS. Robin has been active in Iowa State recruitment and is a licensed engineer in three states.

Jason Olberding
Emerson Process Management
Jason is an ISU ME graduate and serves as the Special Products Group Manager at Emerson Process Management in Waterloo, IA.

Jeff Rea
Sauer-Danfoss
Jeff received his BSME from Iowa State and has been at Sauer-Danfoss in Ames, IA for the past 6 years. He has held various positions in engineering, quality, manufacturing operations, and program management in the agricultural and construction equipment industries, and the automotive industry over the last 25 years. He is currently the global director within the Propel Division at Sauer-Danfoss.

Nancy Stewart
3M
Nancy graduated from ISU with a BS in mechanical engineering and joined 3M shortly afterwards. She has worked in a variety of positions at 3M and is currently serving on an assignment in the Lean Six Sigma Organization in the Skin & Wound Care Division.

Kyle Wehring
Rockwell Collins
Kyle is an ISU BSME graduate and serves as a design engineer at Rockwell Collins. He is responsible for mechanical design and packaging of electronics for fixed site, ground vehicle, and airborne applications.

Professors

Daniel Attinger
Associate Professor

BE and MS, Mechanical Engineering, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, 1997
Sc D, Technical Sciences, Eidgenoessische Technische Hochschule (ETH) Zurich, Switzerland, 2001

Dr. Attinger's research interests include micro and nanofluidics, convective heat transfer, single droplet/bubble dynamics, visualization, engineering and simulation of multiphase flow, and multiscale transport phenomena for energy and forensics applications.

Ganesh Balasubramanian
Assistant Professor

BS, Mechanical Engineering, Jadavpur University, Kolkata, West Bengal, India, 2007
PhD, Engineering Mechanics, Virginia Polytechnic Institute and State University, 2011

Dr. Balasubramanian's research interests include nanoscale transport phenomena, surface modifications through photoswitchable polymers, development and implementation of multiscale computation techniques, predicting mechanical properties of soft matter and synthetic (bio)materials, and designing novel curriculum for teaching emerging technologies.

Sourabh Bhattacharya
Assistant Professor
Henry Black Faculty Fellow in Mechanical Engineering

Degrees

Dr. Bhattacharya's research interests include optimal control theory, game theory, robotics, compressed sensing, large data storage and inference, security for cyber-physical systems, networked control systems, and machine vision.

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 that use ultrasound in treating cancer, quantifying physical properties of tissue using back-scattered ultrasound signals, applying ultrasound to treat infections, and exploring ultrasound-induced bioeffects for ultrasound safety and therapy applications.

Faculty Highlights

Daniel Attinger was the lead organizer and Chair of the 2011 IMECE Micro & Nano Technology Society-Wide Forum. More than 200 posters were presented, mainly by graduate students, at this event sponsored by the National Science Foundation and by the Materials Division and Nano-engineering Council of ASME. The 22 judges for the poster session were mainly faculty members from research Universities. The top three leaders of ASME (President, President-elect, and Executive Director) attended the award ceremony ($40K of awards) that ended that event. Attinger received a certificate of Appreciation from Vicky Rockwell, ASME president, who promised more support for 2012.

Robert Brown leads Iowa State's Bioeconomy Institute (BEI), which promotes interdisciplinary research in biofuels and biobased products. In the past year, the BEI received over $50 million in new award for research in the field of biorenewables.

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.

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.

Baskar Ganapathysubramanian

Assistant Professor

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

In 2011 **Mark Bryden** coauthored with Ken Ragland, Professor Emeritus at the University of Wisconsin–Madison, the textbook Combustion Engineering. Combustion is a critical issue impacting energy utilization, sustainability, and climate change. The challenge is to design safe and efficient combustion systems for many types of fuels in a way that protects the environment and enables sustainable lifestyles. Emphasizing the use of combustion fundamentals in the engineering and design of combustion systems, this textbook provides detailed coverage of gaseous, liquid and solid fuel combustion, including focused coverage of biomass combustion.

Abhijit Chandra received the David R. Boylan Eminent Faculty Award for Research from the College of Engineering. His work on life prediction of orthopedic implants is being used by Aeculap AG of Germany.

