IOWA STATE UNIVERSITY
Department of Mechanical Engineering

Annual Report
2013-2014

November 2014

Contents

Cover Image: Black Engineering Building

Dear Colleagues and Friends,

I am proud to share with you the growth and success of our department this past year, and also excited for the accomplishments that lie ahead of us. This annual report serves as a compilation of highlights from the 2013-2014 academic year in Iowa State's Department of Mechanical Engineering.

Mechanical engineering was again Iowa State's most popular undergraduate major, with enrollment reaching 1918 students in Fall 2014. The department's faculty and students demonstrated their excellence through academics, research undertakings, awards and competitions. Our graduate program rose in the rankings to No. 36 nationally in U.S. News and World Report's list of America's Best Graduate Schools, and is ranked 21st overall among public institutions.

Several student organizations achieved remarkable success in their respective competitions. The Baja SAE team raced their off-road vehicle in all three competitions sanctioned by SAE International, earning two endurance titles and best-ever overall finishes of third and seventh place. Team PrISUm and their solar car, Phaeton, qualified for the American Solar Challenge, a 1,700 mile race from Austin, Texas to Minneapolis, Minnesota. The team finished third overall and won Best Mechanical Design. The Cyclone Space Mining team, supervised by Senior Lecturer in Mechanical Engineering Jim Heise, earned their spot in the "World Cup" of robotic space mining in Hilo, Hawaii, where they won first place for Best Design and Innovation and second place for Mining.

Senior Michael Solberg won Iowa State's Student Employee of the Year Award for his work with the ISU BioCentury Research Farm. Mahdi Javanbakht, postdoctoral research associate in mechanical engineering, won the 2014 Karas Award for Outstanding Dissertation with his dissertation, "Phase-field approach to surface induced phase transformations and dislocations."

Professor Xinwei Wang was elected a fellow of the American Society of Mechanical Engineers (ASME). Dr. Wang's research has long focused on laser-material interaction, but a new project funded by the U.S. Department of Energy is investigating thermal transport in nuclear materials. Song Zhang, William and Virginia Binger Assistant Professor of Mechanical Engineering, was named a fellow of the Society of Photo-Optical Instrumentation Engineers (SPIE), and worked with doctoral student Nik Karpinsky to develop real-time, 3-D teleconferencing technology.

The department is excited to welcome six new faculty members this fall. Assistant Professor Jonathan Claussen joins us from George Mason University, and his research group focuses on understanding and developing science and technology that interfaces with biology on the nano/microscale. Assistant Professor Shan Hu recently received her Ph.D. from the University of Minnesota after moving to the U.S. from China to pursue higher education. She is interested in nanomaterials for energy storage and energy harvesting and scalable manufacturing of nanomaterials-based devices. Assistant Professor Rafael Radkowski conducts research in augmented reality, and object tracking in particular. He began his research career at Universität Paderborn in Germany, and came to Iowa State first as a visiting researcher, then as a postdoc in 2012. Assistant Professor Soumik Sarkar received his Ph.D. in mechanical engineering from Penn State University in 2011, and his areas of research interest include diagnostics, prognostics and supervisory control of complex cyber-physical systems and human-machine interaction. New Assistant Professor Adarsh Krishnamurthy is interested in researching biomechanics, finite element analysis, patient-specific modeling, computational mechanics, geometric modeling, computer-aided design and manufacturing and computer graphics. Assistant Professor Sonal Padalkar comes to ISU from Northwestern University, where she worked as a postdoc studying atom-probe tomography. She is focusing her work on various characterization techniques to solve complex problems in research.

I hope, though this report, you enjoy learning more about our community. We are proud of our past achievements and look forward to providing the best possible environment for continued learning and discovery.
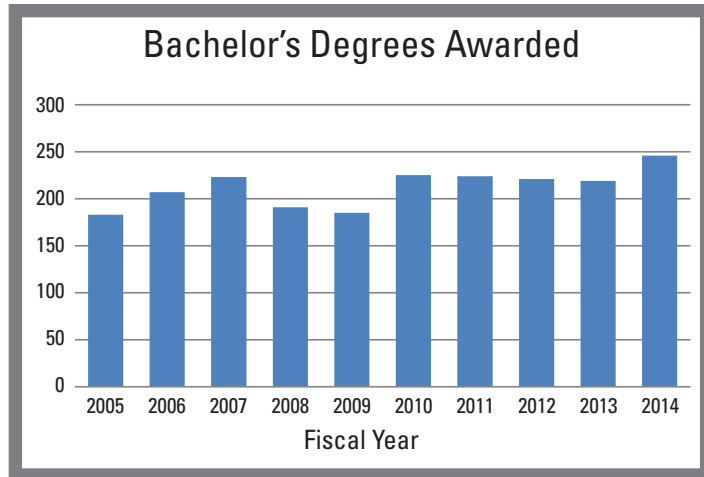
With kind regards,

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

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

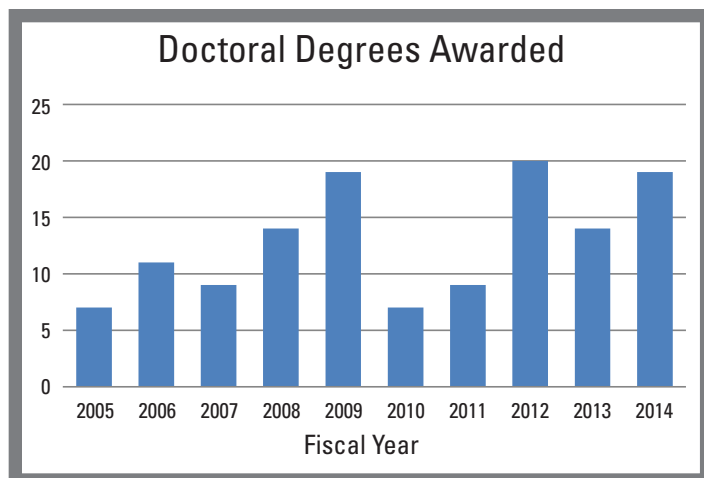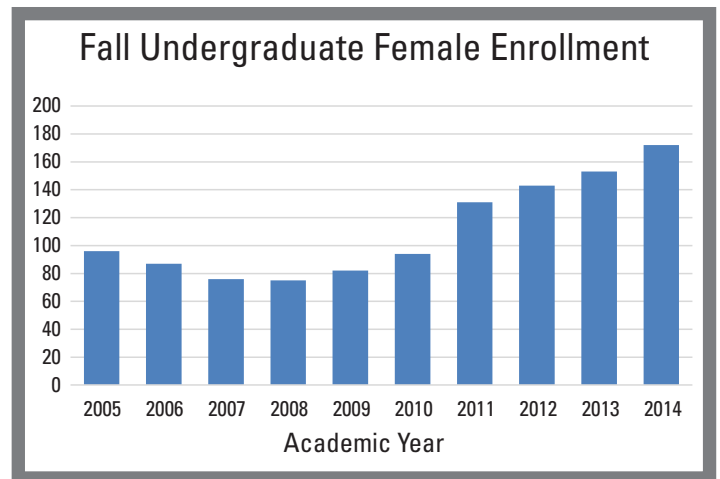# Graduate Enrollment

Fall Graduate Enrollment

Academic Year

Fall Graduate Female Enrollment

Academic Year

Fall Graduate Minority Enrollment

Academic Year
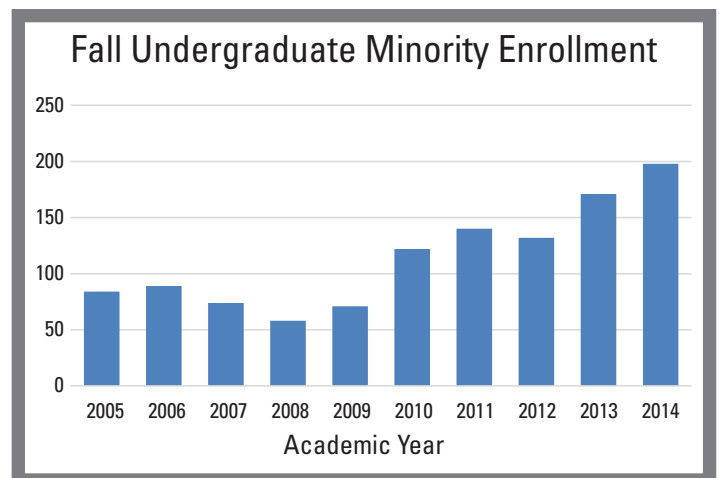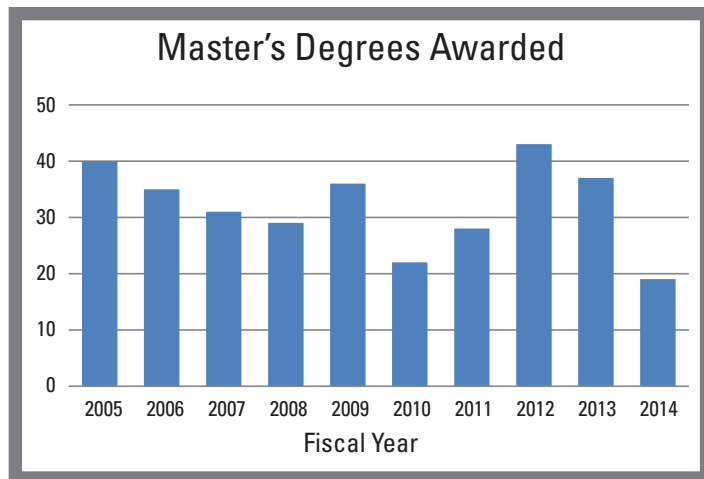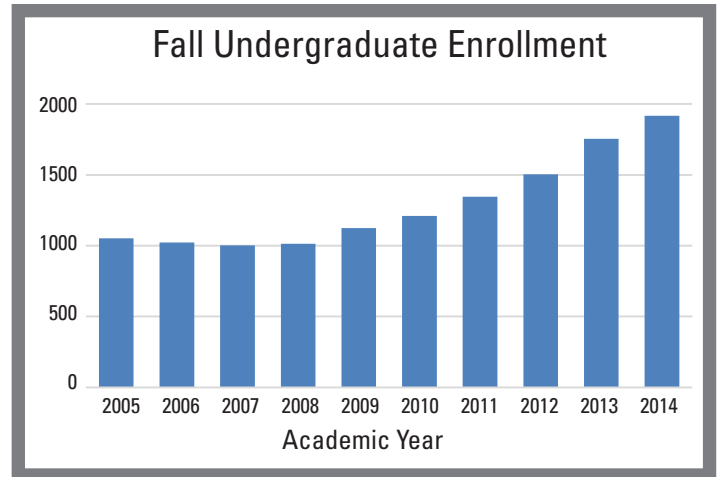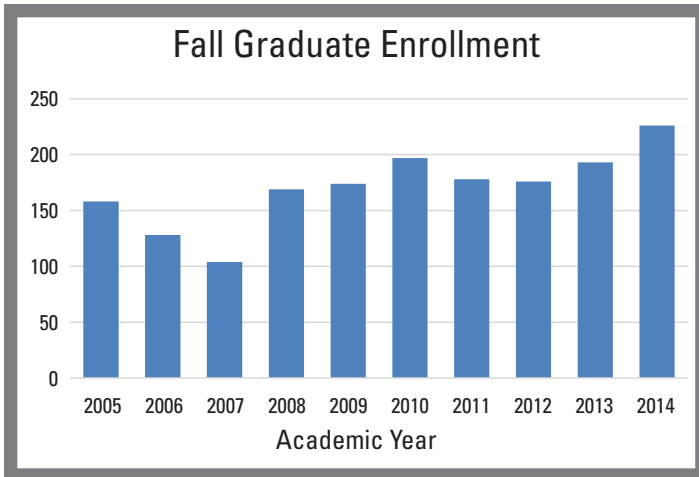
Graduate Program Recruitment

