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ASME
SETTING THE STANDARD

43RD | 2015 NAMRC - MSEC

NAMRC 43

NAMRI/SME North American Manufacturing Research Conference

MSEC 2015

ASME International Manufacturing Science and Engineering Conference

June 8 - 12, 2015
Charlotte, North Carolina USA

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WEBSITE

Looking for more information?
namrc-msec-2015.uncc.edu

ABSTRACTS

Abstracts are available online. Visit:
namrc-msec-2015.uncc.edu/abstracts
for information and access.

QUESTIONS

If you have questions or concerns, visit the Reception Desk located in the Midway Room on the conference floor.

TIPS

Check your room television for any changes or updates to the conference daily schedule.

Student volunteers are ready to assist you. Locate them by their dark green polo shirts.

Updates to the program can be found in the pocket divider between pages16-19.

Monday, June 8, 2015

Time	Event	Location
9:00 AM - 3:00 PM	NAMRI Board of Directors Meeting	Harris
1:00 PM - 3:00 PM	Tutorial: High-speed Milling and Machining Dynamics	Walden
1:00 PM - 3:00 PM	Tutorial: Dimensional Metrology	Olmstead
1:00 PM - 6:00 PM	Registration	Welwyn and Midway
1:00 PM - 6:00 PM	Exhibit Setup	Glenwaters
1:00 PM - 7:00 PM	Workshop: NSF Proposal Writing	Lakeshore III & IV
3:30 PM - 5:30 PM	Tutorial: Machine Tool Metrology	Walden
7:00 PM - 9:00 PM	Welcome Reception	Pool Deck (inclement weather: University Ballroom)

Tuesday, June 9, 2015

Time	Event	Location
7:30 AM - 8:30 AM	Continental Breakfast	Glenwaters
8:00 AM - 8:15 AM	Welcome	University Ballroom
8:00 AM - 5:00 PM	Registration	Midway & Welwyn
8:15 AM - 8:50 AM	Conference Keynote: Chuck Hall, 3D Systems "An Engineer's View of the Third Revolution"	University Ballroom
8:30 AM - 5:00 PM	Exhibits	Glenwaters
8:50 AM - 9:00 AM	Recognition of Robert J. Hocken	University Ballroom
9:00 AM - 10:30 AM	NAMRC: Hocken Symposium I	SALON I
9:00 AM - 10:30 AM	MSEC 2-11: Forming with Polymers	SALON II
9:00 AM - 10:30 AM	MSEC 2-7: Metal Additive Manufacturing I	SALON III
9:00 AM - 10:30 AM	NAMRC: Novel Additive Processes I	SALON IV
9:00 AM - 10:30 AM	NAMRC: Machining Dynamics I	Walden
9:00 AM - 10:30 AM	MSEC 2-1: Non-traditional Abrasive Machining	Keynes

CONFERENCE SCHEDULE

Tuesday, June 9, 2015

Time	Event	Location
9:00 AM - 10:30 AM	NAMRC: Cutting Tools and Mechanics II	Burnham
9:00 AM - 10:30 AM	NAMRC: Manufacturing Efficiency	Audubon
9:00 AM - 10:30 AM	MSEC 1-1: Materials – Experiments and Modeling I	Olmstead
9:00 AM - 10:30 AM	MSEC 2-6: Processing and Testing of Polymers and Composites I	Lakeview
9:00 AM - 11:00 AM	MED Executive Committee Meeting	Harris
10:30 AM - 11:00 AM	Morning Break	Glenwaters
11:00 AM - 12:30 PM	NAMRC: Hocken Symposium II	SALON I
11:00 AM - 12:30 PM	MSEC 2-11: Incremental Forming I	SALON II
11:00 AM - 12:30 PM	MSEC 2-7: Metal Additive manufacturing II	SALON III
11:00 AM - 12:30 PM	NAMRC: Design for Additive Manufacturing	SALON IV
11:00 AM - 12:30 PM	NAMRC: Machining Dynamics II	Walden
11:00 AM - 12:30 PM	MSEC 2-4: Machining IV	Keynes
11:00 AM - 12:30 PM	NAMRC: Cutting Tools and Mechanics III	Burnham
11:00 AM - 12:30 PM	MSEC: Student Manufacturing Design Competition	Audubon
11:00 AM - 12:30 PM	MSEC 1-1: Materials – Experiments and Modeling II	Olmstead
11:00 AM - 12:30 PM	MSEC 2-6: Processing and Testing of Polymers and Composites II	Lakeview
12:30 PM - 2:00 PM	JMSE Editorial Committee Meeting	Boardroom
12:30 PM - 2:00 PM	Lunch • Invitation to 2016 Conference: Dr. Jaime Camelio • Tribute to Prof. B. VonTurkovich: Prof. B. Klamecki • Launch of MTConnect Student Challenge • Research in Germany	University Ballroom
2:00 PM - 3:30 PM	NAMRC: Hocken Symposium III	SALON I
2:00 PM - 3:30 PM	MSEC 2-11: Forming Symposium Keynote: Prof. Dorel Banabic	SALON II
2:00 PM - 3:30 PM	MSEC 2-7: Additive Manufacturing Symposium Keynote: Prof. Suresh Babu	SALON III
2:00 PM - 3:30 PM	NAMRC: Quality in Additive Manufacturing	SALON IV
2:00 PM - 3:30 PM	MSEC 2-4: Machining I	Walden
2:00 PM - 3:30 PM	MSEC 2-5: Advances in Non-traditional Manufacturing Processes I	Keynes
2:00 PM - 3:30 PM	MSEC 2-3: Laser Surface Processing	Burnham
2:00 PM - 3:30 PM	MSEC: Student Manufacturing Design Competition	Audubon

Tuesday, June 9, 2015

Time	Location	Event
2:00 PM - 3:30 PM	MSEC 1-2: Materials Processing, Microstructure, Plasticity and Testing I	Olmstead
2:00 PM - 3:30 PM	MSEC 2-6: Advances in Manufacturing of Polymers and Composites	Lakeview
3:30 PM - 4:00 PM	Afternoon break	Glenwaters
4:00 PM - 5:00 PM	NAMRI Membership Meeting	SALON I
4:00 PM - 6:00 PM	MTConnect Technical Workshop	SALON III
5:00 PM - 6:00 PM	ASME MED Membership Meeting	SALON I
6:00 PM - 9:00 PM	Speedway Club Networking Dinner (Buses leave from hotel lobby)	Off-site

Wednesday, June 10, 2015

Time	Event	Location
7:30 AM - 8:30 AM	Continental Breakfast	Glenwaters
8:00 AM - 12:00 PM	Poster Setup	Lakeview
8:00 AM - 5:00 PM	Registration	Welwyn and Midway
8:30 AM - 10:00 AM	MSEC 2-1: Abrasive Machining Symposium Keynote: Prof. Kai Cheng	SALON I
8:30 AM - 10:00 AM	NAMRC: Cyber-Physical Systems in Manufacturing I → Track Keynote: Prof. Lihui Wang	SALON II
8:30 AM - 10:00 AM	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - I	SALON III
8:30 AM - 10:00 AM	MSEC 2-13: Monitoring, Sensing, and Control for Intelligent Machining and Inspection - I	SALON IV
8:30 AM - 10:00 AM	NAMRC: Additive Manufacturing Materials	Walden
8:30 AM - 10:00 AM	MSEC 2-11: Forming and Joining of Hollow Parts	Keynes
8:30 AM - 10:00 AM	MSEC 2-4: Machining II	Burnham
8:30 AM - 10:00 AM	MSEC 2-4: Forming	Audubon
8:30 AM - 10:00 AM	MSEC 2-5: Advances in Non-traditional Manufacturing II	Olmstead
8:30 AM - 5:00 PM	Exhibits	Glenwaters
10:30 AM - 11:00 AM	Morning Break	Glenwaters
10:30 AM - 12:00 PM	MSEC 4-3: Intelligent Maintenance Scheduling	SALON I

CONFERENCE SCHEDULE

Wednesday, June 10, 2015

10:30 AM - 12:00 PM	NAMRC Panel Discussion: Government Support of Manufacturing Research – Current Status and Future Trends	SALON II
10:30 AM - 12:00 PM	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - II	SALON III
10:30 AM - 12:00 PM	MSEC 2-13: Monitoring, Sensing, and Control for Intelligent Machining and Inspection - II	SALON IV
10:30 AM - 12:00 PM	MSEC 2-10: Welding I	Walden
10:30 AM - 12:00 PM	MSEC 2-11: Innovations in Materials Forming	Keynes
10:30 AM - 12:00 PM	MSEC 2-1: Grinding and Grinding Tools	Burnham
10:30 AM - 12:00 PM	MSEC 1-2: Materials, Processing, Microstructure, Plasticity, and Testing II	Audubon
10:30 AM - 12:00 PM	MSEC 2-5: Advances in Non-traditional Manufacturing III	Olmstead
12:00 PM - 1:30 PM	ASME Awards Luncheon • Best Organizer of Symposium & Session Award • Best Paper Award • MED Outgoing Chair Recognition • Ennor Manufacturing Technology Award • Milton C. Shaw Manufacturing Research Medal • Recognition of JMSE and JMNM Retiring Associate Editors • Chao & Trigger Young Manufacturing Engineer Award • Recognition of ASME Fellows • Recognition of Tech. Program Chairs, Vice-chairs, and Organizers	University Ballroom
1:30 PM - 3:00 PM	MSEC 4-3: Maintenance for Advanced Manufacturing Systems	SALON I
1:30 PM - 3:00 PM	MSEC 2-7: Panel: State-of-the-Art, Challenges, and Research Needs to Further Additive Manufacturing	SALON II
1:30 PM - 3:00 PM	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - III	SALON III
1:30 PM - 3:00 PM	MSEC 2-14: Laser, Process Innovations, and Energy Field Manufacturing I	SALON IV
1:30 PM - 3:00 PM	MSEC 2-10: Welding II	Walden
1:30 PM - 3:00 PM	NAMRC: Forming I	Keynes
1:30 PM - 3:00 PM	NAMRC: Abrasive Machining	Burnham
1:30 PM - 3:00 PM	MSEC 2-10: Assembly	Audubon
1:30 PM - 3:00 PM	MSEC 2-5: Advances in Non-traditional Manufacturing IV	Olmstead
1:30 PM - 5:00 PM	MSEC: Poster Session	Lakeview
3:30 PM - 5:00 PM	MSEC 2-9: Equipment Design and Tooling to Enhance Manufacturing Processes	SALON I

Wednesday, June 10, 2015

3:30 PM - 4:00 PM	Afternoon break	Glenwaters
3:30 PM - 5:00 PM	NAMRC: Cyber-Physical Systems in Manufacturing II	SALON II
3:30 PM - 5:00 PM	MSEC 2-12: Substitution and Enhancement of Traditional Processes with Laser-based Techniques: Technical and Economic Feasibility	SALON III
3:30 PM - 5:00 PM	MSEC 2-14: Laser, Process Innovations, and Energy Field Manufacturing I	SALON IV
3:30 PM - 5:00 PM	MSEC 2-8: Renewable Energy Manufacturing	Walden
3:30 PM - 5:00 PM	NAMRC: Forming II	Keynes
3:30 PM - 5:00 PM	MSEC 2-4: Machining III	Burnham
3:30 PM - 5:00 PM	MSEC 2-11: Incremental Forming II	Audubon
3:30 PM - 5:00 PM	MSEC 2-4: System Modeling	Olmstead
5:30 PM - 7:30 PM	UNC Charlotte Lab Tours/Refreshments • Center for Precision Metrology • Center for Optics and Optoelectronic Communications • Energy Production and Infrastructure Center (Buses leave from hotel lobby)	Off-site

Thursday, June 11, 2015

7:30 AM - 8:30 AM	Continental Breakfast	Glenwaters
8:00 AM - 5:00 PM	Registration	Midway
8:30 AM - 5:00 PM	Exhibits	Glenwaters
8:30 AM - 10:00 AM	MSEC Panel Discussion: National Network for Manufacturing Innovation – How to Get Involved in the NNMI	SALON I
8:30 AM - 10:00 AM	MSEC 2-7: Design Aspects in Additive Manufacturing	SALON II
8:30 AM - 10:00 AM	MSEC 5-2: Sustainable Manufacturing Systems	SALON III
8:30 AM - 10:00 AM	NAMRC: Joining and Assembly I	SALON IV
8:30 AM - 10:00 AM	MSEC 2-4: Nano-scale Modeling	Welwyn
8:30 AM - 10:00 AM	MSEC 4-4: Competitive Manufacturing Engineering	Walden
8:30 AM - 10:00 AM	NAMRC: Drilling and Turning	Keynes
8:30 AM - 10:00 AM	MSEC 1-2: Ceramic and Metal Matrix Composites	Burnham