Baskar Ganapathysubramanian achieved extension and preliminary validation of first fully predictive framework for the three dimensional morphology of a thin film organic photovoltaic device, and developed a fault tolerant, adaptive sparse grid collocation framework for solving high-dimensional complex stochastic problems. He developed a framework for analyzing effects of ductwork on efficiency of green buildings.

Nastaran Hashemi

William March Scholar in Mechanical Engineering
Assistant Professor

BS, Mechanical Engineering, Tehran Polytechnic, 1999
MS, Mechanical Engineering, West Virginia University, 2004
PhD, Mechanical Engineering, Virginia Tech, 2008

Dr. Hashemi's research areas of interest include microfluidics, biosensors, optofluidics, Bio-N/MEMS: design, modeling, and fabrication, diagnostics and therapeutics, physics of micro/nanoscale phenomena, and nonlinear dynamics.

Caroline Hayes

Department Chair
Lynn Gleason Professor of Interdisciplinary Engineering

PhD, Robotics, School of Computer Science, Carnegie Mellon University, 1990
MS, Knowledge-Based Systems, Mellon College of Science, Carnegie Mellon University. Interdisciplinary degree between Psychology, Computer Science and Mechanical Engineering, 1987
BS Computer Science, Carnegie Mellon University, 1983

Dr. Hayes's recent focus is on understanding the sociotechnical factors impacting collaboration in globally distributed design teams, and in developing processes and tools to make such teams more effective. Her research has crossed disciplinary boundaries between engineering, psychology, computer science and management.

Ted Heindel

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

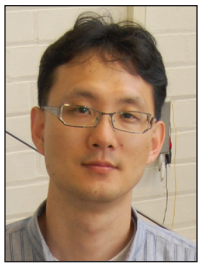
BS Mechanical Engineering, University of Poona, Pune, India, 1984
MS, Mechanical Engineering, Old Dominion University, Norfolk, VA, 1990
PhD, Mechanical Engineering, Old Dominion University, Norfolk, VA, 1993

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.

Faculty Highlights

Nastaran Hashemi published three articles in high impact journals of Biomicrofluidics, Biosensors and Bioelectronics, and Analytical Chemistry. She gave more than seven invited presentations and talks and presented her work in Gordon Research Conferences - Microfluidics, Physics & Chemistry. Her research was selected for publication in the Virtual Journal of Nanoscale Science & Technology and was listed in the Top 20 Most Read Articles Published in Biomicrofluidics in October and November.

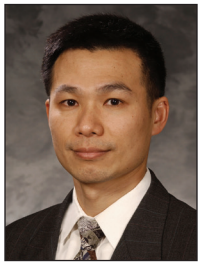
Ted Heindel was elected Fellow in the American Society of Mechanical Engineers (ASME) and received a courtesy appointment in the Department of Chemical and Biological Engineering. He is also leading the effort to develop an undergraduate minor and coursework-only masters of engineering in energy systems.



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
Associate 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

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.

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.

Dr. Kelkar is working with Ames, Iowa startup on the development of new processes and equipment which can be used to recover energy from waste streams such as waste plastics, used oil, and used tires in the form of useful fuels. Dr. Kelkar is also a member of a NASA team engaged in developing methods and tools for early-stage control-relevant design of next generation of Hypersonic vehicles. His impact through entrepreneurial efforts is engagement of ISU faculty from other engineering departments in new research projects through DoD STTR grant. For his contribution to the aerospace field he has been selected to the grade of Associate Fellow of AIAA.

Song-Charng Kong conducts innovative research in exploring alternative engine fuels such as ammonia, mixtures of biodiesel and waste plastics, and mixtures of bio-oil and ethanol. His research also includes biomass gasification and bioenergy systems analysis. He was appointed an associate editor for ASME Journal of Engineering for Gas Turbine and Power and also a member in the editorial board of Internal Journal of Engine Research in recognition of his excellence in engine research.