Complete Applications

- Domestic
- International

Academic Year

Selectivity: Ratio of Complete Graduate Applications to Admissions Offers

Calendar Year

Conversion: Graduate Admission Offers to Acceptance Ratio

Calendar Year

5
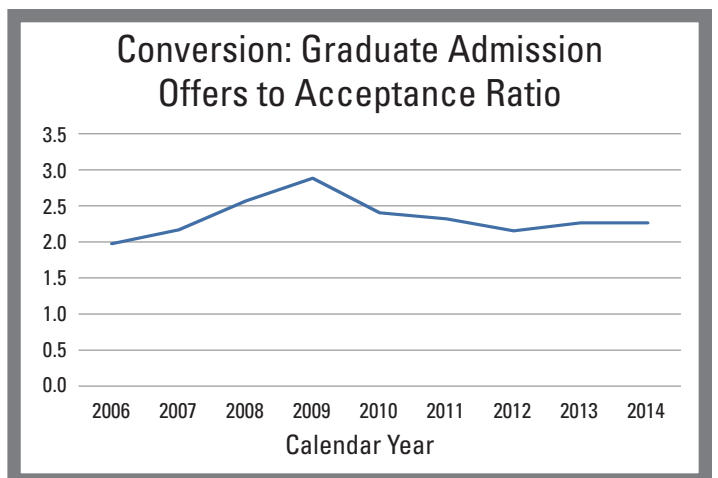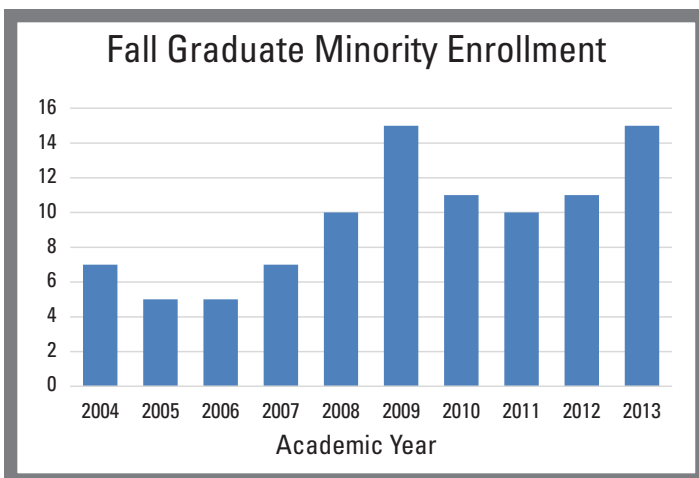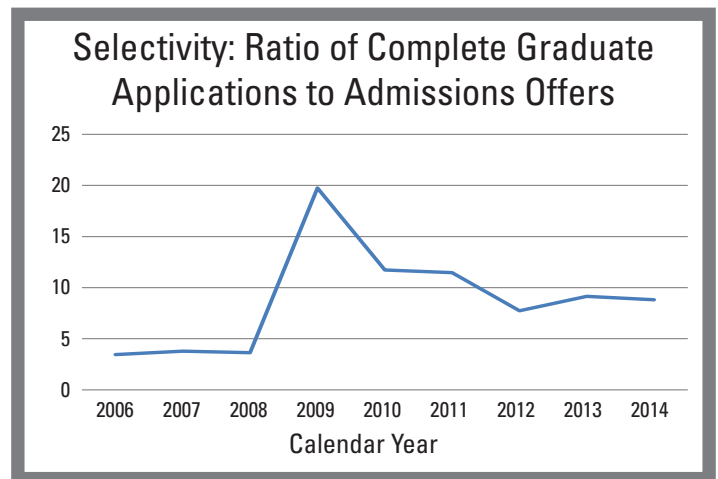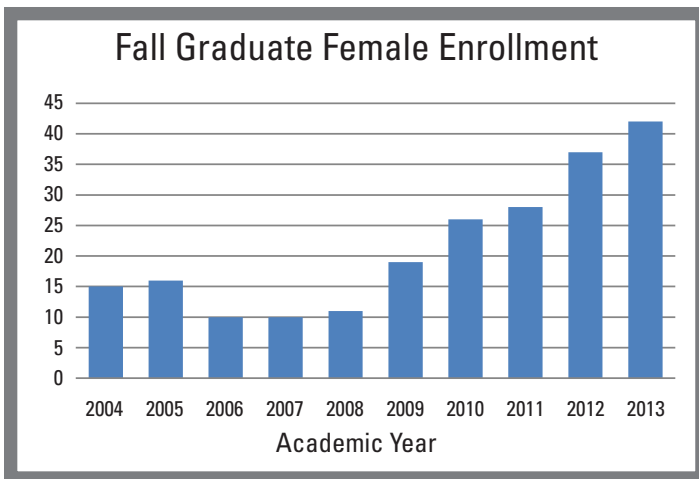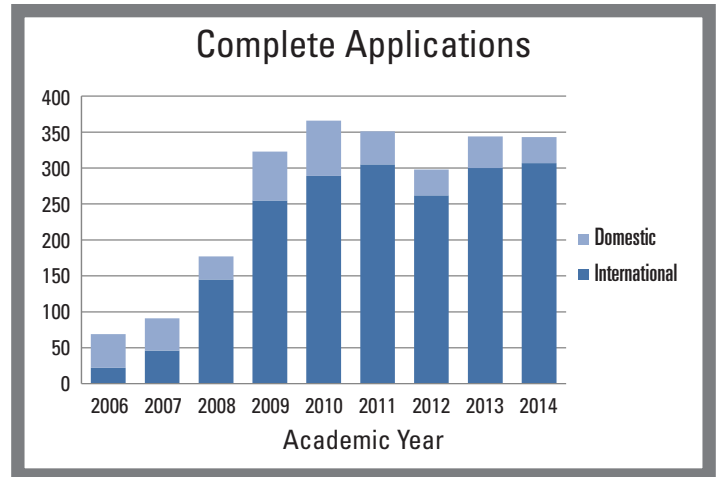
Department Operations

Private Giving: Black-Hilstrom Gift Production

Bar chart showing values from 2005 to 2014 (Fiscal Year), with a y-axis from $0 to $250,000. Peak at 2008 near $200,000.
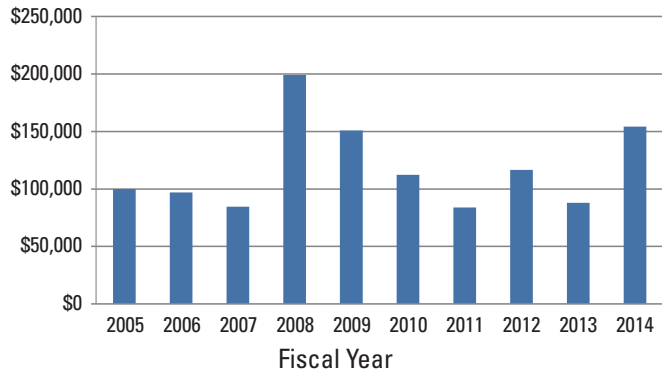
Sponsored Funding Awards Received

Bar chart showing values from 2005 to 2014 (Fiscal Year), with a y-axis from $0 to $30,000,000. Peak at 2012 near $24,000,000.
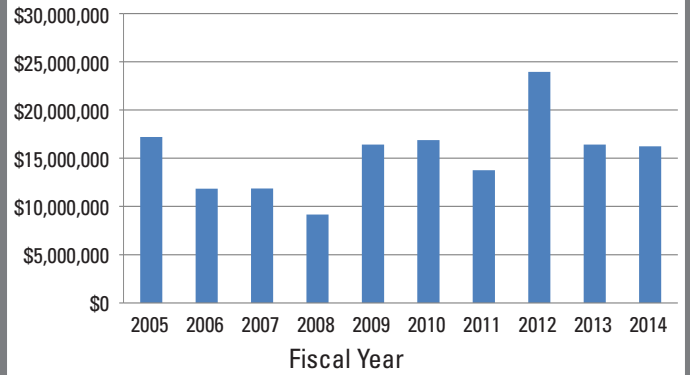
Private Giving: Total Gift Production

Bar chart showing values from 2005 to 2014 (Fiscal Year), with a y-axis from $0 to $3,000,000. Peak at 2008 near $2,500,000.

Research Expenditures

Bar chart showing values from 2004 to 2013 (Fiscal Year), with a y-axis from $0 to $18,000,000. Peak at 2008 near $15,500,000.
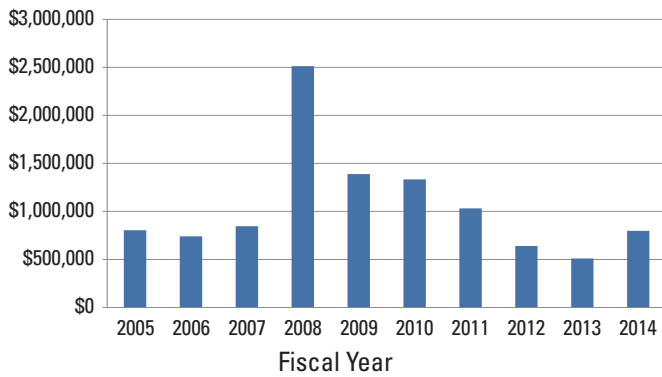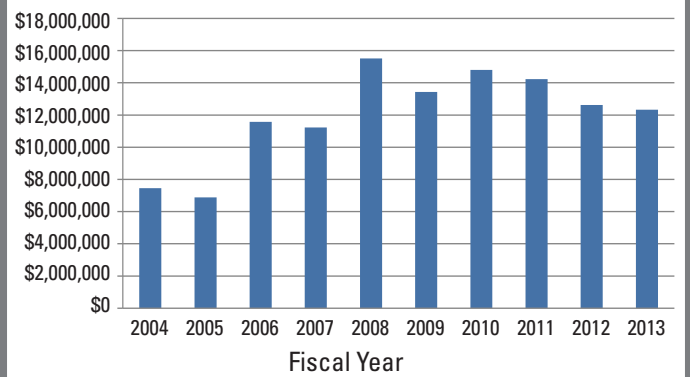
Departmental General University Budget

Bar chart showing values from 2006 to 2015 (Fiscal Year), with a y-axis from $0 to $12,000,000. Increasing trend, peak at 2015 near $10,300,000.
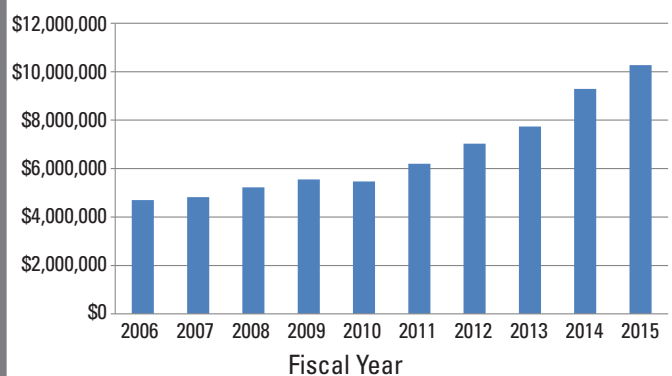
Research