CONFERENCE SCHEDULE

Thursday, June 11, 2015

8:30 AM - 10:00 AM	NAMRC: Manufacturing System Controls	Audubon
8:30 AM - 10:00 AM	MSEC 2-2: Micro-level Applications in Assisted Manufacturing Processes	Olmstead
8:30 AM - 10:00 AM	MSEC 2-8: Energy Efficiency	Lakeview
10:30 AM - 11:00 AM	Morning Break	Glenwaters
10:30 AM - 12:00 PM	NAMRC Panel Discussion: Manufacturing Education, Workforce Development, and Outreach	SALON I
10:30 AM - 12:00 PM	MSEC 2-7: Electrohydrodynamic Jet Printing	SALON II
10:30 AM - 12:00 PM	MSEC 5-2: Sustainable Manufacturing Processes	SALON III
10:30 AM - 12:00 PM	NAMRC: Joining and Assembly II	SALON IV
10:30 AM - 12:00 PM	MSEC 2-2: Assisted Manufacturing Processes II	Welwyn
10:30 AM - 12:00 PM	NAMRC: Metal Additive Manufacturing I	Walden
10:30 AM - 12:00 PM	NAMRC: Milling I	Keynes
10:30 AM - 12:00 PM	MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes I	Burnham
10:30 AM - 12:00 PM	NAMRC: Path Planning	Audubon
10:30 AM - 12:00 PM	MSEC 2-4: Thermal Processing	Olmstead
10:30 AM - 12:00 PM	MSEC 4-1: Key Technologies for Cloud Manufacturing I	Lakeview
12:00 PM - 1:30 PM	SME Awards Luncheon • NAMRC Outstanding Paper Awards • NAMRI/SME Student Research Presentation Awards • SME Dennis S. Bray Outstanding Young Manufacturing Engineer Award • NAMRI Founder's Lecture: Prof. David Dornfeld • S.M. Wu Research Implementation Award • NAMRI/SME Outstanding Lifetime Service Award	University Ballroom
1:30 PM - 3:00 PM	NAMRC: Manufacturing Machines I	SALON I
1:30 PM - 3:00 PM	NAMRC: Manufacturing Systems - Sustainability	SALON II
1:30 PM - 3:00 PM	MSEC 5-2: Sustainable Manufacturing Methods	SALON III
1:30 PM - 3:00 PM	NAMRC: Manufacturing Systems - Modeling	SALON IV
1:30 PM - 3:00 PM	NAMRC: Non-traditional Manufacturing Processes I	Welwyn
1:30 PM - 3:00 PM	NAMRC: Metal Additive Manufacturing II	Walden
1:30 PM - 3:00 PM	NAMRC: Milling II	Keynes
1:30 PM - 3:00 PM	MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes II	Burnham

Thursday, June 11, 2015

1:30 PM - 3:00 PM	MSEC 2-7: Novel Material Extrusion Processes	Audubon
1:30 PM - 3:00 PM	NAMRC: Non-traditional Manufacturing Processes II	Olmstead
1:30 PM - 3:00 PM	MSEC 4-1: Key Technologies for Cloud Manufacturing II	Lakeview
3:30 PM - 4:00 PM	Afternoon break	Glenwaters
3:30 PM - 5:00 PM	NAMRC: Manufacturing Machines II	SALON I
3:30 PM - 5:00 PM	NAMRC: Manufacturing Systems – Design for Manufacturing	SALON II
3:30 PM - 5:00 PM	MSEC 5-3: Industrial Energy Efficiency	SALON III
3:30 PM - 5:00 PM	MSEC 2-9: Equipment Design and Tooling II	SALON IV
3:30 PM - 5:00 PM	NAMRC: Micro Manufacturing	Welwyn
3:30 PM - 5:00 PM	NAMRC: Novel Additive Processes II	Walden
3:30 PM - 5:00 PM	NAMRC: Cutting Tools and Mechanics I	Keynes
3:30 PM - 5:00 PM	MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes III	Burnham
3:30 PM - 5:00 PM	MSEC 2-2: Assisted Manufacturing Processes I	Audubon
3:30 PM - 5:00 PM	NAMRC: Non-traditional Manufacturing Processes III	Olmstead
3:30 PM - 5:00 PM	MSEC 4-1: Key Technologies for Cloud Manufacturing III	Lakeview
5:00 PM - 8:00 PM	NSF Early Career Forum	University Ballroom
5:30 PM - 9:00 PM	Tours	Off-site

- Discovery Place – Networking Social
- IMAX Theater Presentation: Mysteries of the Unseen World
  (Buses leave from hotel lobby)

Friday, June 12, 2015

8:00 AM - 12:00 PM	• Siemens Energy Tour • 3D Systems Tour (Buses leave from hotel lobby)	Off-site

WELCOME

As the President of NAMRI/SME and the Chair of the Executive Committee of the ASME Manufacturing Engineering Division, we would like to welcome the co-located ASME International Manufacturing Science and Engineering Conference (MSEC) and the NAMRI/SME North American Manufacturing Research Conference (NAMRC). This is the fifth time that these two conferences have been co-located. We believe that this co-location has been extremely beneficial to the combined manufacturing research community, and we look forward to continuing this collaboration. We are excited to visit UNC Charlotte this year. We truly appreciate the efforts of Professors John Ziegert, Scott Smith, Brigid Mullany, Tony Schmitz, and others at UNC Charlotte for hosting us and organizing the details of the conference. We also appreciate the efforts of Albert Shih and Gracious Ngaile who are the technical program chairs for the NAMRC and MSEC conferences respectively. Hosting an event of this size requires a tremendous amount of administrative work, and we would like to acknowledge the efforts of Ms. Karen Ford, Ms. Robyne Pomroy, Ms. Jennifer Chastain, and Ms. Christine Knox, as well as the many others who volunteered their time and expertise. Please extend your thanks to our hosts and the technical program chairs for all of their hard work when you see them at the conference. Finally, we would like to thank the members of the Conference Coordinating Committee, Steve Schmid - Chair (Notre Dame), Albert Shih (U. Michigan), Shawn Moylan (NIST), Dean Bartles (UILabs), Brian Paul (Oregon State U.) for their dedication and efforts towards the strategic planning of these co-located conferences.

We wish you a productive conference and hope you will take advantage of this international conference setting to meet old friends, make new acquaintances, and establish new collaborations. Enjoy the conference!

Shreyes Melkote
Georgia Institute of Technology
SME/NAMRI President

Xiaoping Yang
Cummins Inc.
ASME/MED Chair

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WELCOME FROM 2015 NAMRC43/MSEC2015 HOSTS

Dear Colleagues,

As the organizers of the NAMRC43/MSEC2015, and on behalf of the entire manufacturing research and education group at UNC Charlotte, we welcome you to Charlotte. UNC Charlotte is proud to have a long history of excellence in precision manufacturing and metrology. Our faculty and staff are pleased to demonstrate our world-class facilities to you.

Most of us are aware of the recent resurgence of interest in manufacturing in the United States and throughout the world, as well as the increased recognition of the importance of a robust manufacturing segment to overall economic health. This conference directly supports the renaissance of manufacturing in the United States.

The conference also celebrates the career accomplishments of Prof. Robert J. Hocken, who recently retired from the UNC Charlotte faculty. Professor Hocken founded the UNC Charlotte Center for Precision Metrology and was largely responsible for its growth into a globally recognized center of excellence in precision manufacturing and metrology.

We would like to thank key staff members, Karen Ford, Robyne Pomroy, Jennifer Chastain, and Christine Knox, who have worked tirelessly to make this conference a success. We also want to thank the Charlotte Research Institute for financially supporting the conference, and accepting the financial risk inherent to hosting a large conference like this. We are indebted to the NAMRI Scientific Committee and the ASME Technical Committee for overseeing the technical paper submissions and editorial processes that have resulted in an outstanding technical program.

We hope you enjoy your visit to Charlotte, and find the conference useful in expanding your technical knowledge as well as your network of contacts in the manufacturing research community.

John Ziegert

Scott Smith

Brigid Mullany

Tony Schmitz

Jimmie Miller

WELCOME FROM THE NAMRC43/MSEC2015 TECHNICAL PROGRAM CHAIRS

On behalf of the Technical Program Committees, we welcome you to the joint International Manufacturing Conference consisting of the 43rd North American Manufacturing Research Conference (**NAMRC43**), sponsored by the North American Manufacturing Research Institution of SME (NAMRI/SME), and the tenth ASME International Manufacturing Science and Engineering Conference (**MSEC2015**), sponsored by the Manufacturing Engineering Division (MED) of ASME; collocated and hosted by UNC Charlotte from June 8 to June 12, 2015, in Charlotte, NC. As leading technical societies, ASME and SME act as global bridges between industries, government laboratories, and academic institutions. This jointly sponsored conference represents the continued collaboration between these esteemed organizations in support of research exchanges and dissemination in the Manufacturing, Materials and Processing fields.

Each of the conferences includes technical sessions covering the full range of manufacturing topics. Every paper submitted to the conference was put through a rigorous peer review process. We are in debt to all reviewers for volunteering their time to provide critical assessments of a very large number of submissions.

MSEC2015 received 216 draft papers. After the peer review process, 187 papers were accepted for presentation in 68 sessions. This year, the conference features 23 Technical Symposia in five Technical Tracks: Materials, Processing, Biomanufacturing, Properties, Applications and Systems, and Sustainable Manufacturing. In addition, 20 posters were accepted for publication in the proceedings and 47 NSF student posters were accepted for presentation at the conference.

NAMRC43 received 125 technical papers. Following the peer review process, 109 papers were accepted for publication in the Proceedings of NAMRI/SME, published by Elsevier in Procedia Manufacturing. These papers will be presented at the conference in 37 technical sessions. The conference papers address a wide range of basic and applied manufacturing research topics related to both manufacturing processes and manufacturing systems.

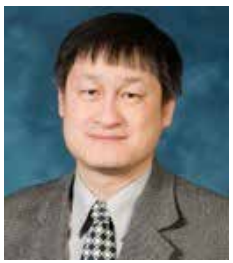
The conferences will also host keynotes from world-renowned scientists in several areas, including: Precision Engineering and Metrology, Plastic Anisotropy and Forming limits in Sheet Metal Forming, Additive Manufacturing, Abrasive Machining, and Cyber-Physical Manufacturing Systems. Expert panel discussions are provided in the areas of Additive Manufacturing, Manufacturing Education and Workforce Development, Future

Federal Support for Manufacturing Research, and Working with the National Network for Manufacturing Innovation Institutes.

The conference program is the result of the outstanding efforts of many people. We would like to thank all the authors for their technical paper and poster submissions. We also express our gratitude to all the organizers for their dedicated management of the tracks, symposia as well as for ensuring the quality of the papers and posters to be presented. We would also like to thank the host Organizing Committee, the Conference Coordinating Committee, the NAMRI/SME Scientific Committee, and the ASME MED Executive and Technical Committees. Our thanks also go to the ASME staff for their outstanding job in presenting conference information on the Internet, managing the submitted technical papers and posters, and ensuring high-quality publication of the conference proceedings for MSEC2015. We sincerely appreciate the efforts of Elsevier in providing the online editorial system for paper reviews for NAMRC43, and ensuring those papers will be available online in Procedia Manufacturing. Additionally, we would like to thank the Advanced Manufacturing Cluster within the Civil, Mechanical, and Manufacturing Innovation (CMMI) Division of the National Science Foundation for providing financial support for 90 US students to participate in the conference.

We wish you a productive and enjoyable conference in Charlotte, NC and hope that you find the technical content of the program to be useful and informative.

Albert Shih
University of Michigan
2015 NAMRI Scientific Committee Chair



Lihui Wang
KTH Institute of Technology
Stockholm, Sweden

Gracious Ngaile
North Carolina State University
2015 MSEC Technical Program Committee Chair

Frank Pfefferkorn
University of Wisconsin
2015 MSEC Technical Program Committee Co-Chair

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Department of Mechanical Engineering and Engineering Science

STUDENT TRAVEL AWARD RECIPIENTS

A National Science Foundation grant will provide support to select students from US institutions to attend the collocated 2015 ASME Manufacturing Science and Engineering Conference (MSEC2015) and the SME 43rd North American Manufacturing Research Conference (NAMRC43), at the University of North Carolina - Charlotte, June 8-12, 2015.

