

Sustainable Manufacturing

*PRODUCTS ** PROCESSES ** SYSTEMS*

Spring 2014
Volume 1, Issue 1

Inside this issue:

Item	PAGE
News	2
Researcher Highlights	3
ISM Laboratories	4 - 5
Save the Dates	6



Prof. I. S. Jawahir
Director

We are pleased to introduce the Institute for Sustainable Manufacturing (ISM), a multi-disciplinary research institute, which was established within the College of Engineering at the University of Kentucky in April 2012. The strategic mission of this new institute is to actively pursue *academic research (basic and applied)* with the goal of producing *new and innovative manufacturing technologies at product, process and systems levels*, developing and implementing *formal (undergraduate and graduate levels) and professional development educational programs* in sustainable manufacturing, and engaging in *technology transfer/ deployment and industry outreach* for effective dissemination of the new knowledge generated. The ISM has a total of 9 *Core Faculty* from three different engineering departments (Mechanical,

A Message From the Director.....

Electrical and Computer Engineering, and Chemical and Materials Engineering) and 15 *Affiliate Faculty* from other department research centers and institutes. The Core ISM Faculty have 10 *Dedicated Research Labs*. There are *xx postdoctoral researchers/visiting scholars, over 50 graduate students (PhD and MS students)* and several undergraduate students working in these labs. Research sponsors include federal agencies such as the NSF, NIST, DoE, US Air Force, US Army, NASA, etc., and major companies such as GE-Aviation, Toyota, GM, Lexmark International, SPX, Semicon Associates, Sandvik Coromant, etc. The annual research funding in AY 2013-14 from various sources exceeds \$3M.

The current research focus of the ISM includes the following six core areas:

- Sustainable materials** (energy-efficient materials for design: molecular, microstructural and metallurgical transformation of materials; self-healing materials and shape memory alloys)
- Sustainable product design** (energy-efficient products; sustainability metrics for products; 6R-based product design for sustainability)

Sustainable manufacturing processes (energy-efficient, environmentally benign manufacturing process development – toxic-free, hazardless, safe and secure technologies; minimal use of metalworking fluids and chemicals; tribological interfaces; coatings; and surface integrity studies. Manufacturing processes covered are machining, sheet metal forming, welding, brazing and soldering, friction stir processing)

Sustainable manufacturing systems (metrics for sustainability performance at enterprise levels, ontology for interoperability of sustainable supply chains; sustainable quality systems; energy-efficient supply chain operations and risk modeling; and manufacturing systems)

Society, public policy and regulatory issues in sustainable manufacturing (societal impact studies; legislative and administrative issues; policy implementation; product and process liability; ethics)

Economic analysis of sustainable products and processes (marketing strategies and business economics for sustainable products and processes; management and logistics)

Journals

ISM houses the editorial offices for two major international journals:

- International Journal of Sustainable Manufacturing
<http://www.inderscience.com/ijsm>
- Machining Science and Technology Journal
<http://www.tandfonline.com/toc/lmst20/current>

Details of our new books, publications, patents, etc., can be found on our website.

News

Announcing the Inauguration of the ISM Industry Alliance

We are pleased to announce the inauguration of the Institute for Sustainable Manufacturing Industry Alliance!

Major benefits offered to companies joining the ISM Industry Alliance (ISM-IA) of companies are:

- ◆ greater effectiveness in new knowledge acquisition through published literature, including technical articles;
- ◆ assistance and technical support in new technology development and deployment (one product/process assessment per year for sustainability, and two student projects per year);
- ◆ facilitating/channeling co-op/internship for engineering students;
- ◆ access to ISM faculty and staff for projects involving sustainability concerns and for new student projects;
- ◆ regular newsletters;
- ◆ networking opportunities and collaboration;
- ◆ dedicated/customized personnel training on sustainable manufacturing at subsidized rates;
- ◆ discounted rates for ISM short courses and workshops; and
- ◆ two free seats in the Annual Sustainable Manufacturing Forum.