Journal Papers Published	144
Conference Papers Published	173
Sections/Chapters in Books	9
Books	3
Patents	4
Doctoral Dissertations	19
Master's Theses/Projects	19

Personnel *(Full-Time Equivalent)*

Tenure and Tenure-Track Faculty   38.9

Non-Tenure Eligible Lecturers   8.1

P&S and Merit Staff   21.3

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

Professional Society Fellows

American Society of Mechanical Engineers

Robert Brown	Jim Oliver
Abhijit Chandra	Judy Vance
Caroline Hayes	Xinwei Wang
Ted Heindel	Jonathan Wickert
Atul Kelkar	

Society of Photo-Optical Instrumentation Engineers

Song Zhang

Research Sponsors

Advanced Renewable Technology International

Archer Daniels Midland Company

Battelle Memorial Institute-Pacific Northwest National Laboratory

Boeing Company

Caterpillar Inc

Deere & Company

Dod-Army Research Office (Aro)

Doe-Us Department Of Energy

Dot-Us Department Of Transportation

Ecoengineers

Exxonmobil Research And Engineering Company

Fraunhofer Center For Sustainable Energy Systems

General Dynamics

Meadwestvaco Corporation

Micro-Vu

Nsf-National Science Foundation

Phillips 66 Company

Rockwell Collins

Sabic Petrochemicals Bv

Sauer-Danfoss Inc

Spectral Energies Llc

Uchicago Argonne Llc-Argonne National Laboratory

University Of California San Diego

Winegard Company

Program Performance Indicators

Mechanical Engineering continues to be a very popular major nationwide, and the same holds true at Iowa State. We are the largest major at ISU with an undergraduate enrollment of over 1900 students, making us one of the largest ME undergraduate programs in the nation! Though there have been significant pressures related to rapid enrollment growth, our department has been able to graduate over 300 students in the past academic year. Our diversity as a major continues to grow, with 10% of our students from underrepresented minority groups. With an enrollment of over 170 female students, ME is also one of the most popular majors for women at ISU. Mechanical Engineering students are also some of the most active at ISU with regards to off-campus educational experiences. Almost 280 of our students did an internship or co-op last year, while almost 60 students did an international study abroad.

Cris Schwartz
Associate Chair
for Undergraduate
Studies

Recent Developments

A number of personnel additions occurred over the past academic year. Taylor Shire took the position as Program Assistant to the Undergraduate Program in November. She is the first person to fill this newly created position to help support the department during continued enrollment growth. In the Kiewit Undergraduate Student Services Center, three new advisers have joined the department. Lisa Phillips joined the department and brings a wealth of knowledge from the perspective of her last appointment in Admissions. Alyssa Mittleider brings her experience as an adviser in Psychology to the ME department. And Mallory Quinn transitioned from her previous role as Advising Program Assistant into her current post as an Academic Adviser. Rounding out the team of new hires is Hazel Peterson who took over as Advising Secretary.

Senior Design Projects

ME 415 – Fall 2013
CIRAS Sponsored Projects
Ag Leader – *GPS Mast Lift System*
 • Stephen Shaw, Andrew Schmitz, Kimberly Kehoe, Kelby Budzine
 • Jacob Brenneman, Chen Chen, Joseph Howard, Michael Peterson, Jason Schluttner*

Diamondback LLC – *ECP Laundry Concept*
 • Jonathan Garrett, Hannah Rundell, Nathan Walkner*, Ashland Westfall
 • Mohammad Hamid, Matt Schram, Mohammad Shaharii, Andrew Van Beek*

Kreg Tools – *Self Adjusting Pliers*
 • Scott Burke, Tim Foster*, Doug Masek, William Sullivan
 • Matthew Wagner*, Josh Hermsen, Stephanie Palacheck, Daniel Oftelie

Montezuma Manufacturing (Cosma) – *Floor Assembly Unload System*
 • Darrin Toney*, Adam DeWolf, Chloe McPherson
 • Ryan Schaefer*, Jon King, Dan Conzett

Paragon International – *Electric tricycle chassis design (w/ INDD/ENGR/EE)*
 • Tim Massie*, Josh Benson, Dhanraj Selvaraj, Partick Jahn

Paragon International – *Quick Connect Coupler for Cotton Candy Machine*
 • Aliff Ahmed, Derek Roberg, Alex Schultz, Ryan Wiest
 • Joseph Dohn*, Shane Lyons, Christoper Rogeness, Joe Stamschror

Terex Crane – *Hybrid crane system (Collaboration with EE)*
 • Adam Donohoe*, Kevin Funke, Alex McCune, Migara Perera
 • Dakota Allen, Yabin Liu, Josh Magill, Caleb Van DeStroet*

Thombert – *Lifting Device for Large Wheel Molding*
 • Mathieu Langeslag, Daniel Taylor, Tobias Brandter, Mike Leonard*
 • Dylan Egger, Travis Frazier*, Dustin Harris, Jianqiu Huang, Thomas Martens

Truart Graphics – *Calendar Binding System*
 • Allen Barrow, Alicia Maher, Matthew McHugh*, David Murray, Patrick Rasmussen
 • Thor Anderson, Peng Li

UL- Newton – *Type B Goniophotometer (collaboration with EE)*
 • Li Chang*, Derrick Hill, Max Hirsch, Elmira Kireeva, Arthur Silva
 • Rob Hanson, Alex Holmes, Nathan Martin, Ben McFarland*, Wendy Van Winkle (Team BRAWN)

Vermeer – *Horizontal Drill Stakedown System*
 • Jacob Riese*, Mark Saul, Julia Sothman, David Williamson, Yi Zhang
 • Kate Brown*, Seth Lang, Joseph Shatek, Alisha Daly

Victor Mfg (Cosma) – *Tote Exchange System*
 • Tim Kooiker, Kevin Bergler*, Brandon Espe, Brittany Bakan
 • Daniel Christensen, Michael Heinz*, Jack Lorch, William Scott

Service Projects
Crossroads Park Elementary – *Ipad device aids for child with ACP*
 • Spencer Johnson, Henry Kelley, Tyler Kramer*, Erik Olson, Josh Pederson

Department Projects
Dr. Greg Luecke (Mechanical Engineering) – *CAFÉ system redesign*
 • Abdulla Abusharkh, Adam Padget, Garrett Smith*, Reed Wagenbach

Dr. Greg Luecke (Mechanical Engineering) – *Brake pedal system for simulator*
 • Kieran Jansen*, Joel Newton, Hoang-Son Nguyen, Nicholas Wong, Drew Zieger

Student Club Projects
SAE International – *Small Engine Dynamometer Stand*
 • Timothy Beavers*, Brian Jend, Kyle Shadle, Justin Brinkman

* Denotes Team Leader

Senior Design Projects

ENGR 466 – Fall 2013
CIRAS Sponsored Projects
Ag Leader – *Weather Station Design/Test*
- Will Heimbuch, Jordan Banwart, Lars Carlberg
- Nick Krauel, Tim Steider, Zachariah Rueger

HON – *Stacking chair design (collaboration with INDD)*
- Kunwei Liu, Szuyin Leow, Megan Kaufman, Jake Scheirer

Paragon – *Bubble Car Systems Body/Interior*
- Mya Easaw, Eric Chon, Yang Hong, Halli Winter

Industry Projects
Altec Engineering – *Hand Control System (Joystick Controller)*
- Aaron Darnell, Ryan Hall, Alex Hay
- Tom Schnieders, Melinda Laszlo, Petter Norder

Department Projects
Integrated Studio Arts Department – *Recycled Plastic School Furniture for Ghana*
- Kellen O'Brien, Marie Kuhlmann, Brenda Klutzke, Zane Pennock, John Hupp

ADRC (Aerospace Engineering) – *Asteroid Rover Systems – NZG Attachment and Collection System*
- Peter Jorgensen, John Keilman, Tim Quetsch

ADRC (Aerospace Engineering) – *Asteroid Rover Systems – Solar Steam Propulstion System*
- Paul Snyder, Josh Lehs, Brittany Petrick

Student Club Projects
Lunabotics – *Autonomous Navigation System and Software*
- Nathan Beougher, Ryan Fear, Ryan Hupp

ENGR 466 – Spring 2014
CIRAS Sponsored Projects
Paragon International – *Electric Vehicle*
- Troy Bowers, Trevor Kehoe, Robert Polinchock, Jaren Turner

R-Pipe – *R-pipe product development*
- Cody Ahrendt, Rachel Hauber, Bobbie Heimberg; Ngoc Le

Weiler – *Asphalt Paver Autodrive System*
- Brian Forsberg, Patrick Hage, Samuel Kelly, Andrew Moore, Letian Yang
- Thor Anderson, David Kominek, Yi Liu, Yaze Wang

Department Projects
ADRC (Aerospace Engineering) – *Attach and Collect in zero gravity*
- Sanel Lisinovic, Diana Jarrell, Matthew Harvey, Danielle Maier

ADRC (Aerospace Engineering) – *Steam Propulsion System*
- Cody Lynne, Kevin Carlson, Brandon Schmidt

Assa Abloy (Industrial Design) – *Zero Transfer Thermal*
- Conner Bealer, Jackson Hemberger, Linden Terpstra

HPV Club/Industrial Design – *High Speed Bicycle Record Attempt*
- Bryan Hayward, Steven Zimmerman; Peter Pisarik,Nathan Carper

Integrated Studio Arts Department – *Recycled Plastic School Furniture for Ghana*
- Ryan Bachman, Michelle Brus, Tianyu Yang

Boeing/Industrial Design – *Aircraft Monuments Design*
- Lizzy Bertelson, Ellen Cram, Matthew Dryden, Alex Himschoot, Caitlin O'Loguhlin, Ben Nosek

Spring 2014 – ME 415
CIRAS Sponsored Projects
Diamondback LLC – *Wash system design and test*
- Lindsey Bahaj, Karem Elbaz, Todd Gutschenritter, Jeff Makinster
- Mohd Hamid, Ryan Jennings, Ahmad Md Nor, Mohamad Syahir, Jonathan Tweedt, Robert Vierhout

Emerson Process Management – *Valve Actuation Force control*
- Cody Brown , Benjamin Perna , Justis Robson, Matt Skarshaug *, Kyle Sogard
- Lindsay Coons , Ryan Creegan , Kyle Hausladen *, Megan Scott , Chau Tan

Hach Inc – *Level-loaded vacuum chamber to safely dry indicator in glass vials*
- Jonathan Bauer, Ryan Diemer, August Logsdon*, Daniel Tell
- Mitchell Amundson, Pradhyumma Ramesh, Mark Sanocki*, Xiangpeng Yang

Harrisvaccines – *Vaccine bottling process*
- Nathan Carper, Yu Cui, Wesley Derrick*, Jeffrey Gorrie, John Maust
- Jared Infelt, Trigg Ruehle, Brian Sund, Ethan Wickerman, Corey Wilson

