The steel, forging, welding, heat treatment, glass, and other industries are indispensable because their products and services are used everywhere, from cars, to appliances, airplanes, ships, and buildings. These are also important industries for Michigan. Rolling and forging represent the upstream sector of the automotive supply chain as well as newly emerging industrial sectors. The operational efficiency of these industries, however, has been limited. Each year around the globe, millions of tons of work pieces are scrapped and nearly Terawatt-Hours of energy are wasted due to the lack of in-line sensors and associated process control algorithms to detect hot surface defects.

With the encouragement and support of the Michigan-based forging and steel industries, industrial and operations engineering professor Jianjun (Jan) Shi and associate professor Jionghua (Judy) Jin, jointly with the OG Technologies, Inc. (OGT), prepared a proposal to develop the S-P3 System: “Sensor-based Prognostics and Predictive Process (S-P3) Control for Hot Deformation Processes,” based on OGT’s Hot Eye™ invention. Hot Eye™ delivers high-definition images of work pieces at or exceeding 1,450°C with room-temperature appearances. Based on these sensing data, on-line control algorithms will be developed to detect and classify surface defects and further diagnosis and predictive control will be conducted to find root causes and improve product quality.

Shi and Jin’s proposal was one of 61 proposals selected to share more than $100 million from the first round of Michigan’s 21st Century Jobs Fund, a $2 billion, ten year initiative to create jobs in Michigan’s emerging technologies. According to Governor Jennifer M. Granholm, “These awards recognize some of the most promising and innovative job creating ideas Michigan has to offer.”

Commercialization of S-P3 will provide technical innovation to help to keep the local forging and steel industries ahead of the competition in other world regions. If forging quality is improved at a lower cost, this will positively impact job creation in the State of Michigan.

Quality in manufacturing has always been a major thrust in the Department of Industrial and Operations Engineering and continues to be vital as exemplified by the Jobs Fund project. The current research and teaching activities described on the next two pages demonstrate the breadth of quality applications.
Quality Research in IOE

On the surface, finding defects during the manufacture of steel may not have a lot to do with epidemiology. But when a representative of the United States Air Force heard a presentation by Jan Shi, professor of Industrial and Operations Engineering, he immediately saw the connection.

Shi’s research in steel manufacturing, funded by the Department of Energy and OG Technologies of Ann Arbor, uses in-line sensing equipment to detect defects and find their causes. Quality checks at prescribed points during the cooling and reduction process have led to energy savings and waste reduction.

With a database of 400,000 coded individual occupational and clinical histories, the Air Force was looking for a way to relate job assignments of its personnel to increased medical symptoms later on. “One general algorithm can be applied to both the steel process and the risk factors associated with job assignments in the Air Force. Air Force personnel are the material and hospital and doctor visits are the quality checks,” said Shi.

The Air Force research uses data mining and causal discovery to create new knowledge. Shi states, “We are able to alert the Air Force to trends they hadn’t recognized,”

Associate Professor Judy Jin’s research interests focus on data fusion and decision making for complex systems to develop new methodologies for system modeling, condition monitoring and fault diagnosis, process control, knowledge discovery and decision making. She received the prestigious Presidential Early Career Award for Scientists and Engineers (PECASE) to develop a unified methodology for variation management and reduction in multistage manufacturing processes (MMPs).

In her work with MMPs, she will be using statistical methods driven by engineering models for product defect prevention and cost reduction.

In one new multi-university research project funded by the Air Force, she is part of a team working on developing a detailed mathematical model capable of emulating the behavior of human decision-makers in complex and dynamic task scenarios. For example, the decisions of military generals will be integrated with mathematical modeling. “Human decision-making is more robust, extracting fewer but better decision factors,” said Jin.

The Internet has become a very complex network with millions of users and a huge range of applications. At the same time, users and the applications require a very high quality of network performance in terms of delays and losses. This is especially so for newer applications such as Internet Telephony (or Voice over IP), on-line games, and streaming video. The delays are caused by queues at the network routers. If the buffer is full, the data packets are simply dropped, leading to losses.