The organizers of NAMRC43/MSEC2015 gratefully acknowledge the generous support of the National Science Foundation in providing financial support to the following students to attend the conference:

- Farbod Akhavan Niaki, Clemson University
- Myrtede Alfred, Clemson University
- Masoumeh Aminzadeh, Georgia Tech
- Yigit Arisoy, Rutgers
- Abishek Balsamy Kamaraj, University of Cincinnati
- Vasileios Bardis, Clemson University
- Mina Bastwros, Iowa State University
- Raunak Bhinge, University of California Berkeley
- Anne Brant, University of Cincinnati
- Michael Brundage, Stony Brook University
- Jose Carballo, University of South Florida
- Demeng Che, Northwestern University
- Bo Cheng, University of Alabama
- Huanyu Cheng, Northwestern University
- Bryan Chu, Rensselaer Polytech
- Jhonatam Cordeiro, NC A&T State University
- Bian Dakai, Columbia University
- Brian Davis, University of Florida
- Dongping Deng, University of Southern California
- Jia Deng, NC State University
- Mohammad Dewan, Louisiana State University
- Zhidong Du, Purdue University
- Lujia Feng, Clemson University
- Palamandadige Fernando, Kansas State University
- Marco Giovannini, Northwestern University
- Xi Gu, University of Michigan
- Yiwei Han, NC State University
- NagarajanHari, Oregon State University
- Shui Huanyi, University of Michigan
- Emmett Hull, Kansas State University
- Garretson Ian, Oregon State University
- Baoyang Jiang, University of Michigan
- Pegah Kakavand, Western Kentucky University
- Xiangcheng Kong, NC State University
- Emrullah Korkmaz, Carnegie Mellon University
- Beiwen Li, Purdue University
- Chao Li, University of Alabama
- Dawei Li, University of Missouri
- Weisi Li, University of Michigan
- Ting Chiang Lin, University of California, LA
- Jingfu Liu, University of Alabama
- Xun Liu, University of Michigan
- Ziye Liu, University of Alabama
- James Lowrie, NC State University
- Harsha Malshe, Oregon State University
- Amin Mirkouei, Oregon State University
- Hadi Miyanaji, University of Louisville
- Hossein Mohammadi, Western Michigan University
- Marzyeh Moradi, University of Pittsburgh
- Justin Morrow, University of Wisconsin, Madison
- Saeed Mousa, Iowa State University
- Ali Nassiri, University of New Hampshire
- Trey Neveux, Penn State, Erie
- Fuda Ning, Texas Tech University
- Haipeng Qiao, Georgia Tech
- HantangQin, NC State University
- Ardeshir Raihanian Mashhadi, SUNY
- Zachary Reese, Penn State, Erie
- Huaqing Ren, Northwestern University
- Timothy Roemer, University of New Hampshire
- Brandt Ruszkiewicz, Penn State, Erie
- Yamin Shao, Georgia Tech
- Vincent Shaw, Xavier University
- Ninggang Shen, University of Iowa
- Amber Shrivastava, University of Wisconsin
- Dennis Siedlak, Georgia Tech
- Xiaoxu Song, Kansas State University
- Xuan Song, University of Southern California
- Shiv Shailendar Sunitha Radhakrishnan, University of Cincinnati
- Wenmeng Tian, Virginia Tech
- Leo Tse, University of Michigan
- Hannah Vincent, Virginia Tech
- Qichang Wang, Missouri University of Science and Technology
- Qinghua Wang, University of Wisconsin, Madison
- Xiaoqing Wang, University of Alabama
- Zhiyu Wang, Georgia Tech
- Sarah Wolff, Northwestern University
- Junling Xie, University of Wisconsin, Milwaukee
- Ruitong Xiong, University of Florida
- Tianyu Yu, Iowa State University
- Xiaoming Yu, Kansas State University
- Feng Zhang, Saint Louis University
- Hao Zhang, Purdue University
- Hongsheng Zhang, University of South Carolina
- Ying Zhang, Texas A&M University
- Zhengyi Zhang, University of Florida
- Zixuan Zhang, Northwestern University
- Jingzhou Zhao, University of California, LA
- Yihao Zheng, University of Michigan
- Jing Zou, Stony Brook University

In addition to the NSF Travel Awards, Zimo Wang, from Texas A&M received sponsorship from Precision Environments.

NOTES

NOTES

9:00 AM - 3:00 PM	NAMRI Board of Directors Meeting	Harris
1:00 PM - 3:00 PM	Tutorial: High-speed Milling and Machining Dynamics	Walden
1:00 PM - 3:00 PM	Tutorial: Dimensional Metrology	Olmstead
1:00 PM - 6:00 PM	Registration	Welwyn and Midway
1:00 PM - 6:00 PM	Exhibitor Setup	Glenwaters
1:00 PM - 7:00 PM	Workshop: NSF Proposal Writing	Lakeshore III & IV
3:30 PM - 5:30 PM	Tutorial: Machine Tool Metrology	Walden
7:00 PM - 9:00 PM	Welcome Reception	Pool Deck (inclement weather: University Ballroom)

NSF PROPOSAL WRITING WORKSHOP

Monday, June 8, 1:00 PM - 7:00 PM Lakeshore III & IV

Effective proposal writing is important for both the National Science Foundation (NSF) and principal investigators. To aid researchers in communicating clear research objectives and improving proposal quality, an NSF proposal writing workshop will be hosted at the 2015 International Manufacturing Research Conference, Charlotte, NC, on Monday, June 8, from 1:00 PM to 7:00 PM. The workshop will include presentations by NSF program managers, breakout sessions to discuss example research objectives, and a question/answer period.

HIGH-SPEED MILLING AND MACHINING DYNAMICS

MONDAY, JUNE 8, 1:00 TO 3:00 PM WALDEN
DR. SCOTT SMITH

This tutorial will provide a global picture of the role of process dynamics in machining. Background material (mechanical vibrations and modal testing) will be reviewed and its application to machining vibration analysis will be described. State-of-the-art analytical and numerical techniques for predicting machining performance will be presented together with examples to unite theory and practice.

The lecture topics will include: high-speed milling important considerations, vibrations background, stability lobe diagram description, modal testing, surface location error, tool wear. An experimental demonstration of natural frequency and mode shape identification will also be provided.

DIMENSIONAL METROLOGY

MONDAY, JUNE 8, 1:00 TO 3:00 PM OLMSTEAD
DR. ED MORSE

This tutorial will provide an overview of dimensional metrology from several different perspectives: shop floor measurement for process control and quality auditing, inspection laboratory measurement for assessing conformance, and the calibration of gages and instruments will all be discussed. Basic principles of dimensional metrology will be covered, and how these apply to both traditional and newer metrology equipment. The role of national and international standards for design specification, metrology equipment verification, uncertainty estimation, and laboratory accreditation will be described to familiarize attendees with the resources available to the dimensional metrology community.

MACHINE TOOL METROLOGY

MONDAY, JUNE 8, 3:30 TO 5:30 PM WALDEN

DR. JOHN ZIEGERT

This tutorial will provide an overview of factors affecting the accuracy of CNC machine tools; and review methods to model, measure, and evaluate positioning errors that affect workpiece accuracy. National and International Standards will be reviewed and summarized.

Topics covered will include: error sources, including thermal effects, geometric errors, axis motion errors; instrumentation and methods for measuring error components; modeling of machine errors; and error compensation.

TUESDAY, JUNE 9, 2015

9:00 AM - 10:30 AM	NAMRC: Cutting Tools and Mechanics II	Burnham
9:00 AM - 10:30 AM	NAMRC: Manufacturing Efficiency	Audubon
9:00 AM - 10:30 AM	MSEC 1-1: Materials – Experiments and Modeling I	Olmstead
9:00 AM - 10:30 AM	MSEC 2-6: Processing and Testing of Polymers and Composites I	Lakeview
9:00 AM - 11:00 AM	MED Executive Committee Meeting	Harris
10:30 AM - 11:00 AM	Morning Break	Glenwaters
11:00 AM - 12:30 PM	NAMRC: Hocken Symposium II	SALON I
11:00 AM - 12:30 PM	MSEC 2-11: Incremental Forming I	SALON II
11:00 AM - 12:30 PM	MSEC 2-7: Metal Additive Manufacturing II	SALON III
11:00 AM - 12:30 PM	NAMRC: Design for Additive Manufacturing	SALON IV
11:00 AM - 12:30 PM	NAMRC: Machining Dynamics II	Walden
11:00 AM - 12:30 PM	MSEC 2-4: Machining IV	Keynes
11:00 AM - 12:30 PM	NAMRC: Cutting Tools and Mechanics III	Burnham
11:00 AM - 12:30 PM	MSEC: Student Manufacturing Design Competition	Audubon
11:00 AM - 12:30 PM	MSEC 1-1: Materials – Experiments and Modeling II	Olmstead
11:00 AM - 12:30 PM	MSEC 2-6: Processing and Testing of Polymers and Composites II	Lakeview
12:30 PM - 2:00 PM	JMSE Editorial Committee Meeting	Boardroom
12:30 PM - 2:00 PM	Lunch • Invitation to 2016 Conference: Dr. Jaime Camelio • Tribute to Prof. B. VonTurkovich: Prof. B. Klamecki • Launch of MTConnect Student Challenge • Research in Germany	UNIVERSITY BALLROOM
2:00 PM - 3:30 PM	NAMRC: Hocken Symposium III	SALON I
2:00 PM - 3:30 PM	MSEC 2-11: Forming Symposium Keynote: Prof. Dorel Banabic	SALON II
2:00 PM - 3:30 PM	MSEC 2-7: Additive Manufacturing Symposium Keynote: Prof. Suresh Babu	SALON III
2:00 PM - 3:30 PM	NAMRC: Quality in Additive Manufacturing	SALON IV
2:00 PM - 3:30 PM	MSEC 2-4: Machining I	Walden
2:00 PM - 3:30 PM	MSEC 2-5: Advances in Non-traditional Manufacturing Processes I	Keynes

2:00 PM - 3:30 PM	MSEC 2-3: Laser Surface Processing	Burnham
2:00 PM - 3:30 PM	MSEC: Student Manufacturing Design Competition	Audubon
2:00 PM - 3:30 PM	MSEC 1-2: Materials Processing, Microstructure, Plasticity and Testing I	Olmstead
2:00 PM - 3:30 PM	MSEC 2-6: Advances in Manufacturing of Polymers and Composites	Lakeview
3:30 PM - 4:00 PM	Afternoon break	Glenwaters
4:00 PM - 5:00 PM	NAMRI Membership Meeting	SALON I
4:00 PM - 6:00 PM	MTConnect Technical Workshop	SALON III
5:00 PM - 6:00 PM	ASME MED Membership Meeting	SALON I
6:00 PM - 9:00 PM	Speedway Club Networking Dinner (Buses leave from hotel lobby)	Off-site

NOTES

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June 9-11 in Glenwaters from 8:30 a.m. to 5:00 p.m.

AN ENGINEER'S VIEW OF THE THIRD REVOLUTION

Charles W. Hull, Co-Founder and Chief Technology Officer, 3D Systems

Charles Hull is the inventor of the solid imaging process known as stereolithography, the first commercial 3D printing technology. With the founding of 3D Systems in 1986 he initiated the 3D printing industry and continues to lead it today with cutting edge innovations ranging from state of the art production 3D printers that have changed the game of manufacturing to the first home-certified 3D printer, the award winning Cube. He is a named inventor on 85 United States patents, plus other patents around the world, in the fields of ion optics and 3D printing.

In 1995 he was awarded the Rank Prize in London, and in 1996 he received the William T. Ennor Manufacturing Technology Award by the American Society of Mechanical Engineers. Also in 1996 he was named Entrepreneur of the Year for high technology in the greater Los Angeles area. In 1997 he received the Albert M. Sargent Progress Award by the Society of Manufacturing Engineers. In 2011, along with Avi Reichental, he was named Entrepreneur of the Year for manufacturing in the Carolinas. In 2013 he received the prestigious Economist Innovation Award. He was inducted into the National Inventors Hall of Fame in 2014. Also in 2014 he was granted the European Inventor Award for Non-European Counties.

Prior to founding 3D Systems, Mr. Hull served as vice president of engineering at UVP, Inc. in San Gabriel, California, a systems manufacturing company. It was at UVP that he developed and patented the stereolithography process. Before that, he was an engineering manager at DuPont's Photo Products Division, concentrating on the development of analytical equipment for chemists, including mass spectrometer and GC/MS systems. Earlier in his career he was a senior engineer at Bell & Howell.

Mr. Hull received a BS in engineering physics from the University of Colorado in 1961 and an honorary Doctorate in Engineering from Loughborough University in the U.K. in 2005.

Additive Manufacturing

Tuesday, June 9, 2:00 PM

OPPORTUNITIES AND CHALLENGES OF METAL ADDITIVE MANUFACTURING: ROLE OF HIGH-PERFORMANCE COMPUTING AND EX-SITU/IN-SITU CHARACTERIZATION TOOLS

Dr. Suresh Babu

UT/ORNL Governor's Chair of Advanced Manufacturing Professor

The University of Tennessee, Knoxville, TN 37996

Advanced Manufacturing Program, Energy and Environmental Sciences Division

Oak Ridge National Laboratory, Oak Ridge, TN 37831

Abstract

Additive manufacturing (also known as 3D printing) of metals is considered as a disruptive technology to produce limited number of high value components with topologically optimized geometries and functionalities. Realization of the above potential for real-world applications is stifled by lack of standard computational design-tools; material feed stock characteristics, methods to probe thermo-mechanical processes under in-situ conditions, and microstructural homogeneity, as well as, anisotropic static and dynamic-properties. This presentation will discuss the needed interdisciplinary science and technology ranging from robotics and automation, process control, multi-scale in-situ and ex-situ characterization methodologies, as well as, high-performance computational tools to address these challenges. Specific focus on understanding and controlling physical processes will be stressed, including powder/wire/tape, powder sintering, adsorption and dissolution of gases, microstructure evolution under extreme thermal gradients, and residual stress evolution under complex thermal gyrations. Emerging pathways to scale up metal additive manufacturing in Fe-, Al- and Ti- alloys to large sizes (→1 m) and higher productivity (5 to 20 kg/h), while maintaining the mechanical performance and geometrical flexibility expected by the additive manufacturing, will be discussed.