John Deere Ottumwa – *Glass break test fixture and glass panel material selection*
- Goran Dobrosavljevic, Jay Graham, Emily Hansen, Kurt Sandholm
- David Donnici, Mitch Hagen, Joe Nettleton, Brady Schmidt, Harrison Thede

Kreg Tool – *Adjusting Clamp Pliers*
- Justin Depew, Brett Pollock, Yan Tian, Michael Tlach*, Kaleb Vorwald
- Qi Fan, Xingyuan ma, Christopher Mach*, Killian McInerney, Marco Wirtz

Paragon – *Electric Vehicle*
- Geoffrey Dammann, Thomas Lowder, Wyatt Seals*, Jared Turner

Roto Rooter – *In-Drain Camera System*
- Jordan Choate*, Daniel Concannon , Jacob Hoffner , Ryan Nelson, Zachary Van Wettering
- Miles Adkins, Joseph Bauer , Nathan Bjerke*, Dong Gao , Daniel Kerkove

R-Pipe – *Composite Pipe Casting Machine*
- John Deutsch, Roslyn Melookaran, Robert Tebben, Jianan Wu
- Grant Anderson, Kathryn Fell, Brady Greer, Wesley Hutter, Kyle Torkelson, Letian Yang

Terex – *Frame Stiffness of Truck Crane*
- Kevin Hartke*, Kaiyu Li, Tom, Mlynarczyk, Ryan Weber
- Braden Bormann, Jordan Boyenga, Jordan Kanter, Nathaniel Taylor, Benjamin Venturi

Veridian Limited – *Vacuum pack process for Firefighter clothing*
- Hazwan Hashim, Yuyang Jin*, Nathan Miner, Ben Nowak
- Xin Chen, Isaac Coleman, Andrew Paulsen, Thomas Sniffin

Vermeer – *Horizontal Drill Simulator station design*
- Michael Ball*, Alec Brown , Brett Cowen , Christopher Meadows , Tria Vang
- Seth Enke, Ian Jordan, Alex Knee, Shubang Sridhar , Claire Turner*

Outreach Projects
West Des Moines Schools – *Crossroads Park Elementary "Team Sam" Project*
- Emily Alexander , Lisa Garrett *

Department Projects
Dr. Sriram Sundararajan (Mechanical Engineering) – *Material wear test fixture*
- Ricardo Canahui Artola*, Mallory Honkomp , Justin Swick , Lauren Wickham-Kolstad

Dr. Greg Luecke (Mechanical Engineering) – *Smoke Cannon*
- Matthew Mouw, Dillon Wirth, Haichen Huang

Seabee Corporation (Agriculture Engineering) – *Hydraulic Cylinder Fluid Cushion model and design traits.*
- Kathryn Hinkle

Student Club Projects
ISU Lunabtoics Club – *RASCAL rover development*
- Corey Anderson, Alex Avendano, Michael Huston, Dillon Kramer, Evan Lowther, Ben Reuter

Enrollment
By the end of the 2013-2014 academic year, the Department of Mechanical Engineering had 200 graduate students enrolled.

Degrees
The department granted 19 Master's degrees and 19 Doctorate degrees during the 2013-2014 academic year. Upon graduation, six Ph.D. students received research excellence awards and five were awarded teaching excellence awards.

Recruitment and Support
469 students applied to our graduate program for admission in fall of 2013, spring of 2014 or summer of 2014. Of those applicants, 108 students were offered admission and 81 offers were accepted. The department supported 54 students through assistantships.

Recent Developments
Iowa State now offers a course-work only, online Master's of Engineering degree in Energy Systems Engineering. The program is an interdepartmental effort developed to give students and working professionals a chance to move into an emerging field. Ted Heindel, Bergles Professor of Thermal Science in the Department of Mechanical Engineering, is serving as director of graduate education for the program. The program consists of 10 classes and requires that students take ME 531: Advanced Energy Systems and Analysis and ME 510: Energy Engineering Economics and Policy, along with a math or statistics course and a professional development course. Electives for the program fall within a variety of energy-related areas including: biorenewables, wind, nuclear, power generation and distribution, building energy and energy efficiency, and thermal science. Students take three courses in a single focus area, and the remaining courses can be selected from a long list of options that cut across engineering disciplines. Additionally, the department has introduced a new online graduate certificate in Energy Systems Engineering. This 12 credit program allows student to take two core courses online and choose two electives from a variety of online courses.

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

Doctoral Dissertations

Le Chen
Dissertation: Wind farm layout optimization under uncertainty with landowners' financial and noise concerns

††§ Dustin Lee Dalluge
Dissertation: Optimization of biomass fast pyrolysis for the production of monomers

§ Nikolaus Lee Karpinsky
Dissertation: Portal-s: High-resolution real-time 3D video telepresence

†† Ravi Kolakaluri
Dissertation: Direct numerical simulations and analytical modeling of granular filtration

Najeeb M. Kuzhiyil
Dissertation: Pyrolytic sugars from cellulosic biomass

††§ Xiao Ma
Dissertation: Electrostatic actuation based modulation of polar molecules and associated force interaction studies

††§ Jing Ren
Dissertation: Micro/nano scale surface roughness tailoring and its effect on microfluidic flow

†† Jinjuan She
Dissertation: Designing features that influence decisions about sustainable products

Sujith Sukumaran
Dissertation: Numerical modeling of pollutant emissions in practical combustion systems using detailed chemical kinetics

§ Yajun Wang
Dissertation: Superfast three-dimensional (3D) shape measurement with binary defocusing techniques and its applications

Adam Timothy Witthauer
Dissertation: Desktop microforming and welding system powered by a flextensional Terfenol-D transducer
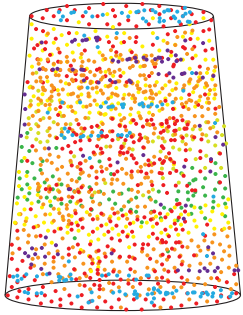
§ Yanan Zhang
Dissertation: Development of integrated assessment platform for biofuels production via fast pyrolysis and upgrading pathway

Yue Zhao
Dissertation: Surface stress detection and mechanism study with microcantilever based sensor for biomolecular monolayers

§ Research Excellence Award
† † Teaching Excellence Award

Biological and Nanoscale Sciences
Cris Schwartz, Faculty Contact

The biological and nanoscale sciences program investigates problems at the interface of engineering, biology, and nanotechnology, allowing us to apply the fundamental principles of mechanical engineering to expand opportunities for new science and engineering breakthroughs.

Several faculty members have focused their research efforts in this area. Professor Xianglan Bai is conducting research projects about understanding fundamentals of fast pyrolysis and improving stability of bio-oil, as well as conversion of municipal solid waste to biofuels. Assistant professor Nastaran Hashemi published research results in several high-impact publications and gave invited talks at the Lab-on-a-Chip European Congress in Barcelona and the University Polytechnic of Catalonia.

Clean Energy Technologies
Terry Meyer, Faculty Contact

The clean energy technologies program investigates alternative energy, energy efficiency, and advanced processes and materials that have reduced resource demand and environmental impact.

Associate professor Daniel Attinger is the leader of a collaborative project between engineers and plant scientists to develop computationally engineered plants that could have the same kind of impact on agriculture as biomedical engineering has had on medicine. Baskar Ganapathysubramanian, assistant professor, is working on the project to develop computer models of how the environment affects a plant's nutrient transport, water uptake, photosynthesis and root architecture.

Complex Fluid Systems
Shankar Subramaniam, Faculty Contact

The Complex Fluid Systems (CFS) research group has had an exciting year with several new faculty members joining our ranks. Adarsh Krishnamurthy whose research in computational modeling of cardiac biomechanics brings expertise in new methods for multiscale simulation and parallel algorithms to our group. Travis Sippel who works on multiphase combustion of propellants brings his expertise on energetic materials to our group. His research on combustion enhancement of composite solid propellants has resulted in two *Combustion and Flame* publications and has been presented at invited seminars to the Maryland chapter of the *AIAA* and at the University of Iowa. Nastaran Hashemi published her work on a microfluidic device for bioassays in *Analytical Chemistry*, and her work on fuel cells in *Physical Chemistry Chemical Physics*. She was also invited by the National Academy of Sciences to participate in the Indo-American Frontiers of Science. Ted Heindel published a book *An Introduction to Bioreactor Hydrodynamics and Gas-Liquid Mass Transfer* with his former student Enes Kadic. He also organized a workshop on computationally engineered crops with Daniel Attinger, Baskar Ganapathysubramanian, and others from ME and Agronomy. Song-Charng Kong secured a 5-year project from the Department of Defense's High Performance Computing Program to perform simulations of high-velocity diesel spray processes in military engines in collaboration with the Army Research Laboratory.

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 multi-physics and hybrid 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.
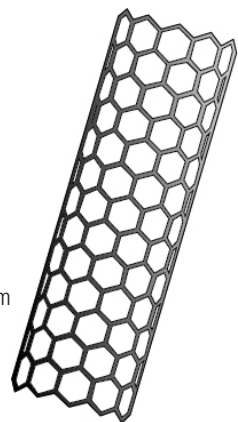
Simulation and Visualization
Song-Charng Kong, Faculty Contact

ME faculty members in Simulation and Visualization Program have found rich applications in biomedical areas. Ming-Chen Hsu recently developed a robust, accurate and efficient computational framework to simulation the function of a heart valve over a complete cardiac cycle under realistic physiological conditions. This will allow researchers to study hemodynamics and cyclic stresses developed in the leaflets and develop new bioprosthetic heart valves with improved performance and durability.

Adarsh Krishnamurthy also conducts computational modeling of heart failure. These advanced computational models, developed from patient-specific clinical data, can help refine the diagnosis and personalize heart failure intervention therapies. His research was used to ascertain a possible mechanism for improvement due to cardiac resynchronization therapy for the first time. This investigation suggests the possibility of extracting important diagnostic information from clinical measurements using computational models.
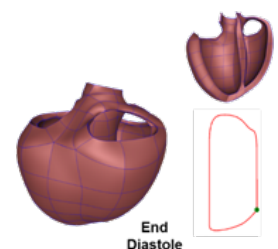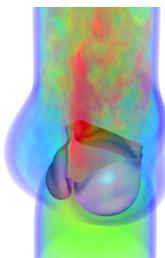
Patient-Specific Cardiac Modeling

Industrial Advisory Council

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.

Jeremy Berg
Cargill, Inc.

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 Chair
Orthopedic Surgery, Olympia Orthopaedics Associates
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 joined the Olympia Orthopaedics Associates in Olympia, Washington and specializes in fracture care and sports medicine.

Diane Fischer
Black & Veatch

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.

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
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.

The ME Industrial Advisory Council meets in the fall and spring each year. This photo was taken at the Spring 2014 meeting in Ames.

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

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.

Joe Wright
Sauer Danfoss

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.

Xianglan Bai
Assistant Professor

BS, Aerospace Engineering, Beijing Univesity of Aero. & Astro., China
MS, Aerospace Engineering, Beijing Univesity of Aero. & Astro., China
PhD, Mechanical Engineering, The University of Tokyo, Japan

Dr. Bai's research interests include bio-fuels and bio-based products, thermochemical conversion of biomass and other waste streams and fast pyrolysis and solvent liquefaction.
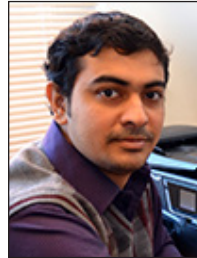
Ganesh Balasubramanian
Assistant Professor

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

B. Tech., Indian Institute of Technology, Bombay, 2002
M.S.E.E., University of Illinois, Urbana-Champaign, 2005
M.S., Applied Mathematics, University of Illinois, Urbana-Champaign, 2009
PhD, Electrical and Computer Engineering, University of Illinois, Urbana-Champaign, 2010

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.