Professor Vijay Nair has been developing new methods and techniques for analyzing internet data in order to characterize and monitor network performance. His work has focused on methods that artificially send packets from one computer to another in the network and study the behavior of these packets. “The interesting question is how to use these end-to-end data to determine where the congestion or poor performance lies within the network,” said Nair.
A Quality Education

Six Sigma

The Six Sigma Certification Training Program is a prime example of the world impact of Michigan Engineering. This program is co-led by professor Gary Herrin and Pat Hammett. The online certification program is offered in nine languages and has had students enrolled from 20 countries. “We have a Mexican student who is taking this course from the Czech Republic,” comments Luis Garcia-Guzman who is one of the Six Sigma instructors.

Since 2002, the Six Sigma program has trained over 6,000 green belts, 100 black belts, and 600 undergrads who have taken IOE 461. Green belts are offered in manufacturing, transportation, design engineering and health care. For more information, go to the Center for Professional Development website, http://cpd.engin.umich.edu/cpd-site/programs/index-certificate.xsl.

Undergrads can take IOE 461 “Quality Engineering Principles” the traditional way, in the classroom, or online from their dorm room. Pat Hammett, who teaches the popular undergraduate course, is developing a new Six Sigma course for design engineers which will be offered in winter 2007. Alumni who have projects that would be suitable for student internships should contact Hammett at phammett@umich.edu. “We have lots of students who are looking for opportunities to apply the Six Sigma concepts.”

Engineering Student Retention

As increased accountability and external demands for results become more prevalent, educational organizations are also beginning to pay attention to frameworks such as ISO, Lean, Six-Sigma and Baldrige.

After a career in industry, Cindy Veenstra decided to enter the PhD program in IOE to study the application of process improvement and quality principles to retention of freshmen in engineering colleges. As part of her research, she has looked at the academic alignment issues between high school and engineering college. “Some K-12 schools are using quality tools such as flow charts, Pareto analysis, and continuous improvement strategies, to align process with their shared vision from high school all the way down to kindergarten,” states Veenstra.

Veenstra is a Fellow of the American Society for Quality (ASQ) and a board member for the Educational Division. She believes that as engineers trained in quality, “IOE alumni could do a lot to help their local school districts understand and implement quality tools to improve the educational outcomes for their communities.”

Engineering Education

As a professor of Industrial and Operations Engineering, Gary Herrin taught quality engineering to thousands of undergraduates over the past three decades. In his current role as Associate Dean for Undergraduate Education, he is able to apply the same quality theory and methods to engineering education programs. “We are engineering an engineering education,” Herrin states.

As a college administrator, Herrin leads the design of systems to reduce costs and improve yield, throughput and quality of all aspects of an undergraduate’s education. Using quality principles and strategies for continuous improvement, the curriculum is now focused on outcomes assessment and metrics. To enforce those outcomes the college must offer the right course at the right time, courses must link together and supplemental help and instruction must be tailored to each individual student. “Mass customization and a seamless process” is Herrin’s ideal.

“The customer defines quality and our constituents tell us they want engineers who are ethical, can solve problems, and function on teams,” states Herrin. Every aspect of the student experience is constantly being evaluated to better achieve these outcomes. “The University of Michigan and the College of Engineering are expected to help define engineering education for the world of the future.”
Chair’s Message

Welcome to IOE News, our newsletter for alumni and friends of the Department of Industrial and Operations Engineering. As I mentioned in our last issue, we plan to focus, in turn, on particular teaching and research areas of the department. This issue features our Quality Engineering (QE) area with particularly strong activities across research, teaching, and outreach. Our faculty and PhD students are featured in articles about the distinctive research activities applying QE in areas ranging from manufacturing to health care to information technology to education.

Our QE educational activities employ the latest technologies to provide online QE courses to both on-campus students and off-campus students, from 20 countries, in nine different languages. Our cover article describes industrial outreach and Professors Shi’s and Jin’s successful proposal to the Michigan Jobs Fund to impact job creation in the state. This was an incredibly competitive process and we are quite proud of Professors Shi and Jin for their accomplishments.

This past year featured a significant changing of the guard with the retirements of Jim Foulke and Don Chaffin joining the ranks of Emeritus Professors Steve Pollock and Walt Hancock. Jim and Don have had a significant impact on the department over many years, and we are hopeful that they will continue to contribute their knowledge and experience in ways that are meaningful to them and to the IOE family.