Faculty Highlights

Dr. MacDonald's research team continues to grow, adding two new graduate and two undergraduate students. She is very grateful for the entire department's support regarding the addition of the youngest new member of the lab, her first child, this past winter. The IRIS lab wishes good luck to postdoc Tahira Reid, as she recently left the lab to join the faculty at Purdue University. Dr. MacDonald presented research findings that indicate it is beneficial to include prediction of landowner participation rates in wind farm layout optimizations at the annual ASME Design Automation Conference, the University of Iowa, and at a meeting of the new Wind Energy Institute at Iowa State University. Her lab also created a new design method to better communicate the sustainability of products; and discovered a relationship between variability in visual perception of products and variability in preference for these products. She advised two NSF REU students this summer and was nominated for the Design Automation Committee's Young Investigator Award (an ASME committee).

Greg Maxwell received renewed support for the Industrial Assessment Center (5 years at $1,000,000), and continued the expansion of the nuclear engineering minor program.

Dr. Terry Meyer received a 5-year National Science Foundation CAREER award for his work on laser diagnostics for combustion and alternative fuels. He also continued as a guest professor at Friedrich-Alexander University in Erlangen, Germany, visiting for a month in the Summer of 2011. He served as chair of two conferences for the Optical Society of America, in addition to co-editing a special issue of Applied Optics.

Pal Molian's research supervision of a female undergraduate student (Roslyn Melookaran) in 2011 led to an archival journal paper: Roslyn Melookaran, Ammar Melaibari, Cheng Deng and Pal Molian, "Laser shock processing on microstructure and hardness of polycrystalline cubic boron nitride tools with and without nanodiamond powders," Materials and Design, 35 (2012) 235-242. Two of Dr. Molian's research papers were among "Top 20 Most Read" according to the Journal of Laser Applications. Source: *http://jla.aip.org/most_downloaded?month=6&year=2011.*

Reza Montazami set up two experimental laboratories: the Smart Materials Laboratory for conducting research on polymeric thin-films, and the Renewable Energy Concepts Laboratory to conduct research on electrofuels and fuel cells.

In 2011, **Dr. Morrow** received an NSF EAGER award for "Large-Scale Equilibrium Design and Pricing under Complex Government Regulations," research that will significantly advance the state-of-the-art in engineering-economic modeling. Dr. Morrow also continued to co-organize the ME Design Expo, an event that gives ISU ME students an opportunity to demonstrate their accomplishments in our many project-based design courses to each other and the public.

Professor Oliver leads ISU's Virtual Reality Applications Center and its graduate program in Human Computer Interaction. His research, teaching, and economic development activities focus on human computer interaction technologies, encompassing computer graphics, geometric modeling, virtual reality, and collaborative networks for applications in product development and complex system operation. His research is supported by a variety of industry partners and federal agencies, and the VRAC supports a broad interdisciplinary constituency that spans the entire university.

Mike Olsen published a paper with Baskar Ganapathysubramanian and graduate student Anthony Fontanini in Energy and Buildings on fabric ducting in HVAC applications that was highlighted in the The HVAC&R Industry eNewsletter from ASHRAE and other trade journals and publications.

Erin MacDonald

Assistant Professor of Mechanical Engineering and of Art & Design

BS, Materials Science and Engineering, Brown University, 1998
MS Mechanical Engineering, University of Michigan, 2004
PhD, Mechanical Engineering, University of Michigan, 2008

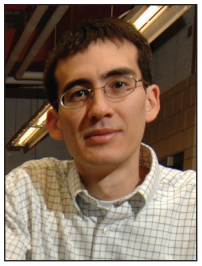
Professor MacDonald researches product design; sustainable design; design optimization; behavioral psychology; construction of consumer preferences; judgment and decision-making regarding products; and cognitive and learning styles.

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

Associate 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.

Reza Montazami
Assistant Professor

BS, Physics and Astronomy, Virginia Tech, 2007
MS, Materials Science and Engineering, Virginia Tech, 2009
PhD, Materials Science and Engineering, Virginia Tech, 2011

Dr. Montazami's researches smart materials and structures, biomimetic materials and devices, nature-inspired soft microrobotics, mems and nems, functional thin-films, polymeric sensors and actuators, and biomaterials for biomedical applications and devices.