Faculty Highlights

Daniel Attinger led the ISU working group on computationally engineered plants, which features three faculty members from the Colleges of Life Sciences and Agriculture and five from the College of Engineering, to receive one of seven awards from President Steven Leath, as part of his university-wide Initiative for Interdisciplinary Research. Attinger enjoyed several opportunities to discuss research with a broader audience, in a talk show on Iowa Public Radio, at the Café Scientifique of the Iowa Science Center, and with vulgarization articles. He also co-chaired an ICNMM/ASME conference in Sapporo, Japan.

Xianglan Bai received four new research grants (three external and one internal), and published four journal papers and six conference presentations. The students Bai supervises received two best poster awards at TCBiomass 2013 and the AICHE 2013 annual meeting, respectively.

In addition to publishing papers and constructing a research program on computational nanoscience and materials modeling, **Ganesh Balasubramanian** was awarded the Miller Faculty Fellowship for development and implementation of a course in nanoscale heat transfer in the ISU undergraduate curriculum.

Timothy Bigelow
Associate 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.

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.

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.

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.

The research group led by **Sourabh Bhattacharya** successfully performed autonomous quadrotor experiments at ISU.

Prof. Brown was named one of the "Top 100 People in Bioenergy" in 2013 by Biofuels Digest for the fourth consecutive year, moving up to 23rd place from 46th place last year. Prof. Brown serves as director of the Bioeconomy Institute at ISU, which conducted $11 million in research in 2013.

Mark Bryden received the 2013 Melville Medal from the American Society of Mechanical Engineers. "The Melville Medal was first awarded in 1927 and is the highest honor for the best original technical paper published in the ASME Transactions in the past two years." Bryden had 11 journal articles published or accepted, including two journal articles that examined the sustainable removal of agricultural residue for bioenergy across the United States.

Abhijit Chandra's multi-physics simulation of Chemical Mechanical Planarization continues to be used by several industries. Based on their research, hip implant life expectancies are enhanced by Aeculap AG of Germany. Work on enhancing life expectancy of wind turbine gear boxes is initiated in collaboration with Nanjing University and Nanjing Gaojing Gear Co. of China.

Jonathan Claussen
Assistant Professor

PhD, Biological Engineering, Purdue University, 2011
MS, Mechanical Engineering, Purdue University, 2008
BS, Mechanical Engineering, University of Minnesota, 2006
BA, Spanish and Portuguese Studies, University of Minnesota, 2006

Professor Claussen's research interests include biosensors (electrochemical and optical, bio-integrated electronics, BioMEMS and BioNEMS, micro/nanoscale propulsion, carbon nanomaterial growth)graphene and carbon nanotubes, nanomanufacturing / materials printing, quantum dots / carbon dots, and mass transport / fluid dynamics.

Baskar Ganapathysubramanian
Associate 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.

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.

Faculty Highlights

Baskar Ganapathysubramanian worked on the extension of the first fully predictive framework for the three dimensional morphology of a thin film organic photovoltaic device, prediction of optimal morphology. He was also involved with the development of framework for enabling high resolution analysis of natural ventilation in buildings and development of framework for tailoring fluid flow in channels by sequence of pillars.

Nastaran Hashemi was invited by the National Academy of Sciences to participate in the Indo-American Frontiers of Science, was accepted to the American Society for Engineering Education's Virtual Community of Practice program, published four journal articles in high impact journals, and delivered four invited talks. Hashemi graduated one MS student who is currently a PhD student at Georgia Tech. Her 'Biomicrofluidic' paper was among the top 20 most downloaded articles for the second year, and she was part of a team of ISU and external investigators that received the ISU Presidential Initiative for Interdisciplinary Research grant of $1,500,000.

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.

Shan Hu
Assistant Professor

Ph.D., University of Minnesota, Minneapolis, MN, 2014
M.S., University of Minnesota, Duluth, MN, 2009
B.S., Harbin Institute of Technology, Harbin, China, 2007

Selected research interests: Nanomaterials for energy storage and energy harvesting; scalable manufacturing of nanomaterials-based devices; sensors, actuators, and controls
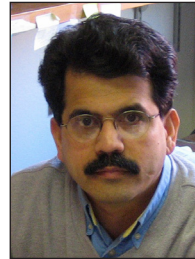
Ming-Chen Hsu
Assistant Professor

BS, Engineering Science and Ocean Engineering, National Taiwan University, 2003
MS, Engineering Science and Ocean Engineering, National Taiwan University, 2005
MSE, Aerospace Engineering and Engineering Mechanics, The University of Texas at Austin
PhD, Structural Engineering, University of California, San Diego, 2012

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.

Ted Heindel is leading the Iowa NSF EPSCoR Project; the project is in its third year of a five-year effort and involves Iowa State, the University of Iowa, and the University of Northern Iowa. The project focus is renewable bioenergy and wind energy, as well as improved energy utilization and energy policy. Ted is also leading an undergraduate minor in energy systems and a soon-to-be-approved Masters of Engineering in Energy Systems degree.

Ming-Chen Hsu is the recipient of the 2013 Chancellor's Dissertation Medal from the University of California, San Diego for his dissertation entitled "Fluid–Structure Interaction Analysis of Wind Turbines." He has been developing novel computational methods for fluids, structures and fluid–structure interaction applied to contemporary engineering problems such as wind turbine and heart valve analysis.

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.

Faculty Highlights

Gap-Yong Kim's research group has been exploring novel ways to synthesize lightweight composite materials. Recent work has focused on making lightweight magnesium composite panels for automotive and aerospace applications. His former graduate student, Lin Liu, became a faculty member in the Department of Mechanical Engineering at University of Kansas. Kim has also been leading the efforts to provide more hands-on experience to ME 324 Manufacturing Engineering Laboratory. Students have been very excited about getting their hands dirty.

Song-Charng Kong has conducted innovative research in exploring alternative engine fuels, particularly novel biofuels mixtures (e.g., bio-oil and its mixtures with ethanol or biodiesel). His research also includes biomass thermochemical conversion and bioenergy systems analysis, and his group is developing high-fidelity computational tools to simulate biomass reactor processes. 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.

Valery Levitas advanced approaches are developed and FEM studies are performed for strain-induced phase transformations in rotational diamond anvil cell, developed new phase field approaches to: interaction of phase transformation and dislocation evolution; twinning; kinetic superheating and laser-induced melting; large strain multivariant martensitic phase transformations, and interface stresses. He worked on new concepts for anisotropic compositional expansion and corresponding chemical potential under stress tensor are developed and applied to stress generation and relaxation in amorphous lithiated silicon for Li-ion batteries. Professor Levitas also found new results supporting his melt dispersion mechanism for reaction of Al nano- and micron scale particles are found.

Greg Luecke continues significant research with industry partners Deere and Co. and Wingard Company in the areas of dynamic simulation, controls, computer interfacing and virtual reality.
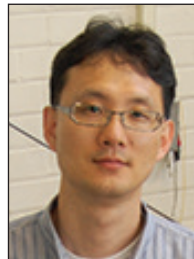
Gap-Yong Kim
Associate Professor

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.
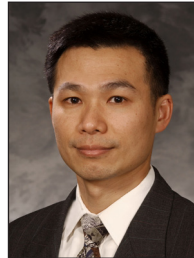
Song-Charng Kong
Associate Professor

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.

Adarsh Krishnamurthy
Assistant Professor

Selected research interests: Biomechanics, finite element analysis, patient-specific modeling, computational mechanics, geometric modeling, computer aided design and manufacturing, computer graphics
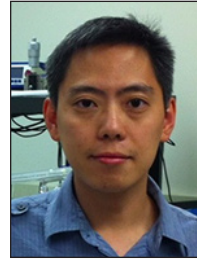
Meng Lu
Assistant Professor

BS, University of Science and Technology of China, 2002
MS, Electrical Engineering, University of Illinois, 2006
PhD, Electrical Engineering, University of Illinois, 2008

Professor Lu's research interests include optical sensors, biomedical engineering, sensors for molecular diagnostics and photonic devices.

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.

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.

Faculty Highlights

Terry Meyer won new research grants totaling over $400,000 for his work on multiphase reacting flows for energy applications. He also submitted a winning proposal to the National Science Foundation for $125,000 for joint experimental/modeling of turbulent combustion. He continued work on grants from the Air Force Office of Scientific Research, Air Force Research Laboratory, National Science Foundation, Department of Energy, and Army Research Office. He served as a Guest Professor at Friedrich-Alexander University in Erlangen.

Reza Montazami established a strong and unique polymer/materials research program at department and university level which has attracted several internal and external collaborators. He has aggressively worked toward improving diversity in the department and has published/presented my research at several journals and conferences.

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.

Professor Passalacqua received the Doctoral New Investigator grant award from the American Chemical Society – Petroleum Research Fund, and developed and released a computational framework to perform automatic uncertainty quantification on the Department of Energy – National Energy Technology Laboratory code MFIX, for the simulation of gas-particle flows.

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.

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.

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
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.

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.

Sonal Padalkar
Assistant Professor

BS, Metallurgy, Government College of Engineering, Pune University, India
MS, Physical Metallurgy, Government College of Engineering, Pune University, India
PhD, Materials Engineering, Purdue University, West Lafayette, Indiana, US

Professor Padalkar conducts research in the areas of synthesis, characterization and simulation of hybrid nanostructures for energy related application, synthesis and characterization of nanomaterials for biosensing, utilizing advanced characterization techniques like TEM, HRTEM, EELS, Atom Probe to obtain solutions for complex research problems, bottom up synthesis techniques in the fabrication of nanostructures for nanoelectronic applications, design, synthesis and characterization of photoelectrodes for water splitting

Rafael Radkowski
Assistant Professor

June 2006: Doctor in Engineering: product design with evolutionary algorithm, Graduate School Automatic Configuration in Open System, Heinz Nixdorf Institute, Paderborn, Germany.

March 2003: Dipl.-Ing. (equal to BS+MS degree), Mechanical Engineering, University of Paderborn, Paderborn, Germany.

Selected research interests: Iterative Closest Points for object identification and tracking; view-dependent rendering and depth cue simulation for CAD workstations; probabilistic search methods for large-scale feature databases

Soumik Sarkar
Assistant Professor

BE, Mechanical Engineering, Jadavpur University, 2006
MS, Mathematics, Penn State University, 2009
MS, Mechanical Engineering, Penn State University, 2009
PhD, Mechanical Engineering, Penn State University, 2011

Professor Sarkar's research interests include diagnostics, prognostics & supervisory control of complex cyber-physical systems; multi-agent systems and analysis of critical phenomena; human-machine interaction; data mining and visualization, machine learning, probabilistic graphical models; and stochastic time series analysis.

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.

Cris Schwartz
Associate Professor
Associate Chair for Undergraduate Education

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.