Another notable event was the 2006 Steffy Distinguished Lecture given by Bill Pulleyblank from IBM. His talk, “BlueGene, Supercomputing and Cyberscience,” delivered to an overflow crowd, was both entertaining intellectually stimulating.

On the awards front, Wally Hopp received our annual IOE Alumni Merit Award. In a relatively short period of time since graduating from IOE, Wally has distinguished himself on many fronts and serves as a fabulous ambassador for the Department. Also of note, we are pleased to showcase our own Chris Konrad, who received the College’s Staff Excellence Award.

Chris is responsible for our department’s infrastructure, and consistently goes above and beyond the call of duty to tend to routine details as well as last minute emergencies.

I’m particularly proud of the grass roots alumni-initiated effort to form a new IOE Alumni Society. The Society has an energetic group of officers and an impressive list of projects that will have a very positive impact on both current and former students. As alumni you can play a key role in supporting the Department in many ways. After reading the article, I’m sure you’ll want to get involved!

Another alumni-driven grass roots effort is the recently established Andrew S. Crawford Award for Entrepreneurship Excellence. Andy Crawford (IOE ’64) developed the first Entrepreneurship course at the Engineering College and taught it for 15 years, influencing the lives of many students, that was clearly demonstrated by the incredibly wonderful testimonials at his memorial and the many letters we have received along with donations. The award will recognize students who demonstrate the entrepreneurial spirit of Andy. Spearheading this effort is Mike O’Connell (IOE ’93) (mike@pavilionwinery.com) along with Brad Finkbeiner (IOE ’99).

As our enrollment continues to grow, we appreciate the ongoing strong support from the College, and currently we are searching to fill two additional faculty positions in the areas of supply chain management and financial engineering. If you know of people who you believe would be excellent additions to the IOE faculty, please point them our way. At this time, I am also pleased to announce that we were successful in hiring our newest faculty member, Professor Xiuli Chao, from the North Carolina State University. His interests are primarily in the areas of queueing theory, scheduling, inventory control, and supply chain management. Professor Chao will join us this Summer and we plan to feature him in the next newsletter.

We have much to celebrate in IOE; the accomplishments of our faculty, staff, and alumni are always a pleasure to showcase. And finally, the recognition garnered by our students, on all fronts, makes me incredibly proud to be Chair of such an outstanding Department.

As always, this is your newsletter and we enjoy hearing from you. Please send your comments, suggestions, news items, etc. to seiford@umich.edu.

Go Blue!

Lawrence M. Seiford
A Changing of the Guard in IOE

On November 16 and 17, 2006, an Occupational Biomechanics Symposium entitled “Celebrating 35 Years of Progress and Looking Toward the Future” marked the retirement of Don Chaffin. Many of his former students were speakers at the seminar and gathered for a reception and dinner in his honor.

Chaffin and recent retirees Steve Pollock and Jim Foulke have, through their seminal research, shaped the field of Industrial and Operations Engineering over the last 40 years. The department has grown and prospered from their vision and commitment. Their legacy of teaching and mentoring of students serves as an inspiration to their colleagues and as well as many thousands of grateful students.

Welcoming Chaffin into a working retirement was Steve Pollock who became Emeritus in 2005.

Among the attendees was Jim Foulke who recently retired after 46 years as a Research Engineer in the Center for Ergonomics.

Don Chaffin, center, is joined by a very impressive group of his current and former students.
Hopp Receives 2006 Alumni Merit Award

Wallace J. Hopp serves as Breed University Professor of Manufacturing Management in the Department of Industrial Engineering and Management Sciences, and director of the Master of Management and Manufacturing Program, a joint program of the Kellogg Graduate School of Management and McCormick School of Engineering at Northwestern University. A widely respected leader of industry, Professor Hopp’s expertise includes the design, control and management of production systems.

An accomplished teacher, Professor Hopp has received a number of teaching awards, including the 1989 McCormick Teaching Award for best engineering professor, the 1998 Kellogg Top Five Professors Award for outstanding management teaching, and the 1998 Institute of Industrial Engineers (IIE) Book-of-the-Year Award for the text Factory Physics: Foundations of Manufacturing Management, and the 2006 Society of Manufacturing Engineers Education Award.