W. Ross Morrow
Assistant Professor

BS, Mechanical Engineering, University of Michigan, 2001
MS, Applied Interdisciplinary Mathematics, University of Michigan, 2008
MS, Mechanical Engineering, University of Michigan, 2008
PhD, Mechanical Engineering, University of Michigan, 2008

Professor Morrow works with engineering design; environmentally benign engineering; environmental regulatory policy and engineering design; numerical methods for nonlinear problems; optimization and equilibrium problems; and models of consumer choice.

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
Larry and Pam Pithan Professor of Mechanical Engineering
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.

Michael Olsen
Associate Professor

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.

Faculty Highlights

Dr. Shrotriya served as the Associate Chair for Graduate Studies and Research and worked with department faculty to develop new graduate certificate programs, establish learning community to improve retention of PhD students, recruit highly talented graduate students through targeted pipelines with regional schools and minority serving institutions, develop international exchange and graduate student recruitment programs, implement new professional degree program and improve the diversity of graduate student population.

Shankar Subramaniam received a National Science Foundation award to study the stability limits for gas-solid suspensions using particle-resolved direct numerical simulations. He has also obtained federal funding from the Department of Energy's National Energy Technology Laboratory for collaborative research with a minority institution (Florida International University) to develop a two-fluid drag law for clustered particles using direct numerical simulation. His research develops better multiphase models for computer simulation of CO2 cleanup, and carbon-neutral energy generation technologies such as chemical looping combustion. Subramaniam presented an invited lecture on 'Multiphase Flow Modeling and Simulation' at the Indo-US Science & Technology Forum's Frontiers of Liquid Atomization Workshop held at the Indian Institute of Technology, Madras, India in Dec 2011. He organized a symposium on Multiphase Flow at the Society for Engineering Science's 2011 Annual Meeting at Northwestern University in Evanston, IL. He revamped the computational fluid dynamics laboratory exercise in undergraduate fluid mechanics ME 335 Fluid Flow in Fall 2011 as part of an effort to give students an exposure to modern tools in engineering, and he taught the graduate multiphase flow class ME 632 Multiphase Flow in Spring 2011.

Professor Sundararajan, in his role as Associate Chair for Undergraduate Studies, has overseen the implementation of a sustainable assessment model to support the department's continuous improvement and accreditation efforts. Under his leadership, the Undergraduate Education Committee has made several improvements to the ME curriculum, including expanding the communications requirements and ensuring exposure of freshman to ME content in their first engineering class.

Dr. Vance established a new laboratory: the Multimodal Experience Testbed and Laboratory (METaL). This laboratory consists of large scale stereo projection walls, position trackers, and 3D input devices. It is being used to develop natural interaction techniques to aid in product design.

Alberto Passalacqua

Assistant Professor

PhD, Chemical Engineering, Politecnico di Torino, 2008
MS, Chemical Engineering, Politecnico di Torino, 2004

Dr. Passalacqua's research interests include multiphase fluid dynamics, fluid particle flows, quadrature-based moment methods, uncertainty quantification, computational fluid dynamics and numerical methods for computational fluid dynamics, open-source tools for computational fluid dynamics.

Cris Schwartz

Assistant Professor

BS, Mechanical Engineering, Iowa State University, 1996
MS, Mechanical Engineering, Iowa State University, 1998
PhD, Mechanical Engineering, Iowa State University, 2006

Dr. Schwartz's research interests include biotribology, polymer tribology, wear of biomaterials and the effects of wear debris in vivo, biomedical implant design, and incorporating naturally derived and biodegradable polymers in design.

Pranav Shrotriya

Associate Professor
Associate Chair for Graduate Studies and Research
Director of Graduate Education

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 Undergraduate Studies

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
Joseph and Elizabeth Anderlik Professor of Engineering

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.

Faculty Highlights

Xinwei Wang was awarded two new grants by Kansas City Plant to study the thermophysical properties of diamond coatings. Three Ph.D. students graduated and one of them was awarded the Research Excellence Award. In 2011, Dr. Wang's lab has published 11 papers in highly visible journals like ACS Nano, Small, Journal of Physical Chemistry C, Physical Review B, and Carbon, and has one paper accepted for publication as an invited review in journal "Nano Reviews." Dr. Wang has given 3 invited/keynote talks, and 5 conference presentations. He was elected Associate Fellow of American Institute of Aeronautics and Astronautics (AIAA), and was awarded "Taishan" Foreign Scholar by Shandong Province, P. R. China. He has one book entitled "Experimental Micro/Nanoscale Thermal Transport" in print by Wiley.