Travis Sippel
Assistant Professor

BS, Mechanical Engineering, University of Kansas, 2006
MSME, Mechanical Engineering, Purdue University, 1997
PhD, Mechanical Engineering, Purdue University, 2001

Professor Sippel's research areas of interest include multiphase combustion, paticularly of propellants, explosives, and pyrotechnics, nanostructured energetic materials and novel applications of energetic materials.

Faculty Highlights

Cris Schwartz was able to scale up his research activities since coming to ISU, to start focusing on the psychological aspects of tactility and skin tribology, and has made inroads to the fundamental science of tactile communication. Additionally, Schwartz took on the role of Associate Chair for Undergraduate Studies and has undertaken efforts to ensure the quality and relevance of an ISU ME degree. His goal is to ensure that the program is not only one of the largest in the country but also one of the most respected.

Pranav Shrotriya received two new research grants and served as the Associate Chair for Graduate Studies and Research. Shrotriya also worked with department faculty to: develop new graduate certificate programs, establish a 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.

Travis Sippel published three archival journal papers, presented three conference papers, and was invited to give an invited talk to the Delaware chapter of the American Institute of Aeronautics and Astronautics on the topic of "Solid Propellant Metal Combustion Augmentation and Agglomeration Control via Inclusion." Additionally, significant development of laboratory capabilities has occurred over the past five months.

Shankar Subramaniam
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
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
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.

Shankar Subramaniam published a review article titled "Particle–Resolved Direct Numerical Simulation for Gas–Solid Flow Model Development" that appeared in the premier journal Annual Reviews in Fluid Mechanics. He delivered invited seminars in the Mechanical Engineering Department at Stanford University and the Laboratoire EM2C at Ecole Centrale in Paris, France. Subramaniam also served as technical mentor to the student group Engineers Without Borders on their borehole project for water supply to a school in Ghana.

Sriram Sundararajan was appointed as the College of Engineering Equity Advisor on November 2013 and assumed leadership of the Broader Impacts Platform of the Iowa NSF EPSCoR grant on Jan. 1, 2014. He continues to serve the department as Associate Chair of Operations and maintains an active research program with current funding from NSF, John Deere and the FAA.

Dr. Vance, in collaboration with Dr. Luecke, continues to advance the field of immersive interaction through the development of a mobile platform to support the use of haptic (force feedback) devices in large scale immersive virtual environments. This mobile platform transports a haptic device throughout a large workspace with little or no added inertial forces. The general nature of the platform allows researchers to easily use this device in a number of environments without the need for significant structural modifications to the facilities.

In 2013, Prof. Xinwei Wang's lab has 17 papers published or accepted for publication in highly visible journals. Two new grants (from NSF and DOE) with the total fund close to $1M have been awarded to him. He graduated 3 Ph.D. in 2013, and recruited 5 new graduate students to the lab.

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
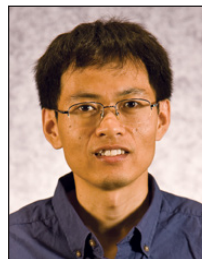PhD, Mechanical Engineering, State University of New York at
    Buffalo, 1999

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
PhD, Mechanical Engineering & Chemical Engineering, Iowa State
    University

Dr. 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
Associate 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 **Eliot Winer**'s lab continued on advanced 3D
rendering techniques of digital medical data on mobile
devices. The software is being jointly developed with a
company and is planned to be released commercially in 2014.
In addition, Winer studied the effects of using Augmented
Reality for digital work instructions for manufacturing on a
factory floor, and found great benefit to implementing this
technology. Winer was on research teams with combined
project budgets of over $4.5M.

Mark Mba Wright published two journal papers, one book chapter,
presented at 4 conferences including one international conference, and
served as co-chair of 2 American Institute of Chemical Engineering sessions.
He taught two lecture courses and two independent study courses.

Dr. Zhang received four new research grants, published one book, filed 3
U.S. patent applications, and had 19 journal papers and 3 book chapters
published or accepted. Dr. Zhang's research was recognized by a variety of
venues including featuring the journal cover, winning the AIAA Best Paper
award, appearing in the public medias, and being one of the most cited
papers in the last five years. Dr. Zhang was elected to the Fellow of SPIE –
The International Society for Optics and Photonics.

Faculty Highlights

Under the direction of **Dr. Emmanuel Agba**, Iowa State University's solar car club, PrISUm, and their car Hyperion, participated in the 2013 Formula Sun Grand Prix in Austin, Texas and took the 3rd place. The club is an interdisciplinary group of students from several departments including Mechanical, Chemical, Aerospace, Electrical and Electronics, Materials, and Accounting. Two Mechanical Engineering Students participated in the interdisciplinary team: Cory Anderson and Dakota Morgan. It

was a very close race; ISU won 3rd with 191 laps, Illinois State won second with 192 laps, and Oregon State took first place with 193 laps. Additionally, Cory Anderson was awarded two individual team member awards as a driver: fastest lap award, and fastest egress award. Moriah Morgan, a Global Resources System (GLOBE) major and who is also a driver, won the fastest slalom award.

Sebastien Feve developed a new ME course entitled: ME296X: 'Early Engineering International Experience'. Students can earn 3 credits of general education or international perspectives. The first offering is a two-week travel course in May-June 2014 entitled: "Discovering Engineering in France" for 1st and 2nd year engineering students.

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

Jackie Baughman
Senior Lecturer

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

Faculty Highlights

Matt Hagge developed the formal pedagogy for Decision Based Learning (DBL). Showed how DBL is different from existing teaching methods, and demonstrated quantitative results demonstrating its effectiveness in learning and retention.

In 2013 **Jim Heise** coordinated 47 projects for the ME Capstone Senior Design Program (M E 415 and M E 466) spread over 69 teams; 28 projects were in direct support of Iowa manufacturers and cosponsored by CIRAS. Procedures piloted by the M E Capstone Senior Design Program continue to be adopted by many departments in the Colleges of Engineering Design for sponsored undergraduate design projects. Under Jim's direction more ME Capstone Senior Design teams are collaborating on projects with students from Industrial Design. Jim continues to serve as faculty advisor to the ISU Lunabotics Club who had their best year yet at the 4th Annual NASA Lunabotics Mining Competition at the Kennedy Space Center. The team placed first for the Joe Kosmo Award for Design Excellence as well as being the first team to receive back-to-back wins for On-Site Mining.

Gloria Starns undertook the development of a six-week design course using human centered design and sustainability principles to be offered in San Isidro, Nicaragua during the summer of 2014. Ten students, Dr. Mark Wright and I will travel to Nicaragua to design and fabricate sustainable systems including bio-digesters, cook stoves, chlorinators, and drip irrigation systems.

Lecturers

Matt Hagge
Senior 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

Howard Shapiro
Lecturer

Jim Heise
Senior 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

Emeritus Faculty

Shyam Bahadur	Max Gassman	Mike Pate
Bill Bathie	Jerry Hall	Leo Peters
Joseph Baumgarten	Alexander Henkin	Dick Pletcher
Jim Bernard	Alfred Joensen	Don Roberts
Jerry Colver	George Junkhan	George Serovy
Bill Cook	Pat Kavanagh	Howard Shapiro
Richard Danofsky	Charles Mischke	Bernard Spinrad
Paul DeJong	Ron Nelson	
Arvid Eide	Ted Okiishi	

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.

Leonard Bond
Courtesy Professor, Aerospace
Engineering

PhD., City University - London

Ultrasonics applied to nondestructive evaluation (NDE)
Advanced diagnostics and prognostics, to estimate safe service life, applied to aerospace and energy systems.

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 Instiiute of Technology, 1999
Adv. Cert, Environmental Managment 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

Alyssa Mittleider
Academic Adviser

Hazel Peterson
Advising Secretary

Lisa Phillips
Academic Adviser

Mallory Quinn
Academic Adviser

Jessica Van Winkle
Academic Adviser

John Wagner
Academic Adviser, Advising Center Coordinator

Johna Wolfe
Academic Adviser

Business Office

Cindy Bartleson
Administrative Specialist, Assistant to the Chair

Mary Bilstad
Program Coordinator

Neely Bushore
Administrative Specialist

Sue Olson
Grant Program Coordinator

Alex Rausch
Communications Specialist

Deb Schroeder
Secretary

Taylor Shire
Undergraduate Program Assistant

Laboratory and Information Technology

Sandy Bremer
Teaching Laboratory Coordinator

Joel Buehler
Systems Support Specialist
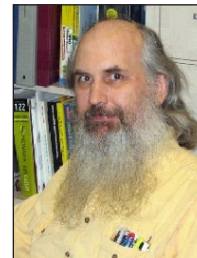
Jim Dautremont
Laboratory Mechanical Technologist

Derek Dickson
Systems Support Specialist

John Howell
Teaching Laboratory Coordinator

Nate Jensen
Systems Support Specialist

Craig Severson
Teaching Laboratory Coordinator

Wyman Martinek
Teaching Laboratory Coordinator

Publications

Peer-Reviewed Journal Publications

X. Bai* and Robert Brown, "Modeling the physiochemistry of levoglucosan during cellulose pyrolysisAn investigation of pyrolysis", Journal of Analytical and Applied Pyrolysis, Vol. 105, 363-368 (2014).

X. Bai*, S. Saudula, P. Johnston and R. C. Brown, "An Experimental Investigation on the Role of Levoglucosan Physiochemistry in Cellulose Pyrolysis", Journal of Analytical and Applied Pyrolysis, Vol. 99, 130-136 (2013).

X. Bai*, P. Johnston and R. C. Brown, "The competing processes of evaporation and polymerization of levoglucosan in cellulose pyrolysis", Journal of Analytical and Applied Pyrolysis, Vol. 99, 58-65 (2013).

M. Korbus, **G. Balasubramanian**, F. Müller-Plathe, H. Kolmar and F.-J. Meyer-Almes, "Azobenzene switch with a highly stabilized cis-state to photocontrol the enzyme activity of a histone deacetylase-like amidohydrolase", Biological Chemistry, in press.

G. Balasubramanian, "Review of Nanoelectronic Devices by Byung-Gook Park, Sung Woo Huang and Young June Park", Journal of Nanotechnology in Engineering and Medicine, 4(1), 016501, 2013.

S. Pal, **G. Balasubramanian** and I.K. Puri, "Reducing thermal transport in electrically conducting polymers: Effects of ordered mixing of polymer chains", Applied Physics Letters, 102, 023109, 2013.

S. Bhattacharya, A. Gupta and T. Bas¸ar. Jamming in mobile networks: A game-theoretic approach, Numerical Algebra, Control and Optimization, 3(1):1-30, March, 2013.

J. Xu, **T.A. Bigelow**, and R. Nagaraju, "Precision control of lesions by high-intensity focused ultrasound cavitation-based histotripsy through varying pulse duration," IEEE Trans. Ultrason. Ferroelectr. Freq. Control., 60, 1401-1411 (2013)

L.A. Wirtzfeld, K. Nam, Y. Labyed, G. Ghoshal, A. Haak, E. Sen-Gupta, Z. He, N.R. Hirtz, R.J. Miller, S. Sarwate, D.G. Simpson, J.A. Zagzebski, **T.A. Bigelow**, M.L. Oelze, T.J. Hall, and W.D. O'Brien Jr, "Techniques and evaluation from a cross-platform imaging comparison of quantitative ultrasound parameters in an in vivo rodent fibroadenoma model," IEEE Trans. Ultrason. Ferroelectr. Freq. Control., 60, 1386-1400 (2013)

J. Xu, **T.A. Bigelow**, and H. Lee, "Effect of pulse repetition frequency and scan step size on the dimensions of the lesions formed in agar by HIFU histotripsy", Ultrasonics, 53, 889896 (2013)

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Wang, K., **Brown, R. C.**, Homsy, S., Martinez, L., and Sidhu, S. S. (2013) Fast pyrolysis of microalgae remnants in a fluidized bed reactor for bio-oil and biochar production, Bioresource Technology 127: 494-499, http://dx.doi.org/10.1016/j.biortech.2012.08.016.