Please contact Heather-Michele Adkins (859) 323-3247 (heathermichele@uky.edu) for more information

Awards and Honors

Prof. Jawahir Received 2013 ASME Milton C. Shaw Manufacturing Research Medal

The ISM Director, Professor I.S. Jawahir, James F. Hardymon Endowed Chair in Manufacturing Systems recently received the 2013 American Society of Mechanical Engineering (ASME)'s Milton C. Shaw Manufacturing Research Medal.



The award is named after Professor Milton Shaw, a prominent manufacturing

researcher and educator who taught for five decades at MIT, Carnegie Mellon and Arizona State University.

"I used Professor Shaw's textbook to learn metal machining in the 1970s," says Prof. Jawahir. "He was a role model and mentor to many of us who studied manufacturing, and I am very privileged to be offered this prestigious ASME award."

Prof. Jawahir received this medal for "significant contributions to the advancement of manufacturing science

and engineering through the development of predictive performance models and optimization techniques for machining operations such as turning, milling and drilling; and through the introduction of environmentally benign, sustainable dry, near-dry and cryogenic methodologies". He received the award at the 2013 ASME International Conference on Manufacturing Science and Engineering held on June 10th - 14th at the University of Wisconsin in Madison, Wisconsin.

Julius Schoop Awarded Karlsruhe House of Young Scientists Scholarship from Germany

Julius Schoop received a scholarship from the Karlsruhe House of Young Scientists (KHYS) for a two month long stay at the Karlsruhe Institute of Technology (KIT) in Karlsruhe, Germany. The exchange visit will follow in the footsteps of KIT graduate student Florian Ambrosy's stay earlier last year, and they will work together with Florian and his advisor, Professor Volker Schulze at the wbk (Institute for Production Sciences at the KIT) on cryogenic machining of refractory metals.



Weijie Zhang Receives IIW Henry Granion Prize



Weijie Zhang has received the prestigious IIW Henry Granion Prize in Category D, Human-Related Topics, in recognition for his paper, Modeling of Human

Welding Behavior. Zhang received his master's degree in electrical engineering / control from Harbin Institute of Technology, China, in 2007, then joined the University of Kentucky at Lexington in 2008 as a

research assistant and PhD candidate in the Institute for Sustainable Manufacturing Welding Research Laboratory. His research interests include sensors, arc welding processes, and system identification and control.

Inside Story Headline



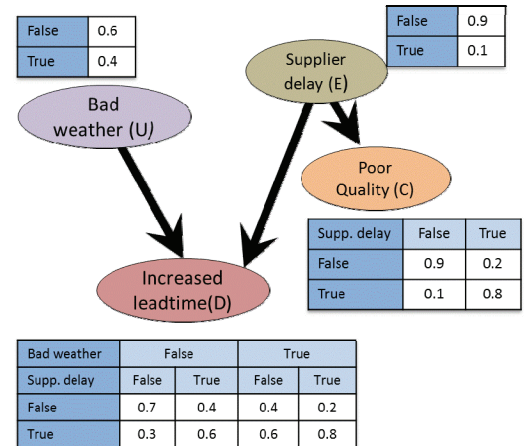
Researcher Highlights Risk Modeling for Sustainable Supply Chains

Prof. Fazleena Badurdeen

The broad-scale impact of sustainable manufacturing upon growing groups of stakeholders has called for multidisciplinary research across a broad spectrum, a development Prof. Badurdeen welcomes. One such collaborative effort, involving faculty from the Colleges of Engineering and Business & Economics at UK, was the multi-year “Risk Assessment for Next Generation Supply Chain Readiness” or, “RANGER”—a project that was led by Prof. Badurdeen. “RANGER was a U.S. Air Force sponsored project which dealt with supply chain risk modeling,” she explains. As if navigating different risk factors is not

daunting enough for a manufacturer, Prof. Badurdeen says it is the interdependence between the risks which needs to be understood, and which RANGER has mapped and modeled. “It is the interdependence which makes managing supply chains so complex. When there was an earthquake and tsunami in Japan, it affected production in Kentucky because Toyota in Georgetown could not get the parts as needed.” Prof. Badurdeen’s team has continued to build on the findings of the RANGER project and extend the application of the tools to various other areas, including modeling and analyzing risks across the supply chain when a company is switching to the use

of new materials for its products. Another area that her team has been using these modeling tools to assess risks in bioenergy supply chains that rely on seasonally varying feedstocks for energy production.