He is also an influential researcher, as recognized by many honors, including the 1990 Scaife Award (with Mark Spearman) for the paper with the greatest potential for assisting an advance of manufacturing practice, the 1993 Pentair-Nugent Professorship in Business Leadership for leadership in manufacturing management, and Fellow Awards from IIE in 2002, and the Institute for Operations Research and The Management Sciences (INFORMS) in 2004, Manufacturing and Service Operations Management (MSOM) Society in 2005 and Production and Operations Management Society (POMS) in 2006.

Professor Hopp is currently editor-in-chief of the journal Management Science and senior editor of Production and Operations Management.

He is an active industry consultant, whose clients have included Bell & Howell, Black & Decker, Case, Dell, Ford, Eli Lilly, Emerson Electric, General Motors, John Deere, IBM, Intel, Motorola, Owens Corning, Texas Instruments, Whirlpool, Zenith and others.

Professor Hopp earned a master of science degree in 1982 and a doctoral degree in 1984 in industrial and operations engineering from the University of Michigan.
Faculty News

**Bernard Martin** has been conferred the “Palmes Académiques” by ministerial order from the French Minister of Education. The honorary title, originally established by Napoleon Bonaparte, is an award for devotion and accomplishment in the areas of teaching, scholarship, and research. It is the oldest distinction attributed to civilians. The award will be conferred by the French Consulate in Chicago.


Sarter gave the keynote at a workshop on neuroergonomics at the 2nd Meeting of the European Societies of Neuropsychology, entitled “Neuroergonomics: Opportunities and Challenges” in Toulouse, France on October 19, 2006.

**Yili Liu** received the Jon R. and Beverly S. Holt Award for Excellence in Teaching for his dedication and commitment to outstanding teaching at all levels.

**Lawrence M. Seiford** has been selected as a Fellow of the Institute for Operations Research and the Management Sciences (INFORMS), a Fellow of the Institute of Industrial Engineers (IIE) and a Fellow of the American Society for Quality (ASQC).

**Jussi Keppo** received funding from NSF for the project “A Global Theory of Information and its Nonconcavity, with Economics and Social Applications”. He has already submitted two papers related to this: “The demand for information: more heat than light,” (co-authored with G. Moscarini and L. Smith) and “Optimal Electoral Timing: Exercise Wisely and You May Live Longer,” (co-authored with D. Davydov and L. Smith)

**Jionghua (Judy) Jin** and **Yu Ding** received the Best Paper Award from IIE Transactions, 2006, for the paper “Online Automatic Process Control Using Observable Noise Factors for Discrete-part Manufacturing,” IIE Transactions on Quality and Reliability, Vol. 36, No. 9, pp. 899-911.

Jing Li, Jionghua (Judy) Jin, and Jianjun (Jan) Shi received the Best Paper Award from the 2006 Industrial Engineering Research Conference for the paper “Causation-Based T2 Decomposition for Multivariate Process Monitoring and Diagnosis”.

Jin was elected Section Chair of the Quality, Statistics, and Reliability (QSR) Subdivision of INFORMS and president of the Quality Control and Reliability Engineering Division at IIE for 2006.

Staff Excellence

**Chris Konrad**, Manager of Information Technology and Facilities, received a 2006 Excellence in Staff Service Award from the College of Engineering for his outstanding technical expertise and his strong commitment to IOE’s faculty, students and staff.

Chris analyzes and coordinates equipment purchases for the department’s research labs, classrooms and offices. He works closely with new faculty to set up their offices and labs, ensuring that every transition to College is seamless.

Chris has done an outstanding job of enhancing the department’s teaching and learning facility through innovation and creativity. Last year, he undertook the redesign and refurbishment of an underused space and turned it into a state-of-the-art, reconfigurable room that is now used for many purposes. More recently, he saw an opportunity to create a computer lab for graduate students by using an extra office in the building and making several computers available.