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Zhang, Y., Brown, T. R., Hu, G., **Brown, R. C.** (2013) Comparative techno-economic analysis of biohydrogen production via bio-oil gasification and bio-oil reforming, Biomass and Bioenergy 51, 99-108.

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McCalley, J., Krishnan, V., Gkritza, K., **Brown, R.**, and Mejia-Giraldo, D. (2013) Investment strategies for national energy and transportation infrastructures, IEEE Power and Energy Magazine 11, 24-35.

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Zhang, Y., Brown, T. R., Hu, G., **Brown, R. C.** (2013) Techno-economic analysis of fast pyrolysis and upgrading facilities employing two upgrading pathways, Chemical Engineering Journal 225, 895-904.

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A. V. Singh, M. Yu, A. K. Gupta, and **K. M. Bryden**, "Investigation of Noise Radiation from a Swirl Diffusion Flame with an Array of Microphones," Applied Energy (JCR = 4.781), 112:313–324 (2013).

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Roy, S., Wu, K-C., and **Chandra, A.**, 2014, Objective Aggregation of Preferences: Heterogenity, Polarization and the Will of the People, Econometrica (submitted).

Yu, T., Asplund, D., **Chandra, A.**, and Bastawros, A. F., 2014, Chemical Mechanical Paired Grinding I: Development and Characterization, J. Mfg. Sc. Eng., ASME (submitted).

S. Samudrala*, J. Zola, S. Aluru, **B. Ganapathysubramanian**, "Parallel Framework for Dimensionality Reduction of Large-scale Datasets", Scientific Programming, accepted for publication (2013)

O. Wodo*, J. D. Roehling, A.L. Moele, **B. Ganapathysubramanian**, "Computational characterization of three dimensional maps of organic blends", Energy and Environmental Sciences, in press (2013)

Q. Guo*, D. Rajeskwi**, E. Takle, **B. Ganapathysubramanian**, Data-driven, location-specific wind-models: Using meteorology data to construct low-dimensional stochastic wind models, Wind Energy, revision (2013).

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H. Amini**, M. Masaeli, E. Sollier, Y. Xie*, **B. Ganapathysubramanian**, H. Stone, D. Di Carlo, Programming fluid flow using sequenced microstructures, Nature Communications, 4, 1826, (2013), doi:10.1038/ncomms2841.

Fontanini*, U. Vaidya, **B. Ganapathysubramanian**, "A stochastic approach to modeling the dynamics of natural ventilation systems", Energy and Buildings, 63, 87–97 (2013).

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J. Yang, S. Ghobadian, P.J. Goodrich, R. Montazami, and **N. Hashemi**, "Miniaturized Biological and Electrochemical Fuel Cells: Challenges and Applications", Physical Chemistry Chemical Physics, 15, 14147-14161 (2013)

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Y. Bazilevs, **M.-C. Hsu**, M.T. Bement, "Adjoint-based control of fluid–structure interaction for computational steering applications", Procedia Computer Science, 18 (2013) 1989-1998.

A. Korobenko, **M.-C. Hsu**, I. Akkerman, J. Tippmann, Y. Bazilevs, "Structural mechanics modeling and FSI simulation of wind turbines", Mathematical Models and Methods in Applied Sciences, 23 (2013) 249-272.

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J.A. Johnson, Z. Bai, **N. Hashemi**, "Development of Monodispersed MnF2 Nanocrystals for Upconverting Luminescence", SULI Poster Session, DOE Ames Laboratory, Ames, August 2, 2013

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Kim, G.Y.*, "Effects of high frequency vibration on microforming of metallic materials," SME MicroManufacturing Conference & Exhibits, Minneapolis, MN, Apr. 16-17, 2013.

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Ryu^, K.H., Zacharakis-Jutz^, G., **Kong, S.-C.**, "Effects of Fuel Compositions on Diesel Engine Performance Using Ammonia-DME Mixtures," SAE 2013-01-1133 (2013).

Sukumaran^, S., **Kong, S.-C.**, Cho, N.H. "Modeling Evaporating Diesel Sprays Using an Improved Gas Particle Model," SAE 2013-01-1598 (2013).

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V. I. Levitas. Pressure and shear induced phase transformations in ceramics (invited lecture). 37th International Conference and Exposition on Advanced Ceramics and Composites, Armor Ceramics Symposium, Daytona Beach, Florida, January 27- February 2, 2013.

V. I. Levitas. Phase field approach to structural changes at the nanoscale. Mach Conference, Annapolis, MD, 04/09/2013-04/12/2013.

V. I. Levitas. Strain-Induced Phase Transformations under High Pressure: Three-Scale Theory and Simulations and Interpretation of Experiments. Mach Conference, Annapolis, MD, 04/09/2013-04/12/2013.

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V. I. Levitas, H. Attariani. Anisotropic compositional expansion and chemical potential for amorphous lithiated silicon under stress tensor. 50th Annual Meeting Society of Engineering Science, Providence, RI, 07/29/2013-07/31/2013.

B. Feng, **V. I. Levitas**. Modeling and simulation in strain-induced phase transformations in a diamond anvil cell. 50th Annual Meeting Society of Engineering Science, Providence, RI, 07/29/2013-07/31/2013.

Y. S. Hwang, **V. I. Levitas**. Melting of aluminum nanoparticles within alumina shell at high heating rates. 50th Annual Meeting Society of Engineering Science, Providence, RI, 07/29/2013-07/31/2013.

M. Javanbakht, **V. I. Levitas**. Advanced phase field approach to dislocation evolution. 50th Annual Meeting Society of Engineering Science, Providence, RI, 07/29/2013-07/31/2013.

A. M. Roy, **V. I. Levitas**. Phase field approach to multiple twinning and variant-variant transformations in martensite. 50th Annual Meeting Society of Engineering Science, Providence, RI, 07/29/2013-07/31/2013.

K. Momeni, **V. I. Levitas**. Phase field model for melt-mediated solid-solid phase transformation. 50th Annual Meeting Society of Engineering Science, Providence, RI, 07/29/2013-07/31/2013.

K. Samani, **V. I. Levitas**. Melting/solidification of nanoparticles: new scale effects, thermally activated surface nucleation and bi-stable states. 50th Annual Meeting Society of Engineering Science, Providence, RI, 07/29/2013-07/31/2013.

Goddard W.A. (Caltech), **Levitas V.I.**, Ma Y. New Pathways toward Metastable Solids through Moderate Pressure and Large Plastic Shear: Multiscale Simulations and Experiments. DARPA Extended Solids Grantee Meeting, Arlington, VA, 9/23/13-9/24/13.

V. I. Levitas. Phase transformations under high pressure and large plastic shear. Materials in Extreme Environments, Army Science Planning and Strategy Meeting, Towson, MD, 12/10/13-12/11/13 (invited talk).

Pavlik, R.A., Vance, J.M., and **Luecke, G.R.**, "Interacting with a Large Virtual Environment by Combining a Ground-based Haptic Device and a Mobile Robot Base", Proceedings of the ASME 2013 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2013, August 4-7, 2013, Portland, Oregon, USA.

*Chen, L.† and **MacDonald, E.**, 2013, "Effects of Uncertain Land Availability, Wind Shear, and Cost on Wind Farm Layout," ASME International Design Engineering Technical Conference/ Design Automation Conference, Portland, OR, August 4-7. (Full paper, peer-reviewed)

*She, J.† and **MacDonald, E.**, 2013, "Trigger Features on Prototypes Increase Preference for Sustainability," ASME International Design Engineering Technical Conference/ Design Theory and Methodology, Portland, OR, August 4-7. (Full paper, peer-reviewed)

*Du, P.† and **MacDonald, E.**, 2013, "Eye-Tracking Data Predicts Importance of Product Features and Saliency of Size Change," ASME International Design Engineering Technical Conference/ Design Theory and Methodology, Portland, OR, August 4-7. (Full paper, peer-reviewed)

She, J.† and **MacDonald, E.**, 2013, "Priming Communication of Sustainability in Design," Mechanical Engineering Graduate Student Seminar, Ames, IA, Nov. 4.

She, J.† and **MacDonald, E.**, 2013, "Sustainable Design Cues Affect Customer Preference Constructions," Max Planck Summer Institute on Bounded Rationality, Berlin, Germany, Jun. 18-25. (Abstract and Poster)

She, J.† and **MacDonald, E.**, 2013, "Trigger Features on Prototypes Increase Preference for Sustainability," ISU Sustainability Symposium, Ames, IA, February 25. (Poster)

Chen, L.† and **MacDonald, E.**, 2013, "Effects of Uncertain Land Availability, Wind Shear, and Cost on Wind Farm Layout," Iowa Wind Energy Association Annual Conference, Des Moines, IA, March 25-27. (Poster)

Chen, L.† and **MacDonald, E.**, 2013, "A Cost-of-Energy Wind Farm Layout Optimization with Landowner Remittances and Participation Rates," Iowa Wind Energy Association Annual Conference, Des Moines, IA, March 25-27. (Poster)

Chen, L.† and **MacDonald, E.**, 2013, "Effects of Uncertain Land Availability, Wind Shear, and Cost on Wind Farm Layout," 2nd National Renewable Energy Laboratory (NREL) Wind Energy Systems Engineering Workshop, Broomfield, CO, January 29-30. (Abstract and Poster)

Chen, L.† and **MacDonald, E.**, 2013, "A Cost-of-Energy Wind Farm Layout Optimization with Landowner Remittances and Participation Rates," 2nd NREL Wind Energy Systems Engineering Workshop, Broomfield, CO, January 29-30. (Abstract and Poster)

Mark Mba Wright, Improving the quality of biomass-derived pyrolysis oils with an auger reactor (Iowa EPSCoR)

Mark Mba Wright, Numerical modeling of biomass fast pyrolysis within an auger reactor (Iowa EPSCoR)

J.B. Michael,† J.D. Miller,† **T.R. Meyer**, M.N. Slipchenko,† S. Roy, and J.R. Gord, "A New Architecture for Burst-Mode Planar Imaging of Turbulent Flames," AIAA Paper 2013-0775, 51st AIAA Aerospace Sciences Meeting, Dallas/Ft. Worth, TX, Jan. 7-10, 2013.

B.R. Halls,† C. Radke,† T.J. Heindel, W.F. Lohry, S. Zhang, **T.R. Meyer**, M.D. Lightfoot, S.A. Danczyk, S.A. Schumacher, S. Roy, J.R. Gord, and A.L. Kastengren, "Characterization of Three-Dimensional Dense Spray Visualization Techniques," AIAA Paper 2013-0477, 51st AIAA Aerospace Sciences Meeting, Dallas/Ft. Worth, TX, Jan. 7-10, 2013.