Biography

Dr. Babu obtained his bachelor's degree in metallurgical engineering from PSG College of Technology, Coimbatore, INDIA and his master's degree in industrial welding metallurgy-materials joining from Indian Institute of Technology, Madras. He obtained his PhD in materials science and metallurgy from University of Cambridge, UK in 1992. He also worked as a research associate in the prestigious Institute for Materials Research, Sendai, Japan before joining ORNL in 1993. From 1993 to 1997, he held joint researcher position with ORNL, University of Tennessee and The Penn State University. From 1997 to 2005, he worked as an R&D staff at ORNL. From 2005 to 2007, Suresh held a senior level technology leader position in the area of engineering and materials at Edison Welding Institute, Columbus, Ohio. From 2007 to 2013, Suresh served as Professor of Materials Science and Engineering and Director of NSF I/UCRC Center for Materials Joining Science for Energy Applications, at The Ohio State University. In 2013, Suresh was appointed as UT/ORNL chair of advanced manufacturing at the University of Tennessee, Knoxville, TN. In this role he acts as a bridge to the ORNL's expertise and infrastructure including manufacturing demonstration facility to develop a collaborative research and education ecosystem locally and deploy engineering solutions to manufacturing industries. Dr. Babu has 21 years of experience in the area of advanced manufacturing, additive manufacturing, physical metallurgy, as well as, computational materials modeling. His work relates to welding metallurgy, solid-state joining, ultrasonic additive manufacturing, laser/electron beam assisted additive manufacturing, phase transformation issues related to low-alloy steels, inclusion formation, nonequilibrium solidification, and application of computational thermodynamics and kinetics to corrosion issues. He is also involved in the application of state-of-the-art characterization tools including atom probe tomography; synchrotron diffraction and neutron diffraction for understanding interaction between weld thermal cycles, phase stability and diffusion in complex alloys, as well as, energy storage materials. Dr. Babu has published more than 140 journal papers and numerous conference proceedings.

Forming

Tuesday, June 9, 2:00 PM

ADVANCES IN PLASTIC ANIOSTROPY AND FORMING LIMITS IN SHEET METAL FORMING

Dr. Dorel Banabic

Technical University of Cluj Napoca, Romania

Professor at the Technical University of Cluj-Napoca (UTCN), Romania

Director of the Research Center in Sheet Metal Forming (CERTETA), UTCN

President of the European Scientific Association for Material Forming (ESAFORM)

Fellow of CIRP (International Academy for Production Engineering)

Fellow of the Academy of Technical Sciences of Romanian Member of the Romanian Academy

Abstract

During the last years, the competition in the automotive and aeronautical industry has become more intense. This fact has led to the development of new steel sorts, aluminium alloys having better performances and increased interest on the use of magnesium and superplastic alloys. Since 2000, the modelling of the anisotropic behaviour of these materials has encouraged research activities focused on the development of yield criteria. The accuracy of the simulation results is given mainly by the accuracy of the material models. Several new models have been¬ proposed during the last years. These models allow a very good description of the anisotropic behaviour both of steel alloys (BCC crystallographic structure), aluminium alloys (FCC structure) and magnesium alloys (HCP structure). The new yield criteria incorporate a large number of coefficients (usually, at least 8 coefficients). Due to this fact, they are able to give an accurate description of the yield surface and follow closely the planar variations of the uniaxial yield stress and the coefficient of plastic anisotropy. Some efforts have been made

during the last years to formulate macroscopic level models that account for the evolution of anisotropy due to evolving texture.

It is a well known fact that the position and shape of the FLC is influenced by the shape of the constitutive models (yield criteria, hardening models) adopted in the computational model. A sensitivity analysis regarding the influence of different material parameters and constitutive models upon the limit strains is needed in the pre-processing stage. Such an analysis is also useful for the sheet metal producers when trying to obtain materials having desired formability characteristics. Aiming to meet these requirements, in the CERTETA centre has been developed a software package named FORM-CERT able to calculate FLC's. One of the most important facilities offered by FORM-CERT consists in the possibility to adopt different yield criteria and strain hardening laws when computing the FLC's. The author proposed a new procedure for the experimental determination of the FLCs. The main advantage of the new experimental procedure consists in the reduction of the frictional effects that may alter the values of the limit strains.

Biography

The major areas of interest are the anisotropic plastic behaviour of materials, formability of sheet metals and virtual fabrication. He developed a family of yield criteria for anisotropic metallic materials (BBC yield criteria). The BBC 2005 model has been implemented by the AUTOFORM software house in the commercial FE code AutoForm 4.1. The BBC 2008 model has been coupled with the ALAMEL crystal plasticity model developed at the Catholic University Leuven in a Hierarchical Multi-Scale framework that allows taking into account evolution of the plastic anisotropy during sheet forming processes. In the field of formability the main contributions are: theoretical and experimental research on the influence of the pulsatory loading on the FLC; proposal of a new method to increase the formability in superplastic sheet metal forming processes using the pulsatory loading; improvement of the Marciniak-Kuczynski and Modified Maximum Force Criterion models to predict the FLC; developing of the FORM-CERT user friendly code to determine the FLC; proposal of a new procedure for the experimental determination of the FLCs based on the hydraulic bulging of a double specimen.

Robert J. Hocken Honorary Symposium

Tuesday, June 9, 9:00 AM

BUILDING PRECISION METROLOGY AT UNC CHARLOTTE AND ACROSS THE GLOBE

Dr. Bob Wilhelm

Vice Chancellor, Research and Economic Development

Executive Director, Charlotte Research Institute

Professor of Mechanical Engineering & Engineering Science

UNC Charlotte

Abstract

Bob Hocken built the Precision Metrology program at UNC Charlotte. He recruited and developed talent, led a long term strategy to create infrastructure and academic programs, and was at the center of many new ideas and initiatives for precision metrology. His results, while concentrated in Charlotte, are seen across the globe. This presentation reviews the approach used by Hocken and the milestones of his building program.

Biography

Dr. Robert G. Wilhelm, Vice Chancellor for Research and Economic Development at the University of North Carolina at Charlotte (UNC Charlotte), has served in executive roles since 2005 and as a faculty member since 1993.

Wilhelm has been instrumental in advancing the quality, diversity, and growth of research at UNC Charlotte by engaging regional and national partners. This advancement includes six National Science Foundation Industry/University Cooperative Research Centers, and three focus areas for large scale research and academic programs in Data Science/Business Analytics, Energy, and Advanced Manufacturing, as well as biomedical and bioinformatics programs. Recent initiatives support Social Sciences, Digital Humanities, and the broader research culture.

Wilhelm leads economic development efforts to start up, grow, and recruit companies for business growth. On campus, his organization supports 20 startup companies, 10 established companies with R&D presence, and numerous partnerships with companies like SAS and Siemens. These efforts help attract the most talented faculty, support long term impact on the economic region, and contribute to distinctive academic programs for students.

Wilhelm joined the UNC Charlotte faculty in 1993 to work on the creation of Ph.D. programs and contributed to the formation of programs in biotechnology, information technology, mechanical engineering, nanoscale science, and physics and optical science. Since 2005, he has served as the Executive Director of the Charlotte Research Institute, UNC Charlotte's portal for business-university partnerships. Wilhelm is a Professor of Mechanical

Engineering and Engineering Science, having lectured and worked in 38 states and over 18 countries.

Wilhelm worked at the Palo Alto Laboratory of Rockwell Science Center and Cincinnati Milacron as well as co-founding a high-technology company, OpSource. He holds a BSIE from Wichita State University, an MSIE from Purdue University, and a doctorate in mechanical engineering from the University of Illinois at Urbana-Champaign. As a Rotary Foundation Fellow, he studied the history of science and technology at the University of Leicester, Great Britain and the Ironbridge Gorge Museum.

Robert J. Hocken Honorary Symposium

Tuesday, June 9, 11:00 AM

"NANOCUT" AND THE MECHANICS OF NANOMETRIC CUTTING

Dr. Don Lucca

Regents Professor and Carl and Gladys Herrington Chair in Advanced Materials

School of Mechanical and Aerospace Engineering

Oklahoma State University, 218 Engineering North, Stillwater, OK 74078

Abstract

The first studies of the forces and energies which result in ultra-precision machining appeared in the early 1990s. Commercially available single point diamond turning machines enabled the study of cutting and thrust forces at sub-micrometer depths of cut, however study of the process mechanics at the nanometer scale required process control beyond their achievable range. A collaborative effort, based on the precision instrument design capabilities of Bob Hocken and his group at UNC Charlotte and the process mechanics capabilities of Don Lucca and his group at Oklahoma State, was undertaken. The goal of this collaboration was to design and build an ultra-precision instrument for controlled nanoindenting and nanocutting, and to then use it to study the process mechanics of nanometric cutting. Funding for the study "The Mechanics of Nanometric Cutting" was provided by NSF and the Hocken-Lucca team set out to design and build "Nanocut", the ultra-precision instrument at UNCC, and then install it in the Ultraprecision Surfaces Laboratory at Oklahoma State where cutting experiments on various materials were performed. This first project resulted in a long term collaboration between the two groups. This presentation will discuss the design of the instrument and the use of "Nanocut" for the nanometric cutting of single crystal semiconductors.

Biography

Don A. Lucca is currently Regents Professor and Carl and Gladys Herrington Chair in Advanced Materials in the School of Mechanical and Aerospace Engineering at Oklahoma State University. He also holds the position of Guest Scientist in the Center for Integrated Nanotechnologies Group in the Materials

Physics and Applications Division at Los Alamos National Laboratory. He received a BS degree from Cornell, MSE from Princeton, and PhD from RPI all in Mechanical Engineering. Professor Lucca is a Fellow of CIRP, SME and ASME. He has served on the Board of Directors of the American Society for Precision Engineering and the North American Manufacturing Research Institution. He is a recipient of the Alexander von Humboldt Research Award for Senior Scientists, and has held positions of Visiting Professor at the Stiftung Institut für Werkstofftechnik at Universität Bremen and at the Politecnico di Torino. He was awarded a Mercator Professorship by the Deutsche Forschungsgemeinschaft in Germany, the Russell Severance Springer Professorship in Mechanical Engineering at the University of California, Berkeley, and the SME Frederick W. Taylor Research Medal, and holds an honorary doctorate from Universität Bremen.

Robert J. Hocken Honorary Symposium

Tuesday, June 9, 2:00 PM

MEASURE WHAT IS MEASURABLE, MAKE MEASURABLE WHAT IS NOT: CONTRIBUTIONS OF BOB HOCKEN TO REALIZE THIS REQUIREMENT

Prof. Horst Kunzmann

Physikalisch-Technische Bundesanstalt

Abstract

The measurements of dimensional quantities in the context of quality of products were long time seen as necessary as an activity for supervizing the results of manufactured parts and products. These measurements were in most cases done after the machining was finished and gave measuring and testing an attitude of dominating the whole manufacturing process. The desired and necessary informations, how to improve the individual steps of machining in such a way that their contributions to the final performance of total process were known, was in most cases not available. For increasing performance of parts gained by increasing accuracy of the products it became more and more necessary to integrate measuring technologies in the complex processes, starting from description of the desired product properties, creation of adequate design for optimal functionality of the future product, evaluate developments of prototypes and new manufacturing technologies. Measurement technologies must be made available to keep manufacturing and assembling of parts towards complex products under control as well as the assembling and maintenance to achieve the desired product properties.

A global view and sketch of the most important developments for dimensional metrology in the context with manufacturing technologies during the last 50 years show three disciplines. These are:

- The discovery of the laser and laser-interferometry
- The Coordinate Measurement Technologies
- The Computer Technologies and their computing capacity

These three disciplines and their development from the first discovery to the state of today's technology are connected and each gained profit from the others, and together they help to solve many problems connected with solutions for making measurable what was long time before not measurable. Bob Hocken and his collaborators at the NBS (NIST) and at the UNC Charlotte contributed an extraordinary part to these developments.