A dedicated member of the staff for more than 20 years, Chris is also an IOE alum. He received a BS in IOE and, while working in IOE, he completed his IOE master’s degree.
IOE Alumni Society Response Form

To become a member of the newly formed IOE Alumni Society please fill out the information below and send to:

Nancy Murray
1883 IOE Building
1205 Beal Avenue
Ann Arbor MI 48109-2117

Name ____________________________________________
Address (Home)____________________________________
__________________________________________________
Email (Preferred)___________________________________
Phone (Home)_____________________________________
Address (Work)__________________________________
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Phone (Work)___________________________________
Current Occupation:____________________________________________________________________________________
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______________________________________________________________________________________________________
News you would like to share in the next newsletter:___________________________________________________________
______________________________________________________________________________________________________
______________________________________________________________________________________________________
__________________________________________________
Indicate below how you would like to participate in the IOE Alumni Society:

☐ Help to plan an alumni event in Ann Arbor for fall 2007
☐ Help to organize regional IOE Alumni gatherings
☐ Work with student groups and the department to enhance student recruiting, job and internship recruiting, mentoring and other efforts to connect with students
☐ Speak in Ann Arbor as part of the Distinguished Alumni Speaker Series
☐ Make a financial contribution to support Society initiatives

The first year membership in the IOE Alumni Society is free! If you wish to help the Society with a financial contribution you may send a check made out to “University of Michigan” or use a credit card with the form on page 11, indicating that your gift is for the IOE Alumni Society.

Online registration is also available at http://ioe.engin.umich.edu/alumni/alumni_society/.
After a year of planning, 17 Alumni met on October 27, 2006, to found a new IOE Alumni Society. The mission of the new IOE Alumni society is to enhance the relationship between the Department of Industrial and Operations Engineering of the University of Michigan, and the alumni of the department, thereby encouraging the excellence of the department and its graduates.

Officers were elected by those present to serve a term beginning October 27, 2006, through July 1, 2009. Officers (Executive Committee) are: Rob Holt (President and Treasurer), Brad Finkbeiner (Vice-president) and Matt Stich (Secretary).

The charter of the new society can be read on the website: http://ioe.engin.umich.edu/alumni/alumni_society/.

While financial support is always a goal of alumni organizations, the immediate focus of the new IOE Alumni Society will be to reach out to students and alumni to fulfill the purpose of the society.

The society plans to have at least one event in the department before the end of the spring 2007 term for alumni to speak to and mingle with students who will be graduating. The society also plans to hold an event in the fall of 2007 to coincide with the annual Michigan Engineering Alumni Weekend. Other goals include a distinguished alumni speaker series; establishing contacts between students and alumni for student and job recruitment, mentoring, and internships; and holding regional social gatherings to reach out to alumni in other parts of the country and the world.

A PhD Alumni Group was formed in 2002 through the efforts of Jack Muckstadt and Don Chaffin. Donations from PhD alumni have provided travel grants to help PhD students attend conferences to present their research and network with other researchers. This PhD Alumni Group will now be a part of the new IOE Alumni Society which is open to BSEs, MSs and PhDs as well as faculty, staff or anyone who has an enduring interest in the IOE department. PhD alumni may still designate their contributions for PhD students if they wish.

Alumni may become active members of the Society by contributing their time and/or by making a donation. Details of membership can be found at the IOE Alumni Society website http://ioe.engin.umich.edu/alumni/alumni_society/ or you may mail in the form at left.

Join Now! First year membership is free!

Some of the alumni who participated in the founders meeting of the new IOE Alumni Society on October 27, 2006 are: (back row) Rob Holt, Dan Reaume, LaVerne Hoag, Howard Estes, Jack Muckstadt, Randy Rabourn; (front row) Elise Metzger, Marilyn Maddox, and Sheryl Ulin.

Alumni Society Purpose
...to foster fellowship and strengthen ties among alumni, students, faculty and friends of the department...to provide advice, encouragement and assistance through mentoring and other methods of communication with the students of the department...

Alumni may become active members of the Society by contributing their time and/or by making a donation. Details of membership can be found at the IOE Alumni Society website http://ioe.engin.umich.edu/alumni/alumni_society/ or you may mail in the form at left.

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Student Honors

IOE Student Awards
Accenture Scholarship
  Ryan Purcell
  Samantha Jarema
Wyeth Allen Scholarship
  Franklin Jen
Goldberg Scholarship
  Michael Duboe
Hancock Scholarship
  Elizabeth Holdsworth
  Jinwei Ni
Clyde Johnson Scholarship
  Steven Agacinski
  Feifei Hu
  David Hamilton
Myun Lee Scholarship
  Carolyn Bertelson

STIET Fellowships
Richard Chen was awarded a STIET Fellowship for 2007. Current STIET fellows Emily Gray and Stan Dimitrov received renewals for 2007.