Get your master’s degree in Manufacturing Systems Engineering (MFS) from the University of Kentucky *ENTIRELY ONLINE* *!

The MFS degree offers a multi-disciplinary program that involves world-renowned faculty specializing in machining, brazing, welding, sustainable manufacturing, lean manufacturing, and sustainable systems, including supply chains.

Start advancing your career today!

* Starting Spring 2015

For more information visit: <http://www.engr.uky.edu/mfs/> or contact Peter Hayman at (859) 257-6336, ext. 80611; email pwha222@uky.edu or Director of Graduate Studies for the MFS program, Prof. Fazleena Badurdeen at Badurdeen@uky.edu



Prof. Wei Li

ISM Welcomes Professor Wei “Mike” Li

We would like to welcome Professor Wei “Mike” Li to the Institute for Sustainable Manufacturing! He joined the University of Kentucky Department of Mechanical Engineering from the University of Calgary, Calgary, Canada in Fall 2013. His teaching and research interests are in Production Scheduling and Control, Simulation and Optimization in Healthcare Systems, Operations Research, Operations Management, Manufacturing Systems.

ISM Sustainable Machining Research Laboratory



Prof. I. S. Jawahir

The Sustainable Machining Research Program is an interdisciplinary activity with active participation of several faculty and researchers with diverse manufacturing background. A number of graduate students and post-doctoral researchers conduct research in a range of project areas in machining focusing on dry, near-dry, and cryogenic machining of materials. Many of the current projects are externally funded (NSF, DOD, NASA, KSEF, GM, Ford, Toyota, Sandvik, Semicon, etc.). As part of the international cooperative research during the last few years, a number of international researchers have visited and worked with our research group on many project areas in machining. We are also actively involved in an international

cooperative research work sponsored by the CIRP (The International Academy for Production Engineering) through its working groups.

The current machining research program is focused on two major thrust areas:

(a) Development of Predictive Models for Sustainable Machining Operations

(b) Integrated Systems for Optimum Machining Performance

The first focus area closely looks at the chip formation process in practical operations such as turning, milling and drilling, and is aimed at developing generic, yet robust “fundamental models” for individual machining performance measures such as cutting forces/power/torque, tool-wear/tool-life, surface integrity, chip-form/chip breakability, and part accuracy. On the basis of these fun-

damental models, using a “machining systems” approach, development of system-specific “applied models” is proposed to include the effects of machine tool, cutting tool, and workpiece material. The second focus area encompasses optimization of machining operations to provide optimum machining conditions, cutting tool selection, etc.

A comprehensive machining performance-based optimization program has been developed for turning operations, and this work was also subsequently extended to milling and drilling operations.



Prof. Keith Rouch



ISM Sustainable Energy and Biomaterials Laboratory

Prof. Cheng’s research areas include nano- and micro-meter scale properties of materials and their applications: nanoindentation modeling and measurements of mechanical properties; growth, structure, and properties of nanostructured materials (e.g., amorphous materials, nano-composites, epitaxial single crystals, single crystal nanowires); microscopic shape memory and superelastic effects; magnetorheological fluids;

superhydrophobic and superhydrophilic surfaces; ion-solid interactions and ion beam modification of materials; automotive applications of new materials and processes, including electrical contacts; high power-density engines and transmissions; environmentally friendly machining processes; hydrogen sensors; fuel cells,

metal hydride batteries; and lithium ion batteries. This laboratory is housed in the Whalen Building.