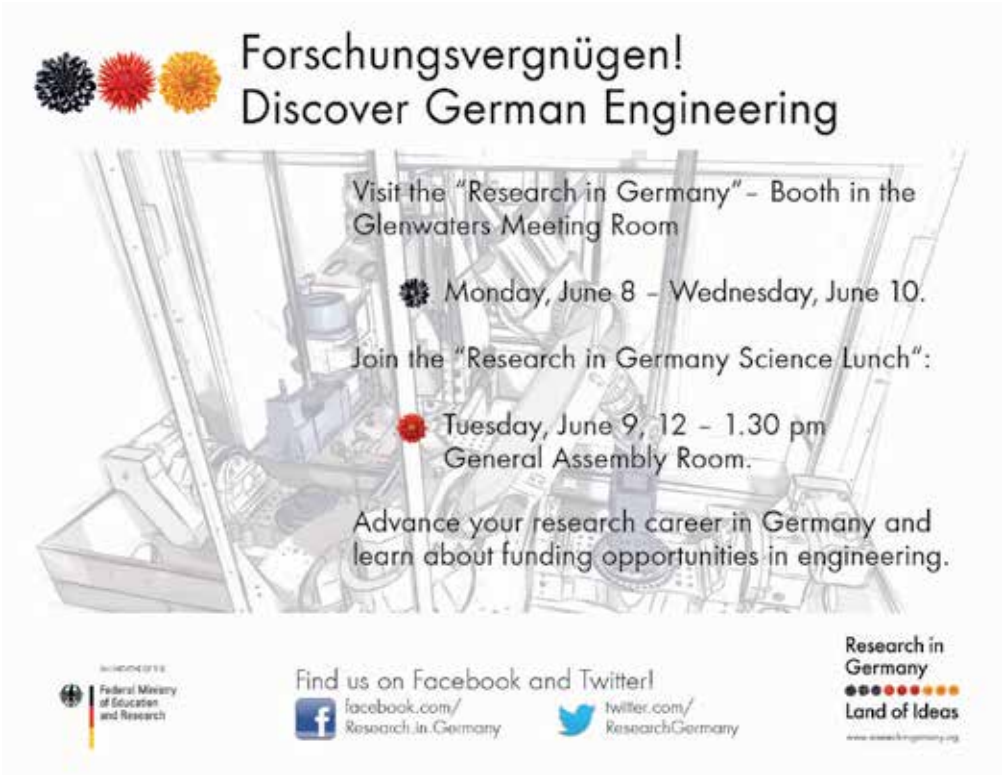
9:00 AM - 10:30 AM **SALON I**	**NAMRC: Hocken Symposium I** ***Session Chair: John Ziegert***	
NAMRC43	B. Wilhelm	Building Precision Metrology at UNC Charlotte and Across the Globe
NAMRC43-40	J. Mayr, M. Egeter, S. Weikert, K. Wegener	Thermal Error Compensation of Rotary Axes and Main Spindles using Cooling Power as Input Parameter
NAMRC43-23	J. Gie, J. Agapiou, S. Kurgin	CNC Machine Tool Work Offset Error Compensation Method
9:00 AM - 10:30 AM **SALON II**	**MSEC 2-11: Forming with Polymers** ***Chair: Rajiv Malhotra, Co-Chair- Matteo Strano***	
MSEC2015-9206	Sven Hildering, Markus Michalski, Ulf Engel, Marion Merklein	Tool Load Sensitivity Against Multidimensional Process Influences in Microblanking of Thin Metal Foils With Silicon Punches
MSEC2015-9212	Lorenzo Iorio, Matteo Strano, Michele Monno	Development of a Die Compensation Algorithm for Sheet Metal Stamping with Deformable Tools
MSEC2015-9263	Mohammad A. Davarpanah, Rajiv Malhotra	Effect of Incremental Depth and Part Shape on Failure Modes in Single Point Incremental Forming of Polymers
9:00 AM - 10:30 AM **SALON III**	**MSEC 2-7: Metal Additive Manufacturing I** ***Chair: Ihab Ragai, Penn State University***	***Co-Chair: Sara Behdad, University at Buffalo, SUNY***
MSEC2015-9244	Jarred Heigel, Pan Michaleris	The impact of Argon Shielding Flow Rate on Laser Engineered Net Shaping (LENS) of Ti-6Al-4V
MSEC2015-9317	Xibing Gong, Xiaoqing Wang, Zachary Jones, Kenneth Cooper, Vernon Cole, Y. Kevin Chou	Characterization of Microstructure and Mechanical Property of Inconel 718 from Selective Laser Melting
MSEC2015-9321	Luis Criales, Yigit Arisoy, Tugrul Ozel	A Sensitivity Analysis Study On The Material Properties And Process Parameters For Selective Laser Melting Of Inconel 625
9:00 AM - 10:30 AM **SALON IV**	**NAMRC: Novel Additive Processes I** ***Session Chairs: Yong Huang and Yayue Pan***	
NAMRC43-10	J. Sun	3D Printing for Customized Food Fabrication
NAMRC43-124	R. Xiong, Z. Zhang, Y. Huang	Identification of Optimal Printing Conditions for Laser Printing of Alginate Tubular Constructs
NAMRC43-96	S. Das, D. Cormier, S. Williams	Multi-Functional Additive Manufacturing Using Pulsed Photonic Sintering

9:00 AM - 10:30 AM **Walden**	**NAMRC: Machining Dynamics I** ***Session Chairs: Hitomi Yamaguchi and Bruce Tai***	
NAMRC43-6	T. Schmitz	Effect of Retention Knob Geometry on Machining Dynamics
NAMRC43-80	S J. Dang, L. Zhang, J. Dong, P. Cohen	AFM-based 3D Nanofabrication using Ultrasonic Vibration Assisted Nanomachining
NAMRC43-63	K. Singh, R. Singh, V. Kartik	Comparative Study of Chatter Detection Methods for High-Speed Micromilling of Ti6Al4V
9:00 AM - 10:30 AM **Keynes**	**MSEC 2-1: Non-traditional Abrasive Machining** ***Session Chair: Markus Weiss***	
MSEC2015-9239	Mohammad Mainuddin, Russell Keanini, Brigid Mullany	Utilizing Small External Vibrational Sources to Increase Polishing Material Removal Rates
MSEC2015-9220	Richard Brocker, Frederik Vits, Patrick Mattfeld, Fritz Klocke	Contact Forces In Unguided Vibratory Finishing
MSEC2015-9300	Qiuyan Wang, Zhiqiang Liang, Xibin Wang, Wenxiang Zhao, Yongbo Wu, Li Jiao, Tianfeng Zhou	Research on Surface Formation Mechanism in Elliptical Ultrasonic Assisted Grinding (EUAG) of Monocrystal Sapphire using Structure Function Fractal Method
9:00 AM - 10:30 AM **Burnham**	**NAMRC: Cutting Tools and Mechanics II** ***Session Chairs: Yuebin Guo and Scott Miller***	
NAMRC43-36	T. Sugihara, T. Enomoto	High Speed Machining of Inconel 718 Focusing on Wear Behavior of CBN Tool
NAMRC43-42	R. Goncalves, M. da Silva	Influence of Copper Content on 6351 Aluminum Alloy Machinability
NAMRC43-82	P. Kolar, P. Fotju, T. Schmitz	On Cutting Force Coefficient Model with Respect to Tool Geometry and Tool Wear
9:00 AM - 10:30 AM **Audubon**	**NAMRC: Manufacturing Efficiency** ***Session Chairs: Chinedum Okwudire and Frank Pfefferkorn***	
NAMRC43-64	H. Zhang, F. Zhao, J. Sutherland	Manufacturing Scheduling of Collaborative Factories for Energy Cost Reduction
NAMRC43-104	V. Townsend, J. Urbanic	A Case Study Measuring the Impact of a Participatory Design Intervention on System Complexity and Cycle Time in an Assemble-to-Order System
NAMRC43-116	S. Cheong, H. Jeong, S. Hwang, S. Hong, J. Domblesky, N. Kim	Accelerated Life Testing to Predict service Life and Reliability for an Appliance Door Hinge

Tuesday, June 9, 2015

9:00 AM - 10:30 AM	MSEC 1-1: Materials – Experiments and Modeling I	
Olmstead	***Chair: Saurabh Basu, Georgia Institute of Technology***	***Co-Chair: Chang Ye, The University of Akron***
MSEC2015-9316	Jingyi Zhao, Guo-Xiang Wang, Yalin Dong, Chang Ye	A Cellular Automata Model for Nitriding of Nanocrystalline Iron
MSEC2015-9423	Xiangcheng Kong, Li Zhang, Jingyan Dong, Paul Cohen	Machining Force Modeling Of Vibration-Assisted Nano-Machining Process
MSEC2015-9472	Saurabh Basu, Zhiyu Wang, Christopher Saldana	Crystallographic Textures Produced During Sand Blasting
9:00 AM - 10:30 AM	**MSEC 2-6: Processing and Testing of Polymers and Composites I**	
Lakeview	***Chair: Fabrizio Quadrini, University of Rome Tor Vergata***	***Co-Chair: Catalin Fetecau, Dunarea de Jos University of Galati***
MSEC2015-9223	Haibin Zhao, Xiangfang Peng	The Effect Of Nanoclay On The Rheological Properties Of Polylactic Acid (Pla)/Polyhydroxybutyrate-Valerate (Phbv) Blends
MSEC2015-9342	Risa Yoshizaki, Kim Tae Sung, Atsushi Hosoi, Hiroyuki Kawada	Mechanical Properties Of Densified Untwisted Carbon Nanotube Yarn / Epoxy Composites
MSEC2015-9411	Felicia Stan, Laurentiu I. Sandu, Catalin Fetecau	Investigation on the Effect of Carbon Nanotubes Concentration on the Electrical and Rheological Properties of PP/MWCNTs Composites

NOTES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NOTES

11:00 AM - 12:30 PM	**NAMRC: Hocken Symposium II**	
SALON I	***Session Chair: Scott Smith***	
NAMRC43	D. Lucca	"Nanocut" and the Mechanics of Nanometric Cutting
NAMRC43-34	H.S. Park, U. Tuladhar, C. Shah	Development of an Inspection System for Micro Level Roughness Detection
NAMRC43-53	S. Pande, P. Biradar	Efficient Algorithms for Automated Inspection of Freeform Surfaces
11:00 AM - 12:30 PM	**MSEC 2-11: Incremental Forming I**	
SALON II	***Chair: Rajiv Malhotra***	***Co-chair- Matteo Strano***
MSEC2015-9404	Rakesh Lingam, Anirban Bhattacharya, Javed Asghar, N Venkata Reddy	Compensations For Tool Path To Enhance Accuracy During Double Sided Incremental Forming
MSEC2015-9437	Brandt Ruszkiewicz, Sean S Dodds, Zachary C Reese, John Roth, Ihab Ragai	Incrementally Formed Stiffeners Effect on the Reduction of Springback in 2024-T3 Aluminum After Single Point Incremental Forming
MSEC2015-9471	Rakesh Lingam, I. V. M. Kishan, C L Harikrishnan, N Venkata Reddy	Importance of Feature Sequencing in Incremental Forming
11:00 AM - 12:30 PM	**MSEC 2-7: Metal Additive Manufacturing II**	
SALON III	***Chair: Jarred Heigel, Pennsylvania State University***	***Co-Chair: Weilong (Ben) Cong, Texas Tech University***
MSEC2015-9322	Xiaoqing Wang, Xibing Gong, Y. Kevin Chou	Review On Laser-Based Additive Manufacturing Of Inconel 718
MSEC2015-9477	Bo Cheng, Y. Kevin Chou	Deformation Evaluation of Part Overhang Configurations in Electron Beam Additive Manufacturing
MSEC2015-9392	Ardeshir Raihanian Mashhadi, Behzad Esmaeilian, Sara Behdad	Impact of Additive Manufacturing Adoption on Future of Supply Chains
11:00 AM - 12:30 PM	**NAMRC: Design for Additive Manufacturing**	
SALON IV	***Session Chairs: Yong Chen and Chi Zhou***	
NAMRC43-109	W. Zha, S. Anand	Optimizing Material Deposition Direction for Functional Internal Architecture in Additive Manufacturing Processes
NAMRC43-51	S. Yang, Y. Tang, Y. Zhao	A New Part Consolidation Method to Embrace the Design Freedom of Additive Manufacturing
NAMRC43-122	T. Wu, S. Jahan, P. Kumar, A. Tovar, H. El-Mounayri, J. Zhang, D. Acheson, R. Nalim, K. Brand	Effect of Deep Penetration of Interleaf on Delamination Resistance in GFRP

11:00 AM - 12:30 PM	**NAMRC: Machining Dynamics II**	
Walden	***Session Chairs: Jaydeep Karandikar and Patrick Kwon***	
NAMRC43-99	C. Cheng, Z. Wang, W. Hung, S. Bukkapatnam, R. Komanduri	Ultra-Precision Machining Process Dynamics and Surface Quality Monitoring
NAMRC43-73	C. Schmitt, S. Klein, D. Bahre	An Introduction to the Vibration Analysis for the Precision Honing of Bores
NAMRC43-7	T. Schmitz, A. Honeycutt	The Extended Milling Bifurcation Diagram
11:00 AM - 12:30 PM	**MSEC 2-4: Machining IV**	
Keynes	***Chair: Sunday, J. Ojolo, University of Lagos***	***Co-Chair: Demeng Che, Northwestern University***
MSEC2015-9254	Michael K.O. Ayomoh, Khaled A. Abou-El-Hossein, Sameh F.M. Ghobashi	Surface Roughness Prediction using Numerical Scheme and Feedback Control
MSEC2015-9276	Fawang Zhang, Lin Gu, Wansheng Zhao,	Study of The Gaussian Distribution of Heat Flux for Micro-EDM
MSEC2015-9310	Faping Zhang, Jibin Yang, Tiguang Zhang, Yan Yan	Surface Morphology Separation Based On Wavelet Reconstruction and Empirical Mode Decomposition
11:00 AM - 12:30 PM	**NAMRC: Cutting Tools and Mechanics III**	
Burnham	***Session Chairs: Livan Fratini and Petr Kolar***	
NAMRC43-88	K. Trapp, L. Kaefer, D. Baehre	Effects of Machining Ferromagnetic Materials on Magnetic Property Changes
NAMRC43-130	A. Davoudinejad, E. Chiappini, S. Tirelli, M. Annoni, M. Strano	FE Simulation and Validation of Chip Formation and Cutting Forces in Dry and Cryogenic Cutting of Ti–6Al–4V
NAMRC43-108	D. Ulutan, A. Pleta, A. Henderson, L. Mears	Comparison and Cost Optimization of Solid Tool Life in End Milling Nickel-Based Superalloy
11:00 AM - 12:30 PM	**MSEC 1-1: Materials – Experiments and Modeling II**	
Olmstead	***Chair: Christopher Saldana, Georgia Institute of Technology***	***Co-Chair: Meenakshisundaram Shankar, University of Pittsburgh***
MSEC2015-9318	Yigit Arisoy, Tugrul Ozel	Investigations On Machining Induced Microstructural Changes In Inconel 100
MSEC2015-9320	Zhencheng Ren, Yalin Dong, Chang Ye	Molecular Dynamic Simulation Of Surface Amorphization of Nitinol Under Dynamic Shock Peening
MSEC2015-9473	Marzyeh Moradi, Saurabh Basu, Meenakshisundaram Shankar	Characterization of Deformation Mechanics and Microstructure Evolution During Indirect Extrusion In Small Length Scales