2006 Student Instructor Awards
Changxu Wu received the 2006 Outstanding Student Instructor Award sponsored by the American Society for Engineering Education.

NSF Fellowships Awarded
Marc Berman, Ada Barlatt and Gabrielle Tremblay received NSF Graduate Research Fellowships for 2007.

Barbour Scholar
Jing Li has been selected as a Barbour Scholar for 2007 by the Rackham School of Graduate Studies.

Entrepreneurship Award
Rachel Davis received the first Andrew S. Crawford Award for Entrepreneurship Excellence for 2006.

Andrew S. Crawford Entrepreneurship Award
A group of alumni recently established the Andrew S. Crawford Award for Entrepreneurship Excellence at the University of Michigan. This award is named after the late Professor Andy Crawford, in honor of his entrepreneurial spirit and interest in imparting business skills to Michigan engineers.

Professor Crawford spent 15 years teaching the entrepreneurship class in the Department of Industrial and Operations Engineering (IOE). The class he designed provided an overview of the skills needed to run a business — from goal-setting to accounting to marketing and sales. For many of you, writing your first business plan in Andy’s course was an early milestone. This class, which is still taught today, is an excellent example of how Andy was an incredible mentor to and motivator of Michigan undergrads — a unique relationship at such a large university. In fact, Larry Page, co-founder of Google, was a student in the Entrepreneurship class.

The Crawford Award is intended to encourage engineers to pursue their entrepreneurial interests in a wide range of fields, just as many of you have done. Hopefully, the Crawford Award will empower future engineers who have the skills and interest to find the passion to also choose this path.

A donor has agreed to match all contributions. Mike O’Connell (IOE ’93) (mike@pavilionwinery.com) and Brad Finkbeiner (IOE ’99) have already written to many of you. If you are interested in supporting the Crawford Award, please contact Mike, Brad, or Larry Seiford (seiford@umich.edu).
How can you...

...make a difference for IOE students?

...keep IOE on the leading edge?

Your tax-deductible gift to IOE will provide opportunities for students and keep our program strong. Designate your support to:

**IOE Special Gift Fund**
Your gift enables us to develop programs that help to support student organizations, sponsor seminars and outside speakers, initiate student research efforts, pursue special recruiting programs, and many other activities to enrich the department.

**IOE Undergraduate Scholarship Fund**
Your gift enables us to make awards to undergraduates who have financial need, are outstanding students, or have exemplified exceptional leadership and character.

**IOE Graduate Fellowship Fund**
Your gift enables us to make awards to graduate students based on financial need, outstanding scholarship, teaching and/or research.

Please use the form below to make your gift today.

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Please check if you would like your gift to remain anonymous

Please designate my gift to IOE for:

- [ ] IOE Special Gift Fund
- [ ] IOE Undergraduate Scholarship Fund
- [ ] IOE Graduate Fellowship Fund

(Undesignated gifts will be placed in the IOE Special Gift Fund)

Enclosed is my gift of:

- [ ] $500
- [ ] $250
- [ ] $100
- [ ] Other

Enclosed is my (or my spouse’s) employer matching gift form

My check is made payable to: University of Michigan-IOE

Charge my gift of $_______ to my:

- [ ] Visa
- [ ] MasterCard
- [ ] Discover
- [ ] AMEX

Signature (for credit card gift)

Send to: Nancy Murray
1883 IOE Building
1205 Beal Avenue
Ann Arbor, MI 48109-2117
W. R. Pulleyblank, Vice President of the Center for Business Optimization, IBM Business Consulting Services, was the Wilbert Steffy Distinguished Lecturer for 2006.

The 2006 Wilbert Steffy Distinguished Lecture was delivered on September 14, 2006, by W.R. Pulleyblank, Vice President of the Center for Business Optimization with IBM Business Consulting Services. His talk, “BlueGene, Supercomputing and Cyberscience,” described how the computing power of the IBM BlueGene/L supercomputer is creating opportunities for major advances in many areas of scientific computing, including protein science, climate modeling and material science. The IBM BlueGene/L supercomputer is the world’s most powerful supercomputer.

The Lectureship was established by an endowment from Doris Steffy in memory of her husband to bring a distinguished individual in Industrial and Operations Engineering to lecture to the faculty, students, staff and public and to promote intellectual exchange between UM researchers and other internationally recognized leaders.