Jonathan Wickert

Senior Vice President and Provost, Iowa State University
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

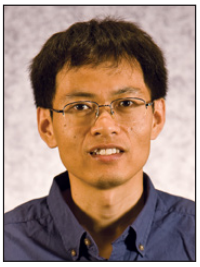
Professor Winer is active in internet technology for large-scale collaborative design; medical imaging, analysis and visualization, multidisciplinary design synthesis, computer aided design and graphics, application in optimal design, and scientific visualization and virtual reality for large-scale design.

Mark Mba-Wright

Assistant Professor

BS, Mechanical Engineering, Iowa State University, 2005
MS, Biorenewable Resources & Technology, Iowa State University, 20
PhD, Mechanical Engineering & Chemical Engineering, Iowa State University, 20

Dr. Mba-Wright investigates the cost and performance of energy systems, researching techno-economics, process modeling, and energy conversion. Recent projects investigated the costs and emissions of biomass conversion to gasoline and diesel. He also researches novel ways of converting biomass into fuels. Current research includes low-temperature thermochemical conversion (torrefaction and pyrolysis) of lignocellulosic biomass into platform chemicals and fuels.



Song Zhang

William and Virginia Binger Assistant Professor of Mechanical Engineering

BS, Precision Machinery & Precision Instrumentations, University of Science & Technology of China, China, 2000
MS, Mechanical Engineering, Stony Brook University, 2003
PhD, Mechanical Engineering, Stony Brook University, 2005

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

Faculty Highlights

Research in **Dr. Eliot Winer**'s lab is focusing on allowing enhanced exploration of digital medical data has been transitioned into a commercial product. It is currently being used at a major US hospital for planning radiation oncology treatments and organ transplant procedures. Dr. Winer was on research teams that attracted more than $1.5M in new funding to ISU.

Dr. Song Zhang was awarded NSF CAREER grant and one US patent in 2011, and had 12 journal papers and 3 book chapters published or accepted. One journal paper was featured on the cover, another one was highlighted by Optics InfoBase as the Image of the Week, and the third one was among the top 5 most cited papers in the past 5 years published by Journal of Optics and Lasers in Engineering. His students won a number of awards including the NSF graduate research fellowship, the research excellence award, and the HCI student of the year award.

Faculty Highlights

Emmanuel Agba is the major adviser to the PrISUm Solar Car Team. The team raced to 4th position in the 2011 Formula Sun Grand Prix solar car racing at the Indianapolis Motor Speedway.

Sebastien Feve developed and/or co-developed several team-based projects in ME170 exposing freshman students to reverse engineering, rapid prototyping and computer-aided manufacturing through hands-on, open-ended design projects.

Matt Hagge wrote a journal article based on work after completion of PhD, completion of ME 231 course based on student understanding, FE Exam Review.

In 2011, **Jim Heise** introduced 29 projects into the ME Capstone Design Program for senior design courses ME415 and 466. Of those projects, thirteen were co-sponsored by ISU Extension CIRAS in support of Iowa manufacturers; two were for out-of-state corporations; 12 projects were associated with student club design competitions; one project was for an extended care facility in northern Iowa; and two were for M E department faculty projects. Jim's summer efforts were to assist Dr. Ron Cox and the College of Engineering to adopt practices used by the M E Department to help other department efficiently manage company-sponsored capstone design projects. Jim also accompanied ISU's Lunabotics Club to the 2nd annual NASA Lunabotics Mining Competition at the Kennedy Space Center; the team made a good showing but did not place.

Gloria Starns is working with linguists, psychologists, physicists and engineers to better understand how students go through the process of setting up and solving problems; the ultimate objective of this work is to develop systems that will help students successfully frame complex problems.