Tuesday, June 9, 2015

11:00 AM - 12:30 PM	MSEC 2-6: Processing and Testing of Polymers and Composites II	
Lakeview	***Chair: Loredana Santo, University of Rome Tor Vergata***	
MSEC2015-9236	Catalin Fetecau, Felicia Stan, Laurentiu I. Sandu, Florin Susac	Tuning the Mechanical Properties of High-Density Polyethylene by ECAE Process
MSEC2015-9289	Fabrizio Quadrini, Giovanni Matteo Tedde, Loredana Santo	Shape Memory Composite Hands For Space Applications
MSEC2015-9364	Dave (Dae-wook) Kim, Aaron Beal, Patrick Kwon	Effect of Tool Wear on Hole Quality in Drilling of Carbon Fiber Reinforced Plastic-Titanium Stacks Using Tungsten Carbide and PCD Tools

NOTES

2:00 PM - 3:30 PM	**NAMRC: Hocken Symposium III**	
SALON I	***Session Chairs: Tony Schmitz***	
NAMRC43	H. Kunzmann	Measure What Is Measurable, Make Measurable What Is Not: Contributions of Bob Hocken To Realize This Requirement
NAMRC43-38	B. Muralakrishnan, M. Shilling, P. Rachakonda, W. Ren, V. Lee, D. Sawyer	Towards the Development of a Documentary Standard for Derived-point to Derived-point Distance Performance Evaluation of 3D Imaging Systems
NAMRC43-110	C. Dang, C. Bui, J. Hwang	Volumetric Error Model for Multi-Axis Machine Tools
2:00 PM - 3:30 PM	**MSEC 2-11: Forming Symposium Keynote: Prof. Dorel Banabic**	
SALON II	***Session Chair Rajiv Malhotra***	***Co-chair Matteo Strano***
MSEC2015-9213	Dorel BANABIC	Advances in Plastic Anisotropy and Forming Limits in Sheet Metal Forming
2:00 PM - 3:30 PM	**MSEC 2-7: Additive Manufacturing Symposium Keynote: Prof. Suresh Babu**	
SALON III	***Chair: Shawn Moylan, National Institute of Standards and Technology***	***Co-Chair: Ihab Ragai, Penn State University***
MSEC2015-9533	Suresh Babu	Opportunities and Challenges of Metal Additive Manufacturing: Role of High-Performance Computing and Ex-situ/In-situ Characterization Tools
2:00 PM - 3:30 PM	**NAMRC: Quality in Additive Manufacturing**	
SALON IV	***Session Chairs: John Obielodan and Roland Chen***	
NAMRC43-43	W. Land, B. Zhang, J. Ziegert, A. Davies	In-Situ Metrology System for Laser Powder Bed Fusion Additive Process
NAMRC43-93	C. Li, C. Fu, Y.B. Guo	Fast Prediction and Validation of Part Distortion in Selective Laser Melting
NAMRC43-92	P. Das, R. Chandran, R. Samant, S. Anand	Optimum Part Build Orientation in AM for Minimizing Part Errors and Support Structures
2:00 PM - 3:30 PM	**MSEC 2-4: Machining I**	
Walden	***Chair: Sunday, J. Ojolo, University of Lagos***	***Co-Chair: Xueping Zhang, Shanghai Jiao Tong University***
MSEC2015-9201	Alaa A. Olleak, Hassan A. El-Hofy	Prediction of Cutting Forces in High Speed Machining of Ti6Al4V using SPH Method
MSEC2015-9249	Demeng Che, Jacob Smith, Kornel Ehmann	Finite Element Study of the Cutting Mechanics of the Three Dimensional Rock Turning Process
MSEC2015-9258	Peng Wang, ,Song Zhang, Zhe Li, Jianfeng Li	Machining Process Planning and Machining Simulation for Vehicle Rear Bumper Mold

Tuesday, June 9, 2015

2:00 PM - 3:30 PM	**MSEC 2-5: Advances in Non-traditional Manufacturing Processes I**	
Keynes	***Chair: Bin Wei, GE Global Research Center***	***Co-Chair: Sadaiah Mudigonda, Dr Babasaheb Ambedkar Technological University***
MSEC2015-9275	Zengwei Zhu, Dengyong Wang, Jun Bao, Di Zhu	Process Simulation of Electrochemical Machining of Convexity Structure on Revolving Workpiece
MSEC2015-9294	Sadaiah Mudigonda, Deepakkumar Patil	Investigations on Surface Texturing on Monel 400 using Photochemical Machining
MSEC2015-9456	Baoyang Jiang, Shuhuai Lan, Jun Ni	On Modeling and Simulation of the Discharging Activity in Electrochemical Discharge Machining
2:00 PM - 3:30 PM	**MSEC 2-3: Laser Surface Processing**	
Burnham	***Chair: Frank Pfefferkorn, Univ Of Wisconsin-Madison***	***Co-Chair: Kevin Klingbeil, LasX Industries***
MSEC2015-9242	John W. Flemmer, Edgar Willenborg	Simultaneous 9-Axis-Laser-Processing
MSEC2015-9243	John W. Flemmer, Norber Pirch, Fabian Drinck	LMDCAM2: Software Tool for Near-Net Repair, Cladding and Built-Up by Laser Metal Deposition
MSEC2015-9272	Panjawat Kongsuwan, Grant Brandal, Y Lawrence Yao	Laser Induced Porosity and Crystallinity Modification of a Bioactive Glass Coating on Titanium Substrates
2:00 PM - 3:30 PM	**MSEC 1-2: Materials Processing, Microstructure, Plasticity and Testing I**	
Olmstead	***Chair: Xin Wu, Wayne State Univ.***	***Co-Chair: Thierry Barriere, University of Franche-Comte***
MSEC2015-9260	Jianchao Yu, Gang Wang, Jianwei Qin, Maobing Shuai, Yiming Rong	Experimental and Physical-Based Constitutive Model Study of FCC Metal over Wide Temperature and Strain Rate Ranges
MSEC2015-9326	Mohammad Dewan, Gustavo Gonzalez, Muhammad Wahab	Effects Of Rotating - Bending snd Torsional Fatigue Loads on Gas Tungsten Arc (Gta) Welded Aisi 1018 Low Carbon Steel Joints
MSEC2015-9414	Thierry Barriere, Alexandre Royer, Jean-Claude Gelin	Study Of The Degradation Of Polyethylene Glycol In Inconel 718 Feedstock during Powder Injection Moulding Process
2:00 PM- 3:30 PM	**MSEC 2-6: Advances in Manufacturing of Polymers and Composites**	
Lakeview	***Chair: Felicia Stan, Dunarea de Jos University of Galati***	
MSEC2015-9313	Loredana Santo, Fabrizio Quadrini, Giovanni Matteo Tedde	Manufacturing Of A Shape Memory Polymer Actuator
NAMRC43-62	W. Li, B. Belmont, A. Shih	Design and Manufacture of Polyvinyl Chloride (PVC) Tissue Mimicking Material for Needle Insertion

NOTES

MTCONNECT TECHNICAL WORKSHOP

This workshop is designed to provide the following information and capabilities to prospective participants in the MTConnect Student Challenge:

- Industrial Internet, Standards, and MTConnect
- Architectural overview of MTConnect
- Data collection, storage, and analysis using MTConnect
- Demonstration of Amazon Web Services based MTConnect data analysis using open source tools
- Discussion of grand challenges and MTConnect as enabler of future solutions
- Questions and Answers

The focus of the talk will be on getting students quickly up to speed on MTConnect using existing open source frameworks, data sources, and data sets. Once completed, the students will have a basic knowledge of MTConnect, the architecture of the standard, what tools they need to work with the data, and pointers to open source technology to begin exploratory work with a minimal learning curve and startup cost.

For more than 50 years, Charlotte Motor Speedway has set the standard for motorsports entertainment and evolved into "The Greatest Place to See the Race." Nestled in the heart of NASCAR country, the Mecca of Motorsports is the only race vacation destination where fans can immerse themselves in the sport by taking in an event at the legendary 1.5-mile superspeedway and visit race team shops and the newly-opened NASCAR Hall of Fame in the same weekend. Generating a regional economic impact of approximately $451 million annually, the speedway hosts three premiere NASCAR events each year - the NASCAR Sprint All-Star Race, the Coca-Cola 600 and the Bank of America 500 - as well as more than three dozen other events for automotive and motorsports enthusiasts of all ages. Charlotte Motor Speedway's basic philosophy is to always put "Fans First" and create memories that last a lifetime for all that pass through the gates.

- The Charlotte Motor Speedway complex encompasses nearly 2,000 acres and includes a 2.25-mile road course, a six-tenths-mile karting layout and a quarter-mile oval within the walls of the 1.5-mile superspeedway. A one-fifth-mile oval is located just outside Turn 3.
- Three NASCAR Sprint Cup Series events, two NASCAR Nationwide Series races and a NASCAR Camping World Truck Series race are among the events held each year on the 1.5-mile superspeedway. Other events on the various tracks include a weekly short-track series for Legend Cars and Bandoleros; national and regional car club competitions; and World Karting Association regional, national and international races. Charlotte Motor Speedway also annually presents three of the nation's largest car shows and swap meets—the AutoFairs in April and September and the Goodguys Southeastern Nationals street rod spectacular in October.
- In May 2000, a state-of-the-art four-tenths-mile clay oval—The Dirt Track at Charlotte—was completed across Highway 29 from the speedway. The stadium-style facility has 14,000 seats and annually hosts the World of Outlaws Sprint Car Series and the World of Outlaws Late Model Series along with a championship Monster Truck spectacular.
- In August 2008, zMAX Dragway was completed on 46.5 acres of land adjacent to The Dirt Track. The Bellagio of drag strips boasts 30,000 grandstand seats and 40 luxury suites. It's also a track of "firsts," as in the first drag strip in the world to feature two pedestrian tunnels underneath the strip to increase fan mobility, and its most prominent feature, the world's only four-lane all-concrete racing surface.

WEDNESDAY, JUNE 10, 2015

7:30 AM - 8:30 AM	Continental Breakfast	Glenwaters
8:00 AM - 12:00 PM	Poster Setup	Lakeview
8:00 AM - 5:00 PM	Registration	Welwyn and Midway
8:30 AM - 10:00 AM	MSEC 2-1: Symposium Keynote: Prof. Kai Cheng	SALON I
8:30 AM - 10:00 AM	NAMRC: Cyber-Physical Systems in Manufacturing I → Track Keynote: Prof. Lihui Wang	SALON II
8:30 AM - 10:00 AM	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - I	SALON III
8:30 AM - 10:00 AM	MSEC 2-13: Monitoring, Sensing, and Control for Intelligent Machining and Inspection - I	SALON IV
8:30 AM - 10:00 AM	NAMRC: Additive Manufacturing Materials	Walden
8:30 AM - 10:00 AM	MSEC 2-11: Forming and Joining of Hollow Parts	Keynes
8:30 AM - 10:00 AM	MSEC 2-4: Machining II	Burnham
8:30 AM - 10:00 AM	MSEC 2-4: Forming	Audubon
8:30 AM - 10:00 AM	MSEC 2-5: Advances in Non-traditional Manufacturing II	Olmstead
8:30 AM - 5:00 PM	Exhibits	Glenwaters
10:30 AM - 11:00 AM	Morning Break	Glenwaters
10:30 AM - 12:00 PM	MSEC 4-3: Intelligent Maintenance Scheduling	SALON I
10:30 AM - 12:00 PM	NAMRC Panel Discussion: Government Support of Manufacturing Research – Current Status and Future Trends	SALON II
10:30 AM - 12:00 PM	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - II	SALON III
10:30 AM - 12:00 PM	MSEC 2-13: Monitoring, Sensing, and Control for Intelligent Machining and Inspection - II	SALON IV
10:30 AM - 12:00 PM	MSEC 2-10: Welding I	Walden
10:30 AM - 12:00 PM	MSEC 2-11: Innovations in Materials Forming	Keynes
10:30 AM - 12:00 PM	MSEC 2-1: Grinding and Grinding Tools	Burnham
10:30 AM - 12:00 PM	MSEC 1-2: Materials, Processing, Microstructure, Plasticity, and Testing II	Audubon
10:30 AM - 12:00 PM	MSEC 2-5: Advances in Non-traditional Manufacturing III	Olmstead
12:30 PM - 2:00 PM	ASME Awards Luncheon	UNIVERSITY BALLROOM

- Best Organizer of Symposium & Session Award
- Best Paper Award
- MED Outgoing Chair Recognition
- Ennor Manufacturing Technology Award
- Milton C. Shaw Manufacturing Research Medal
- Recognition of JMSE and JMNM Retiring Associate Editors
- Chao & Trigger Young Manufacturing Engineer Award
- Recognition of ASME Fellows
- Recognition of Tech. Program Chairs, Vice-chairs, and Organizers