Prof. Y.T. Cheng



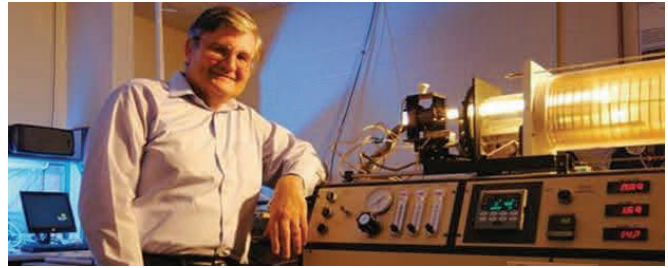
Inside The ISM Laboratories

ISM Brazing, Soldering and Heat Exchangers Research Laboratory

Brazing, soldering and heat exchangers research laboratory is a part of the UK ISM and the Department of Mechanical Engineering. The Brazing Laboratory has received support from NSF, DOD, DOE, KSEF as well as industrial partners such as: GE Aviation, Caterpillar, SAPA, Delphi, Semicon Associates, KB Alloys.

The researchers at this laboratory perform fundamental and applied research for development of state-of-the art brazing technologies (such as

controlled atmosphere brazing of aluminum, brazing of refractory materials, wetting and spreading of liquid metals). Laboratory performs fundamental and applied research for development of state-of-the art brazing technologies (such as controlled atmosphere brazing of aluminum, brazing of refractory materials,



Prof. Dusan Sekulic

wetting and spreading of liquid metals). This program combines fundamental research and technological advances relevant for practical applications.

ISM Brazing, Soldering and Heat Exchangers Research Laboratory



Prof. Lawrence Holloway

Professor Larry Holloway leads a research program in manufacturing systems, focusing on production planning and con-

trol, along with discrete event simulation for manufacturing and shop floor applications. His research group is also actively engaged in investigation of energy use in industrial processes and facilities. Effective use of energy in

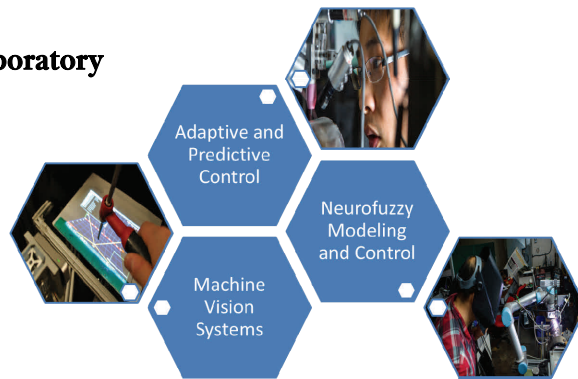
manufacturing operations at plant level and achieving energy efficiency in manufacturing are among the primary research areas.

ISM Welding Research Laboratory



Prof. YuMing Zhang

Prof. Zhang's research is devoted to system identification, adaptive and predictive control, neurofuzzy modeling and control, machine vision systems, and various sensors with applications to welding/manufacturing automation, especially to the development of innovative electrical arc welding processes with improved productivity/controllability.



In addition to his numerous publications, Dr. Zhang has been awarded 7 U.S. patents for his inventions on sensors, control methods, and processes for electrical arc welding. Prof. Zhang's research has been supported by government agencies such as NSF, US Navy and industrial sponsors.

Meet the ISM Staff...



Charles Arvin
ISM Research
Laboratory Manager



Heather-Michele Adkins
Business Manager

INSTITUTE FOR SUSTAINABLE MANUFACTURING

College of Engineering
University of Kentucky
414 CRMS Bldg
147 Graham Avenue
Lexington, KY 40506-0108,
USA

Phone: 859-323-3238
Fax: 859-257-1071
Web: www.ism.uky.edu



Save the Dates!

Friday
14
March

Institute for Sustainable Manufacturing
External Advisory Board Meeting
Friday, March 14th, 2014

Tuesday
21
October

Monitoring and Control Of
Welding Processes Short Course
by Prof. YuMing Zhang
Tuesday, October 21st, 2014
9:30am–5:00pm

Wednesday
14
May

Introduction to Sustainable Manufacturing
Short Course
by Prof. I. S. Jawahir
Wednesday, May 14th, 2014
9:30am–5:00pm

Friday
14
November

Sustainable Product Design and Development
Short Course
by Prof. I. S. Jawahir
Friday, November 14th, 2014
9:30am–5:00pm

Friday
12
September

4th International Sustainable Manufacturing Forum
Friday, September 12th, 2014
8:30am–4:00pm

We're on the web!
www.ism.uky.edu