Lecturers

Emmanuel Agba
Senior Lecturer

PhD, Mechanical Engineering, Florida Atlantic University
M Eng, Mechanical Engineering, University of Benin, Nigeria
B Eng, Mechanical Engineering, University of Benin, Nigeria

Interests: Product realization, product lifecycle management, virtual manufacturing engineering, computer-aided engineering

David Asjes
Lecturer

BS, Engineering, U.S. Naval Academy, 1985
MS, Aeronautical Engineering, Naval Postgraduate School, 1992
MA, National Security, Naval War College, 1998

Interests: Control theory, optimal and robust control, multi-disciplinary design optimization, aeroservoelastic modeling

Sebastien Feve
Lecturer

MS, Mechanical Engineering, Ecole Nationale d'Ingenieurs de Metz, France, 1998

Interests: Tire research, fundamentals of thermodynamics, engineering education, international & study abroad opportunities

Matt Hagge
Lecturer

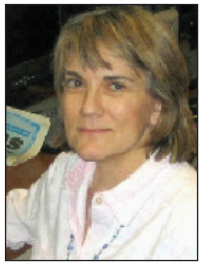
PhD, Mechanical Engineering, Iowa State University, 2005
MS, Mechanical Engineering, Iowa State University, 2002
BS, Mechanical Engineering, Iowa State University, 1998

Interests: Computational modeling, wood, combustion, pyrolysis, thermodynamics, and visualization of bloodstain pattern analysis

Jim Heise
Lecturer

MS, Mechanical Engineering, Iowa State University
BS, Mechanical Engineering, Iowa State University
AS, Mechanical Engineering Technology, Hawkeye Community College

Interests: Product design engineering, project management, design for Lean Sigma®/Six Sigma®



Gloria Starns
Senior Lecturer

PhD, Mechanical Engineering, Iowa State University
MS, Mechanical Engineering, Iowa State University
BS, Mechanical Engineering, University of Kentucky

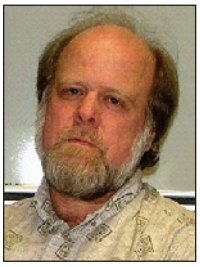
Interests: Private consulting, project engineer for a commercial refrigeration manufacturer

Adjunct and Courtesy Appointments

Ashraf Bastawros
Adjunct Associate Professor
Aerospace Engineering

BS, Mechanical Engineering, Cairo University, Cairo, Egypt, 1988
MS, Mechanical Engineering, Cairo University, Cairo, Egypt, 1991
MS, Applied Mathematics, Brown University, Providence, RI, 1995
PhD, Engineering, Brown University, Providence, RI, 1997

Dr. Bastawros' research interests include micro and nano surface machining, experimental methods to study structure-property relationships, thermo-mechanical characteristics of porous solids and biological materials, mechanics of cellular materials, and mechanics of manufacturing processes at the micro/nano scale.



Joseph Gray
Adjunct Associate Professor
Physicist, Center for Nondestructive Evaluation

BA, Physics and Mathematics, University of Colorado, 1977
MS, Physics, Pennsylvania State University, 1980
PhD, Physics, University of Michigan, 1985

Dr. Gray works on nondestructive evaluation techniques using x-ray and neutron radiography methods and modeling of x-ray and neutron image formation process.

Wei Hong
Courtesy Assistant Professor
Aerospace Engineering

PhD, Engineering Sciences, Harvard University, 2006
MS, Engineering Mechanics, Tsinghua University, Beijing, China, 2002
BS, Engineering Mechanics, Tsinghua University, Beijing, China, 2000

Dr. Hong's research interests include solid mechanics, soft materials, smart materials and structures, fracture and microstructure evolution, and multiphysics modeling and simulation.

Michael Kessler
Courtesy Associate Professor
Materials Science and Engineering

BS, Mechanical Engineering, LeTourneau University, 1996
PhD, Theoretical and Applied Mechanics, University of Illinois at Urbana-Champaign, 2002

Prof. Kessler is an expert in the mechanics, processing, and characterization of polymer matrix composites and nanocomposites.

John McClelland
Adjunct Associate Professor
Senior Physicist, Ames Laboratory

BS, Physics, Dickinson College, 1965
PhD, Physics, Iowa State University, 1976

Dr. McClelland's research interests include molecular spectroscopy of materials and analytical instrument automation.

