ISM is in its sixth year of operation, and is continuing to make excellent progress with our overall mission of conducting academic research (basic and applied), offering educational programs, and providing outreach to industry. With our focus on product, processes and systems, ISM faculty and researchers have been in the forefront of research and applications being actively engaged in several research projects sponsored by industry groups and agencies. Once again, we have exceeded our expectations in research productivity with increased funding, research publications, etc., and industry outreach. Here are some highlights of achievements in 2017:

- ISM formed a strategic partnership with United Technology Research Center (UTRC), in collaboration with Edison Welding Institute (EWI), industry partners (GKN, HOoCAR, AAM) and the University of Michigan – Ann Arbor, and proposed a major advanced manufacturing project to LIFT (Lightweight Innovations for Tomorrow, a NNMI institute funded by the DoD - Office of Naval Research, ONR). In May 2017, this research consortium secured a total funding of $2.35M, including cost-sharing, for a two-year project on Sustainable High Efficiency Machining. ISM’s share of this funding is $500,000.
- ISM faculty, Professor Fazleena Badarudeen and Professor Dusan Sekulic continued their research with major funding from DoD agencies (DMDH, another NNMI institute, and NASA) totaling over $2.2M for two projects involving industry partnerships and international collaboration. They both also continued to serve as Co-PIs for a major DoD-funded five-year project on Developing Next Generation Energy Assessment Workforce, with the funding totaling over $1.8M.
- ISM continued with strong industry interactions with major companies such as GE Aviation, Toyota and Lexmark International. We also continued our interactions with several US universities and national labs. We look forward to future opportunities for strategic partnership for large proposals at national level.
- We continued to offer courses for the Online Masters Degree Program in Manufacturing Systems Engineering, focusing on sustainable manufacturing, with more online courses added to the list. From 2016 this program is fully online, and our enrollment has increased significantly during the last few years.
- ISM faculty continued to expand our international collaborations with researchers from Australia, Brazil, China, Finland, France, Germany, Italy, Lebanon, Malaysia, Norway, Portugal, Slovenia, Sweden, Turkey and United Kingdom. New researchers from Germany, Sweden, China and Turkey joined ISM this year to conduct collaborative research.

I. S. Jawahir, Director, ISM
Joshua Werner joined the Mining Engineering Department as an Assistant Professor at the University of Kentucky in Fall 2017, and is an affiliate faculty of the Institute of Sustainable Manufacturing (ISM). He has an active research program focused on collaborative rare earth element projects (Co-PI) totaling over $7M in total project value. His research interests include design, performance and process optimization of extractive metallurgical systems, with an emphasis in hydrometallurgy. His diverse educational and industrial background have led him to pursue projects in the juncture between academia and industry. Pursuing collaborative research in the intersection of academia and industry allows for significant and achievable advances in both primary (mining) and secondary (reycling) metals production. His current research on extractive metallurgical processes and technology contributes to society’s sustainability needs with environmental benefits. Extractive metallurgy is critical in today’s world to balance environmental stewardship and responsibility with ever increasing metals consumption. Josh’s research focus is to develop solutions to meet our needs for metals produced efficiently, effectively and in a sound and sustainable way.

His current research projects include:

- Design and modeling of an advanced pressure leaching process
- Copper upgrading from auto shredder residue
- Rare Earth element extraction from coal and coal hydropyrolysis (Co-PI on a $3M project from the US Department of Energy)

To accomplish his research objectives, he is building and outfitting a lab to allow quick-turn testing utilizing a variety of hydrometallurgical techniques. (See Figure)

I.S. Jawahir delivered two invited plenary keynote papers:

- An emphasis in hydrometallurgy.

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YuMing Zhang delivered an invited keynote presentation:

- Recent Developments in Real-Time Monitoring and Control of Weld Joint Penetration”, 7th BW Annual Assembly and International Conference, Shanghai, China, June 25-30, 2017.
- Human-Robot Collaborative Cyber Physical System Based Learning of Human Welder Intentions”, 7th Annual IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligence, Yiwu Beach, Hawaii, USA, July 31-August 4, 2017.

Y.T. Cheng delivered an invited presentation:


YuMing Zhang was elected as the Chair of the Technical Papers Committee (TPC) of the American Welding Society during the TPC meeting on Tuesday, Nov. 7, 2017 in Chicago, IL. The term start January 1, 2018.

Dusan Sekulic was appointed as a Foreign Expert Chair Professor at the Harbin Institute of Technology, China, starting August 2017.

I.S. Jawahir served as the Honorary Chairman, 16th CIRP Conference on Manufacturing Operations (CMM), Cluj, France on June 15-16, 2017.

I.S. Jawahir was awarded the 2017 University Research Professorship by the University of Kentucky, Lexington, KY, USA in April 2017.

I.S. Jawahir was selected as a Member of the US Team for US-China Technology Collaboration in Manufacturing, and visited a number of German universities and research institutes in February 2016.

Dusan Sekulic

- High precision laser metal surface finishing driven flow modeling (brazeing and 3-D printing)
- Kinetics of brazed joint formation in terrestrial and space conditions
- Impact of nano-particles doping on microstructure evolution for refractory metals systems
- Homogenization of ceramics-metal-ceramic interface domains

Fazleena Badurdeen

- Multi-lifecycle Sustainable Product Design
- Sustainable and Reconfigurable Manufacturing Systems
- Supply Chain Risk and Resilience Modeling

Mike Li

- Adaptive production scheduling and control
- Trade-off balancing with time series
- Operating room scheduling in healthcare systems
- Coordination of material flows in supply chain