1:30 PM - 3:00 PM	MSEC 4-3: Maintenance for Advanced Manufacturing Systems	SALON I
1:30 PM - 3:00 PM	MSEC 2-7: Panel: State-of-the-Art, Challenges, and Research Needs to Further Additive Manufacturing	SALON II
1:30 PM - 3:00 PM	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - III	SALON III
1:30 PM - 3:00 PM	MSEC 2-14: Laser, Process Innovations, and Energy Field Manufacturing I	SALON IV
1:30 PM - 3:00 PM	MSEC 2-10: Welding II	Walden
1:30 PM - 3:00 PM	NAMRC: Forming I	Keynes
1:30 PM - 3:00 PM	NAMRC: Abrasive Machining	Burnham
1:30 PM - 3:00 PM	MSEC 2-10: Assembly	Audubon
1:30 PM - 3:00 PM	MSEC 2-5: Advances in Non-traditional Manufacturing IV	Olmstead
1:30 PM - 5:00 PM	MSEC: Poster Session	Lakeview
3:30 PM - 5:00 PM	MSEC 2-9: Equipment Design and Tooling to Enhance Manufacturing Processes	SALON I
3:30 PM - 4:00 PM	Afternoon break	Glenwaters
3:30 PM - 5:00 PM	NAMRC: Cyber-Physical Systems in Manufacturing II	SALON II
3:30 PM - 5:00 PM	MSEC 2-12: Substitution and Enhancement of Traditional Processes with Laser-based Techniques: Technical and Economic Feasibility	SALON III
3:30 PM - 5:00 PM	MSEC 2-14: Laser, Process Innovations, and Energy Field Manufacturing I	SALON IV
3:30 PM - 5:00 PM	MSEC 2-8: Renewable Energy Manufacturing	Walden
3:30 PM - 5:00 PM	NAMRC: Forming II	Keynes
3:30 PM - 5:00 PM	MSEC 2-4: Machining III	Burnham
3:30 PM - 5:00 PM	MSEC 2-11: Incremental Forming II	Audubon
3:30 PM - 5:00 PM	MSEC 2-4: System Modeling	Olmstead
5:30 PM - 7:30 PM	UNC Charlotte Lab Tours/Refreshments	Off-site

- Center for Precision Metrology
- Center for Optics and Optoelectronic Communications
- Energy Production and Infrastructure Center

(Buses leave from hotel lobby)

NOTES

FEDERAL SUPPORT FOR MANUFACTURING RESEARCH

Wednesday, June 10, 10:30 AM Salon II

GOVERNMENT SUPPORT FOR MANUFACTURING RESEARCH: CURRENT STATUS AND FUTURE TRENDS

Purpose and Objective:

Over the past few years, attitudes towards the value of manufacturing to the US economy and global competitiveness have undergone a dramatic shift; with increased recognition of the vital role a vigorous manufacturing sector has on our ability to innovate and compete in a global marketplace. During this period a number of new initiatives by the Federal government, including the establishment of a network of Manufacturing Innovation Institutes, have targeted ways to support and strengthen US-based manufacturing. This panel discussion will provide an update on current and future Federal programs aimed at supporting manufacturing research in both the commercial and academic sectors; and will provide an overarching view of the US government's objectives and strategy for ensuring continued technological innovation in advanced manufacturing. Panel members will consist of high-level administrators from the Departments of Commerce, Energy, Defense, and from NSF and NASA. Agency specific goals and objectives will be highlighted, and important technology trends and focus areas identified.

Panelists:

Mr. Michael Molnar (Department of Commerce: Director – Advanced Manufacturing National Program Office)

Dr. Pramod Khargonekar (National Science Foundation: Assistant Director and Head of the Engineering Directorate)

Dr. Mark Johnson (Department of Energy: Director – Advanced manufacturing Office)

Ms. Adele Ratcliffe (Office of the Secretary of Defense: Director of Manufacturing Technology)

Moderator:

Prof. Scott Smith (University of North Carolina at Charlotte: Professor and Chair: Department of Mechanical Engineering and Engineering Science)

Organizers:

John Ziegert, Scott Smith, Rob Ivester

ADDITIVE MANUFACTURING

Wednesday, June 10, 1:30 PM Salon II

STATE-OF-THE-ART, CHALLENGES AND RESEARCH NEEDS TO FURTHER ADDITIVE MANUFACTURING

Purpose and Objective:

The purpose of this panel is to provide a forum for conference participants to engage in a discussion about the research priorities of future AM technologies. The capabilities of AM demonstrate significant potential for a revolutionary, rapid design-to-product cycles for high-value, complex-shape, and mass-customizing manufactures. However, development and qualification of a process for a new component still requires a time consuming trial-and-error based optimization over so many process parameters. By bringing in experts together from the industry, federal government and academia, in the areas of both metal and non-metal AM, the objective of this panel is to identify innovations needed to further advancement of AM technologies tomorrow.

Panelists:

Bryan Dods (GE Power & Water: Chief Manufacturing Engineer)

Rajeev Kulkarni (3D Systems: Vice President and Chief Product Officer)

Dr. Rob Ivester (Department of Energy),

Dr. Shawn Moylan (National Institute of Standards and Technology)

Dr. Suresh Babu (University of Tennessee at Knoxville)

Dr. Yong Chen (University of Southern California)

Moderator:

Dr. Kevin Chou (University of Alabama)

Organizers:

Kevin Chou, Shawn Moylan, Ihab Ragai

8:30 AM - 10:00 AM	**NAMRC: Cyber-Physical Systems in Manufacturing I Track Keynote: Prof. Lihui Wang**	
SALON II	***Session Chairs: Wei (Mike) Li and Prahalad Rao***	
NAMRC43-126	L. Wang, M. Torngren, M. Onori	TRACK KEYNOTE - Current Status and Advancement of Cyber Physical Systems in Manufacturing
NAMRC43-47	M. Hutchins, R. Bhinge, M. Micali, S. Robinson, J. Sutherland, D. Dornfeld	Framework for Identifying Cybersecurity Risks in Manufacturing
NAMRC43-57	H. Vincent, L. Wells, P. Taragaza, J. Camelio	Trojan Detection and Side-Channel Analyses for Cyber-Security in Cyber-Physical Manufacturing Systems
8:30 AM - 10:00 AM	**MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - I**	
SALON III	***Chair: Jerry Ying Hsi Fuh, National University Of Singapore***	***Co-Chair: Robert C. Chang, Stevens Institute of Technology***
MSEC2015-9367	Yang Wu, Jerry Ying Hsi Fuh, Yoke-San Wong, Jie Sun	Fabrication of 3D Scaffolds via E-Jet Printing for Tendon Tissue Repair
MSEC2015-9443	Filippos Tourlomousis, Azizbek Babakhanov, Houzhu Ding, Dilhan Kalyon, Robert C. Chang	A Novel Melt Electrospinning System for Studying Cell Substrate Interactions
MSEC2015-9475	Jingyu Ock, Wei Li	Selective Laser Foaming For Three-Dimensional Cell Culture On A Compact Disc
8:30 AM - 10:00 AM	**MSEC 2-13: Monitoring, Sensing, and Control for Intelligent Machining and Inspection - I**	
SALON IV	***Chair: Robert X. Gao, Ph.D., Case Western Reserve University***	***Co-Chair: Jarred Heigel, Pennsylvania State University***
MSEC2015-9346	Zhenhua Wu	Cutting Tool Condition Monitoroing And Prediction Based On Dynamic Data Driven Approaches
MSEC2015-9463	Jinjiang Wang, Xinyao Tang, Zhaoyan Fan, Peng Wang, Robert Gao	Dual-Tree Wavelet Packet Transform For Ultrasonic Data Transmission Through Metal Structure
MSEC2015-9470	Vasileios Bardis, Farbod Akhavan Niaki, Durul Ulutan, Laine Mears	Investigation Of The Relationship Between Vibration Data And Tool Wear During End-Milling Of Gamma-Prime Strengthened Alloys
8:30 AM - 10:00 AM	**NAMRC: Additive Manufacturing Materials**	
Walden	***Session Chairs: Jingyan Dong and Meisam Salahshoor***	
NAMRC43-78	Y. Zhou, Y. Tang, T. Hoff, M. Garon, F. Zhao	The Verification of the Mechanical Properties of Binder Jetting Manufactured Parts by Instrumented Indentation Testing
NAMRC43-121	X. Song, Y. Chen, T. Lee, S. Wu, L. Cheng	Ceramic Fabrication Using Mask-Image-Projection-based Stereolithography Integrated with Tape-casting
NAMRC43-103	A. Habib, N. Ahsan, B. Khoda	Optimizing Material Deposition Direction for Functional Internal Architecture in Additive Manufacturing Processes

8:30 AM - 10:00 AM	**MSEC 2-11: Forming and Joining of Hollow Parts**	
Keynes	***Session Chairs: Murali Sundaram and Bahir Khoda***	
MSEC2015-9204	Frank Schieck, Dirk Landgrebe	Hot Gas Forming for Advanced Tubular Automobile Components - Opportunities and Challenges
MSEC2015-9442	Ali Nassiri, Greg Chini, Brad Kinsey	Arbitrary Lagrangian Eulerian FEA Method to Predict Wavy Pattern and Weldability Window during Magnetic Pulsed Welding
MSEC2015-9496	James Lowrie, Gracious Ngaile	Novel Extrusion Punch Design For Improved Lubrication And Punch Ejection
8:30 AM - 10:00 AM	**MSEC 2-4: Machining II**	
Burnham	***Chair: Demeng Che, Northwestern University***	***Co-Chair: Xueping Zhang, Shanghai Jiao Tong University***
MSEC2015-9450	Jianfeng Ma, Changqing Qiu, Shuting Lei	Comparison of the Effects of Down Milling and up Milling on the Tool Temperature in Machining of Ti-6Al-4V
MSEC2015-9358	Sunday, J. Ojolo, Olumuyiwa, Agunsoye, Oluwole Adesina, M. G. Sobamowo	Force Modelling For Temperature Field Determination During High Speed End- Milling Of Super Alloys
MSEC2015-9415	Lei Chen, Juhchin A. Yang, Albert Shih, Bruce L. Tai	Investigation of Finite Element Thermal Models for Workpiece Temperature in Cylinder Boring
8:30 AM - 10:00 AM	**MSEC 2-4: Forming**	
Audubon	***Chair: Demeng Che, Northwestern University***	***Co-Chair: Xueping Zhang, Shanghai Jiao Tong University***
MSEC2015-9376	Anupam Agrawal, N Venkata Reddy, Prakash M Dixit	Optimal Blank Shape Prediction Considering Sheet Thickness Variation for Multistage Deep Drawing
MSEC2015-9379	Bishoy Dawood, Mostafa Shazly, Abdalla Wifi, ALAA ELMOKADEM	Effect of Variable Blank Holder Force on the Springback and Weld-line Movement During Draw bending of Tailor Welded Blanks
MSEC2015-9499	Feng Zhang, Arif Malik	Strip Flatness Mechanism Analysis In Single-Stand Cold Mills
8:30 AM - 10:00 AM	**MSEC 2-5: Advances in Non-traditional Manufacturing II**	
Olmstead	***Chair: Wansheng Zhao, Shanghai Jiao Tong University***	***Co-Chair: Tianfeng Zhou, Beijing Institute of Technology***
MSEC2015-9261	Xufan Yan, Song Zhang, Jianfeng Li, Gaoqi Wang	Electrochemical corrosion resistance of AISI H13 steel machined by electro discharge machining
MSEC2015-9311	Tianfeng Zhou, Lizheng Ma, Siqin Pang, Zhiqiang Liang, Xibin Wang	Analysis of Shaped Electrode Based on Size Effects in Electrical Discharge Machining (EDM)
MSEC2015-9348	Arvind Pattabhiraman, Deepak Marla, Shiv Kapoor	Atomized Dielectric Spray-Based Electric Discharge Machining (Spray-Edm) For Sustainable Manufacturing

10:30 AM - 12:00 PM	MSEC 4-3: Intelligent Maintenance Scheduling	
SALON I	***Chair: Qing Chang, Stony Brook University***	***Co-Chair: Xi Gu, University of Michigan***
MSEC2015-9307	Jing Zou, Qing Chang, Yong Lei, Guoxian Xiao, Jorge Arinez	Stochastic Maintenance Opportunity Windows For Serial Production Line
MSEC2015-9345	Xufeng Yao, Zeyi Sun, Lin Li, Hua Shao	Joint Maintenance And Energy Management Of Sustainable Manufacturing Systems
MSEC2015-9441	Xi Gu, Xiaoning Jin, Jun Ni	Real-Time Maintenance Policy In Manufacturing Systems With Intermediate Buffers

10:30 AM - 12:00 PM **NAMRC Panel: Federal Support for Manufacturing Research - Current Status and Future Trends**

SALON II ***Session Chair: Prof. Scott Smith, UNC Charlotte, Professor and Chair, Department of Mechanical Engineering and Engineering Science***

- Mr. Michael Molnar, Department of Commerce: Director – Advanced Manufacturing National Program Office
- Dr. Pramod Khargonekar, National Science Foundation: Assistant Director and Head of the Engineering Directorate
- Dr. Mark Johnson, Department of Energy: Director – Advanced Manufacturing Office
- Ms. Adele Ratcliffe, Office of the Secretary of Defense: Director of Manufacturing Technology

10:30 AM - 12:00 PM	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - II	
SALON III	***Chair: Yuan-Shin Lee, North Carolina State University***	***Co-Chair: Andrew C Barnett, Pennsylvania State University***
MSEC2015-9488	Yuan-Shin Lee, Fanxia Kong	Analytical Force Modeling of Ultrasonic Vibration Assisted Drilling of Bones for Medical Surgical Applications
MSEC2015-9295	Zhongwei Hu, Bi Zhang, Wangyuan Lin, Yinghui Ren, Xipeng Xu, Jianyun Shen	Experimental Study on "Break-In" Cutting Energy of Porcine Ascending Aorta
MSEC2015-9352	Adam Gordon, Inki Kim, Andrew C Barnett, Jason Z Moore	Needle Insertion Force Model for Haptic Simulation