Richard T. Stone
Courtesy Assistant Professor
Industrial and Manufacturing Systems Engineering

BS, MIS, The Rochester Institute of Technology, 1999
Adv. Cert, Environmental Management Science, 2002, Robotics and CAM, 2001, The Rochester Institute of Technology
MS, IT with concentration in Robotics and W/M programing, The Rochester Institute of Technology, 2001
PhD, Industrial and Systems Engineering, The University of Buffalo, SUNY, 2008

The core of Dr. Stone's research is in human performance enhancement in both physical and mental domains. He employs multiple approaches toward this goal, including cognitive and physiological engineering, classical and experimental ergonomics, augmented reality, and the incorporation and application of new technologies.

Staff

Kiewit Undergraduate Student Services Center

Jill Batten
Academic Adviser

Mallory McCarty
Program Assistant

Kevin Osgerby
Academic Adviser

Jessica Van Winkle
Academic Adviser

John Wagner
Academic Adviser, Advising Center Coordinator

Johna Wolfe
Academic Adviser

Business Office

Mary Bilstad
Program Coordinator

Carol Knutson
Account Clerk

Clare Polking
Program Assistant

Alex Rausch
Communications Specialist

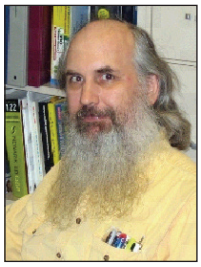
Deb Schroeder
Secretary

Denise Wright
Administrative Specialist, Assistant to the Chair

Laboratory and Information Technology

Sandy Bremer
Teaching Laboratory Coordinator

Joel Buehler
Systems Support Specialist



Jim Dautremont
Laboratory Mechanical Technologist

Nate Jensen
Systems Support Specialist

Wyman Martinek
Teaching Laboratory Coordinator

Hap Steed
Manager, Technical Services

Graduate Program Office

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Bill Cook
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Paul DeJong
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Max Gassman
Jerry Hall
Alexander Henkin
Alfred Joensen
George Junkhan
Pat Kavanagh
Charles Mischke
Ted Okiishi
Mike Pate
Leo Peters
Dick Pletcher
Don Roberts
George Serovy
Howard Shapiro
Bernard Spinrad

Publications

Peer-Reviewed Journal Publications

Agba, Emmanuel. 2011. Characterization of Aluminum Rib Distortion under High Speed Machining. i-manager's Journal on Mechanical Engineering 1 (4): 20 – 26.

Garty, G., M. Grad, B. K. Jones, Y. Xu, J. Xu, G. Randers-Pehrson, **D. Attinger**, and D. J. Brenner. 2011. Design of a Novel Flow-and-Shoot Microbeam. Radiation Protection Dosimetry 143: 344-348.

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Jarboe, L. R., Z. Wen, D.W. Choi, **R. C. Brown**. 2011. Hybrid thermochemical processing: fermentation of pyrolysis-derived bio-oil. Applied Microbiology and Biotechnology 91:1519–1523.

Brown, T. R., M. M. Wright, and **R. C. Brown**. 2011. Estimating profitability of two biochar production scenarios: slow pyrolysis vs. fast pyrolysis. Biofuels, Bioproducts and Biorefining 5: 54–68.

Patwardhan, P., D. Dalluge, B. Shanks, and **R. Brown**. 2011. Distinguishing primary and secondary reactions of cellulose pyrolysis. Bioresources Technology 102: 5265-5269.

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Hou, D., F. Zhang, C. Ji, T. Hannon, H. Zhu, Z. Wu, **V.I. Levitas**, and Y. Ma. 2011. Phase Transition and Structure of Silver Azide at High Pressure. Journal of Applied Physics 110: 023524.

Levitas, V.I., and M. Javanbakht. 2011. Phase-field approach to martensitic phase transformations: Effect of martensite-martensite interface energy. International Journal of Materials Research 102(6): 652-665.

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Ji, C., F. Zhang, D. Hou, H. Zhu, J. Wu, M.-C. Chyu, **V.I. Levitas**, and Y. Ma. 2011. High pressure X-ray diffraction study of potassium azide. Journal of Physics and Chemistry Solids 72(6): 736-739.

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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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