C.E. Dedic,† J.D. Miller,† **T.R. Meyer**, and J.R. Gord, "Vibrational/Rotational Hybrid fs/ps Coherent Anti-Stokes Raman Scattering for Combustion Analysis," AIAA Paper 2013-0337, 51st AIAA Aerospace Sciences Meeting, Dallas/Ft. Worth, TX, Jan. 7-10, 2013.

H. Subramani,† **T.R. Meyer**, N. Jiang, A. Caswell, S. Roy, and J.R. Gord, "Application of the Cross Wavelet Transform and Wavelet Coherence to OH-PLIF in Bluff Body Stabilized Flames," AIAA Paper 2013-1183, 51st AIAA Aerospace Sciences Meeting, Dallas/Ft. Worth, TX, Jan. 7-10, 2013.

B.R. Halls,† **T.R. Meyer**, M.D. Lightfoot, S.A. Danczyk, S.A. Schumaker, S. Roy, J.R.Gord, and A.L. Kastengren, "Quantitative Flash X-ray Imaging of Liquid Mass Distribution in Optically Dense Sprays," 25th Annual.Institute for Liquid Atomization and Spray Systems (ILASS)-Americas Conference, Pittsburgh, PA, May 5-8, 2013.

J.B. Michael,† H. Subramani,† **T.R. Meyer**, J.D. Miller,† M.N. Slipchenko,† S. Roy, and J.R. Gord, "High-speed Imaging and Analysis of Turbulent Flames," 8th U.S. National Combustion Meeting, Salt Lake City, UT, May19-22, 2013.

T.B. Morgan, B.R. Halls,† **T.R. Meyer**, and T.J. Heindel, "A High-speed X-ray Detector System for Noninvasive Fluid Flow Measurements," Proceedings of the ASME 2013 Fluids Engineering Division Summer Meeting, Paper FEDSM2013-16427, Incline Village, NV, July 7-11, 2013

R. Zhang, N. Hashemi, M. Ashuri, **R. Montazami**, "Advanced Gel Polymer Electrolyte for Lithium-Ion Polymer Batteries", ASME, Minneapolis MN, (2013)

Y. Fu, Z. Poursharifi, M. Ashuri, N. Hashemi, **R. Montazami**, "Development of Polymeric Porous Membrane for Mediator-less Microbial Fuel Cells: An Electrochemical Study", ASME, Minneapolis MN, (2013)

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Z. Poursharifi, M. Ashuri, **R. Montazami**, N. Hashemi, " A Novel Method for Fabricating Conductive Microfibers for Microbial Fuel Cells", ASME, Minneapolis MN, (2013)

J. Yang, S. Ghobadian, **R. Montazami**, N. Hashemi, "Using Shewanella oneidensis MR1 as a Biocatalyst in a Microscale Microbial Fuel Cell", ASME, Minneapolis MN, (2013)

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R. Montazami, M. Ashuri, R. Zhang, W. Hong, A. Machtemes, N. Carrington, "Directional underwater sensor based on ionic electroactive polymer device", SPIE, San Diego CA, (2013)

C. Grace Heckmann, J.J. Michalek, **W.R. Morrow**, Yimin Liu (2013) "Sensitivity of Vehicle Market Share Predictions to Alternative Discrete Choice Model Specifications" In the Proceedings of ASME's International Design Engineering Technical Conference 2013, August 4-7th in Portland, OR.

W.R. Morrow, C.G. Haaf, J.J. Michalek, Y. Liu, & M.H. Long. "Sensitivity of Vehicle Market Share Predictions to Alternative Discrete Choice Model Specifications" Abstract in Proceedings of INFORMS annual meeting, Minneapolis MN, October 4-6th 2013 (Invited presentation in a session about research at Ford Motor Company)

R. Radkowski and **J.H. Oliver**, "Simulation of Motion Parallax for Monitor-based Augmented Reality," Proc. ASME 2013 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Portland, OR, August 2013

J.S. Casallas, **J.H. Oliver**, J.W. Kelly, F. Merienne and S. Garbaya, "Towards a model for predicting intention in 3D moving-target selection tasks" Proc. 15th International Conference on Human-Computer Interaction (HCII 2012), Las Vegas, Nevada, July 2013

R. Radkowski and **J.H. Oliver**, "Natural Feature Tracking Augmented Reality for on-site Assembly Assistance Systems, Proc. 15th International Conference on Human-Computer Interaction (HCII 2011), Las Vegas, Nevada, July 2013

R. Radkowski and **J.H. Oliver**, "A Hybrid Tracking Solution to Enhance Natural Interaction in Marker-based Augmented Reality Applications," Proc. Sixth International Conference on Advances in Computer-Human Interactions, ACHI 2013, Nice, France, February 2013

M.G. Olsen, Y. Shi, G. Iaccarino, R.O. Fox, "CFD predictions of confined turbulent swirling Flows in a microscale multi-inlet vortex reactor," 66th Annual Meeting of the American Physical Society Division of Fluid Dynamics, Pittsburgh, PA, Nov.24-26, 2013

J.C. Hill, K. Nilsen, B. Kong, R.O. Fox, **M.G. Olsen**, "Turbulent transport and mixing of a Passive scalar in a confined liquid wake," 66th Annual Meeting of the American Physical Society Division of Fluid Dynamics, Pittsburgh, PA, Nov.24-26, 2013

M. Ramezani, S. Subramaniam, **M.G. Olsen**, "Experimental investigation of two phase fluid Flow and passive scalar mixing around a periodic array of spheres," 66th Annual Meeting of the American Physical Society Division of Fluid Dynamics, Pittsburgh, PA, Nov.24-26, 2013

Z. Liu, R.O. Fox, J.C. Hill, **M.G. Olsen**, "Turbulent velocity and concentration measurements In a multi-inlet vortex nanoprecipitation reactor," 66th Annual Meeting of the American Physical Society Division of Fluid Dynamics, Pittsburgh, PA, Nov.24-26, 2013.

Y. Shi, **M.G. Olsen**, R.O. Fox., "Turbulent confined swirling flow in a microscale multi-inlet Vortex reactor," 2013 Annual Meeting of the American Institute for Chemical Engineers, San Francisco, CA, Nov. 3-8, 2013

A. Passalacqua, X. Hu, R. O. Fox, Uncertainty Quantification Tools for Multiphase Flow Simulations using MFIX, 2013 NETL Workshop on Multiphase Flow Science, Morgantown, August 6th – 7th 2013

B. Kong, **A. Passalacqua**, R. O. Fox, Extended Conditional Quadrature-Based Moment Method for Polydisperse Gas-Particle Flows With Size-Conditioned Velocity, AIChE Annual Meeting, San Francisco, CA, November 3rd – 8th, 2013

X. Hu, **A. Passalacqua**, R. O. Fox, A Quadrature-Based Uncertainty Quantification Approach With Reconstruction of the Probability Distribution Function of the System Response in Bubbling Fluidized Beds, AIChE Annual Meeting, San Francisco, CA, November 3rd – 8th, 2013.

A. Passalacqua, B. Kong, R. O. Fox, Quadrature-based moment methods for polydisperse multiphase flows with size-dependent velocity, Fluidization XIV - May 26-31, 2013 - NH Conference Centre Leeuwenhorst Noordwijkerhout, The Netherlands (poster).

M. Baker, **A. Passalacqua**, R. O. Fox, Multiphase Computational Fluid Dynamics in an Industrial-Scale Tubular Loop Reactor, ISU CBE Centennial Research Symposium, September 26th 2013 (poster).

X. Hu, E. Madadi Kandjani, N. S. Panicker, **A. Passalacqua**, Advanced methods for computational fluid dynamics, Advanced methods for computational fluid dynamics, September 26th 2013 (poster).

X. Hu, **A. Passalacqua**, R.O. Fox, Uncertainty quantification tools for multiphase gas-solid flow simulations using MFIX, September 26th 2013 (poster).

*Laux, K. and **Schwartz, C.J.**: "Wear of PEEK and its dependence on wear path shape and direction," abstract and presentation, 2013 STLE Annual Meeting, Detroit, Michigan, May 5-9, 2013.

Schwartz, C.J.: "Quantifying the Haptic Characteristics of Polymer-Based Textiles: Using Human Sensation as a Measuring Tool," paper and presentation, ANTEC 2013, Cincinnati, Ohio, April 24, 2013

*Laux, K.A. and **Schwartz, C.J.**: "Influence of Linear Reciprocating and Multi-Directional Sliding on PEEK Wear Performance and Transfer Film Formation," paper and presentation, 19th International Conference on Wear of Materials (WOM), Portland, Oregon, April 13-18, 2013

*Plumlee, K. and **Schwartz, C.J.**: "Investigation of surface layer plastic deformation in UHMWPE wear, and its relationship to the classic rippled surface phenomenon," paper and presentation, 19th International Conference on Wear of Materials (WOM), Portland, Oregon, April 13-18, 2013

Schwartz, C.J. and *Darden, M.: "Investigating the haptics of textured polypropylene using friction coefficient," paper and presentation, 2013 Society of Plastics Engineers International Polyolefins Conference, Houston, Texas, February 24-26, 2013

Çapraz, Ö., **P. Shrotriya**, and K. Hebert, Stress Distributions in Anodic Alumina Films Prior to the Onset of Pore Formation. Meeting Abstracts, 2013(21): p. 1805-1805.

@*Hebert, K., Çapraz, Ö., **P. Shrotriya**, . Modeling Stress Distributions in Anodic Alumina Films Prior to the Onset of Pore Formation. in 224th ECS Meeting (October 27–November 1, 2013). 2013. Ecs.

Ma, X. and **P. Shrotriya**. Study on Specific Binding Interaction Between Protein and DNA Aptamer via Dynamic Force Spectroscopy. in ASME 2013 2nd Global Congress on NanoEngineering for Medicine and Biology. 2013. American Society of Mechanical Engineers.

Shrotriya, P., B.-H. Chua, and A. Chandra, Load Assisted Dissolution AND Damage of Copper Surface under Single Asperity Contact: Influence of Contact Loads and Surface Environment. Meeting Abstracts, 2012. MA2012-01(23): p. 964.

Çapraz, Ö., **P. Shrotriya**, and K. Hebert, "Curvature Interferometry and Measurement of stresses associated with electrochemical reactions", Presented at 50th Annual Technical Meeting of Society of Engineering Science; Providence, Rhode Island; July, 2013

X. Ma and **P. Shrotriya**, "Electrostatic Actuation based Modulation of Binding Interaction between Protein and DNA Aptamer via Dynamic Force Spectroscopy", Presented at 50th Annual Technical Meeting of Society of Engineering Science; Providence, Rhode Island; July, 2013

Y. Zhao and **P. Shrotriya**, "Transduction of molecular binding associated conformational changes to mechanical deformation", Presented at 50th Annual Technical Meeting of Society of Engineering Science; Providence, Rhode Island; July, 2013

Sippel, T. R., Son, S. F., Groven, L. J., "Agglomeration Control in Solid Propellant Combustion Using Hydrocarbon Inclusion Modified Aluminum," Presented at the 39th International Pyrotechnics Seminar, Valencia, Spain, 2013.

Sippel, T. R., Son, S. F., Groven, L. J., "Composite Propellant Agglomeration Reduction Using Polymer Inclusion," Presented at the 2013 AIChE Annual Meeting, San Francisco, CA, Nov. 7, 2013.

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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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