10:30 AM - 12:00 PM	MSEC 2-13: Monitoring, Sensing, and Control for Intelligent Machining and Inspection - II	
SALON IV	***Parikshit Mehta, Ph.D., Alcoa Technical Center, Alcoa Inc.***	***Co-Chair: Hui Wang, Ph.D., University of Michigan***
MSEC2015-9416	Arunachalam Narayanaperumal, Vijayaraghavan Lakshmanan	Evaluation of the Working Surface Condition of the Grinding Wheel using Speckle Image Analysis
MSEC2015-9214	Rajesh Vazhayil Govindan, Narayanan Namboothiri Velimamkovil Narayanan	Recurrence Quantification Analysis of System Signals for Detecting Tool Wear in a Lathe
MSEC2015-9357	Farbod Akhavan Niaki, Durul Ulutan, Laine Mears	Parameter Estimation Using Markov Chain Monte Carlo Method In Mechanistic Modeling Of Tool Wear During Milling

10:30 AM - 12:00 PM	MSEC 2-10: Welding I	
Walden	***Chair: Scott Miller, University of Hawaii***	***Co-Chair: Bruce L. Tai, Texas A&M University***
MSEC2015-9248	Yunwu Ma, Yongbing Li, Wei Hu, Ming Lou, Zhongqin Lin	Modeling of Friction Self-Piercing Riveting (F-SPR) of Aluminum to Magnesium
MSEC2015-9431	Grant Kruger, Scott Miller, Albert Shih, Theo van Niekerk	Robustness of 802.15 Wireless Interface for Real-Time Thermal Feedback Control of the Friction Stir Welding Process
MSEC2015-9457	Xun Liu, Shuhuai Lan, Xianli Qiao, Jun Ni	Study of Plunge Stage for a Hybrid Friction Stir Welding Process Based on Electro-Plastic Effect
10:30 AM - 12:00 PM	**MSEC 2-11: Innovations in Materials Forming**	
Keynes	***Chair: Gap Yong Kim, Co-chair: Matteo Strano***	
MSEC2015-9237	Hua-Chu Shih	Galling And Die Build-Up In Forming Uncoated, Cold-Rolled High -Trength Steels (Ahss)
MSEC2015-9283	Arshpreet Singh, Anupam Agrawal	Experimental Investigation on Elastic Spring Back in Deformation Machining Bending Mode
MSEC2015-9467	Saeed Mousa, Gap-yong Kim	Direct Adhesion of Warm Roll-Bonded Al1100/Polyurethane/Al1100 Sandwich Composite
10:30 AM - 12:00 PM	**MSEC 2-1: Grinding and Grinding Tools**	
Burnham	***Chairs: Mark Jackson, Bonded Abrasives Inc. and Barbara Linke, UC Davis***	
MSEC2015-9280	Tatsuya Furuki, Toshiki Hirogaki, Eiichi Aoyama, Keiji Ogawa, Kiyofumi Inaba	Fabrication Of Electroplated Cbn End-Mill For High-Efficiency Face Milling Of Carbon Fiber Reinforced Plastic
MSEC2015-9319	Tianyu Yu, Ashraf Bastawros, Abhijit Chandra	Modeling Wear Process Of Electroplated CBN Grinding Wheel
MSEC2015-9413	Markus Weiß, Sebastian Barth, Fritz Klocke, Patrick Mattfeld, Matthias Rasim	Detailed Analysis And Description Of Grinding Wheel Topographies
10:30 AM - 12:00 PM	**MSEC 1-2: Materials, Processing, Microstructure, Plasticity, and Testing II**	
Audubon	***Chair: Zhiyu Wang, Georgia Institution of Technology***	***Co-Chair: Mohammad Dewan, Louisiana State University***
MSEC2015-9476	Zhiyu Wang, Christopher Saldana, Saurabh Basu	Subsurface Deformation In Surface Mechanical Attrition Processes
MSEC2015-9412	Chetan Nikhare, Ihab Ragai, David Loker, Shannon Sweeney, Chris Conklin, John Roth	Investigation Of Acoustic Signals During W1 Tool Steel Quenching
MSEC2015-9440	Timothy Roemer, Yannis Korkolis, Brad Kinsey	Design of a Continuous-Bending-under-Tension Machine and Initial Experiments on AL 6022-T4

10:30 AM - 12:00 PM	MSEC 2-5: Advances in Non-traditional Manufacturing III	
Olmstead	*Chair: Sehijpal Singh Khangura, Guru Nanak Dev Engg College*	*Co-Chair: Weilong (Ben) Cong, Texas Tech University*
MSEC2015-9227	Weilong (Ben) Cong, Fuda Ning	Rotary Ultrasonic Machining of CFRP: Design of Experiment with a Cutting Force Model
MSEC2015-9259	Sehijpal Singh Khangura, Harinder Singh, Lakhvir Singh Sran, Anil Srivastava	Investigations Into The Removal Of EDM Recast Layer With Magnetic Abrasive Machining
MSEC2015-9391	P K S C Fernando, Zhijian Pei, Weilong (Ben) Cong, Meng Zhang, Xiaoxu Song	Rotary Ultrasonic Machining of Carbon Fiber Reinforced Plastics: Design of Experiment

NOTES

Wednesday, June 10, 12:30 PM **University Ballroom**

- Best Organizer of Symposium & Session Award
- Best Paper Award
- MED Outgoing Chair Recognition
- Ennor Manufacturing Technology Award
- Milton C. Shaw Manufacturing Research Medal
- Recognition of JMSE and JMNM Retiring Associate Editors
- Chao & Trigger Young Manufacturing Engineer Award
- Recognition of ASME Fellows
- Recognition of Tech. Program Chairs, Vice-chairs, and Organizers

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POSTER SESSIONS

Wednesday, June 10, 1:30 – 5:00, Lakeview

Development of an Advanced Turning System Assisted by Chip-Pulling
» B. Sencer, E. Shamoto, T. Aoki

Experimental Analysis of the Damages in Drilling Composites
» Y. Bao, H. Gao, X. Liu

Flexible Ceramic Membrane with High Strength and Conductive
» C. Xu, J. Yang

Metal Structures Fabrication Using Hybrid AM And Electrodeposition Methods
» J. Obielodan, J. Wu, K. Gronski, J. Gyorog

Energy Efficiency of Ultra-High Speed Spindles
» P. Harris, B. Linke, S. Spence

Wear Protection of Complex Parts using Laser Surface Treatment
» M. Bock, D. Heinen

Development of Coaxial Needles for Breast Cancer Biopsy
» H. Kahraman, H. Yamaguchi

Electro-generated Chemical Polishing Method
» P. Zhou, R. Kang, K. Shan, S. Gao, F. Zheng

Supply Power Design of Oil Cooling Strategies for Precision Ball Screw Unit
» T. Liu, W. Gao, Y. Zhang, D. Zhang

The Prediction of Fixture Comprehensive Influence on the Machining Error of Features Pattern
» G. He, L. Guo, W. Tian, X. Zhao

Additive Manufacturing of CFRP Composites using Fused Deposition Modeling: Effects of Carbon Fiber Content and Length
» W. Cong, F. Ning

Novel Sheet Metal Straining Devices for In-Situ Neutron Diffraction
» J. Milner

Effect of Torque Holding Time on Sheet Separation in Flow Drill Screwing
» R. Prasad, J. Skovron, L. Mears, D. Ulutan, D. Detwiler, B. Baeumler, L. Claus

Study of Diamond Polishing with Chemical and Mechanical Synergistic Effects
» Z. Jin, S. Shi, X. Guo, P. Zhou, H. Dai, R. Kang

Cloud Manufacturing: strategic alignment between manufacturing industry and cloud computing
» Y. Hao, P. Helo

Comparison of Machined Surface after Micro-EDM of NiTi and Ti-6Al-4V
» P. Kakavand, M. Jahan

Micro-EDM of Ti-6Al-4V with Focus on Surface Finish
» J. Wassom, M. Jahan

Electrically Assisted Augmentation of the Forming Process
» H. Date, A. Pleta, L. Mears, D. Ulutan

Wear Protection of Complex Parts Using Laser Surface Treatment
» D. Heinen, M. Bock

The Impact of Training Method on Skill Acquisition and Transfer
» M. Alfred, D. Neyens, A. Gramopadhye

Additive Manufacturing of Metal Parts by Electrochemical Deposition
» A. Brant, G. Ackerman, A. Kamaraj, A., Boddapati, M. Sundaram

Investigations on Machining Induced Microstructural Changes in Inconel 100
» Y. Arisoy, T. Ozel

Structured Light System Calibration with Optimal Fringe Angle
» B. Li, S. Zhang

Overhang Configuration Evaluations in Electron Beam Additive Manufacturing
» B. Cheng, K. Chou

Experimental Study of Self-Assembly for Microscale Integration
» J. Carballo, N. Crane

Effect of Deep penetration of Interleaf on Delamination Resistance in GFRP
» D. Bian, T. Bucher, H. Tan, Y. L. Yao

Machining of SPD-Processed Bulk Titanium for Biomedical Applications
» B. Davis, Y. Huang

AFM-Based 3D Nanofabrication Using Ultrasonic Vibration Assisted Nanomachining
» J. Deng, L. Zhang, J. Dong, P. Cohen

Magnet Assisted Precision Scanning Stage
» D. Yoon, C. Okwudire

Novel Hybrid Feed Drive for Energy Efficient Manufacturing
» C. Okwudire, M. Duan, J. Rodgers

Effects of Tool Design on Delamination in Rotary Ultrasonic Drilling of CFRP
» P. Fernando, Z.J. Pei

Scalable Platform for Batch Fabrication of Micro/Nano Devices on Engineering Substrates of Arbitrary Shapes and Sizes
» M. Santosh, K. Mutyala, A. Javadi, J. Zhao, T.C. Lin, W. Tang, X. Li

Process Effects in Micro-Scale Direct Write Surface Texturing
» H. Qioa, R. Ghandi, J. Norman, S. Basu, J.B. Mann, C. Saldana

Transfer Printing of PbS Quantum Dot and Metal Composite Films to Assemble Solar Cell Device
» H. Keum, Y. Jiang, M. Shim, S. Kim

An Anomaly Detection and Diagnosis Method Based on Real-Time Health Monitoring for Progressive Stamping Processes
» H. Shui, X. Jin, J. Ni

Directionally Dependent Adhesion For Use In Transfer Printing
» H. Cheng, Y. Huang, J. Rogers

Edible Electronics: It Tastes Like Chicken
» H. Cheng, Y. Huang, J. Rogers

Mechanically Robust Design For Wearable Tattoo Electronics
» H. Cheng, Y. Huang, J. Rogers

Laser Induced Plasma Micro-Machining
» I. Saxena, S. Wolff, J. Cao, K. Ehmann

Micro-EDM of Ti-6Al-4V with Focus on Surface Finish
» J. Wasson, M. Jahan

Study on Materials and Fabrication of Functional Thin Film ALN Force Sensors
» M. Santosh, K. Mutyala, J. Zhao, T.C. Lin, X. Li

Investigating Substrate Wettability with MD Simulations
» J. Cordeiro, S. Desai

Manufacturing and Supply Chain Analysis to Support Sustainable Design
» K. Aaoufi, K. Kim, C. Psenka, K. Jackson, K. Haapala

Incremental Sheet Forming – Introduction and Proposed Directions
» K. Wilt

A Fast Interfacial Convective Assembly for the Large-Area Integration of Nanostructures
» A. Korkmaz, C. Yilmaz, Z. Li, C. Duan, A. Busnaina

Study of Vibrational Motions on Tissue Cutting for Solid Biopsy Needles
» M. Giovanni, N. Moser, X. Wang, K. Ehmann

Electric Field Control in Near Field Electrospinning
» N. Martinex Prieto, M. Abecassis, J. Xu, J. Huang, K. Ehmann, J. Cao

Experimental Modeling and Analyses for Friction Stir Extrusion of Mg Chips
» N. Shen, R.A. Behnagh, H. Ding

Calibration of Biaxial Tension Testing Machine
» P. McDonald, S. Beatty, C. Nikhare, J. Roth

Comparison of Machined Surface after Micor-EDM of NiTi ad Ti-6Al-4V
» P. Kakavand, M. Jahan

Design and Optimization of Flow Fields to Improve PEM Fuel Cell Performance
» Q. Wang, M. Leu, U. Koylu

Electrohydrodynamic Jet Printing of Silver Seeds: Micro-Scale Patterning by Electroless Copper Deposition
» H. Qin, J. Dong, Y.-S. Lee

A New Surface Prediction Model for Pulsed Laser Micro Polishing
» Q. Wang, J. Morrow, N. Duffie, F. Pfefferkorn

Magnetically Controlled Laser Induced Plasma Micro-machining
» S. Wolff, I. Saxena, K. Ehman, J. Cao

Modeling Wear Process of Electroplated CBN Grinding Wheel
» T. Yu, A. Chandra, A. Bastawros

Continuous-Bending-Under-Tension to Enhance the Formability of Sheet Metal
» T. Rowmer, Y. Korkolis, B. Kinsey

Polyvinyl Chloride as a Multimodal Tissue-Mimicking Material
» W. Li, B. Belmont, A. Shih

Machining Force Modeling of Vibration-Assisted Nano-Machining Process
» X. Kong, L. Zhang, P. Cohen, J. Dong

Ultrasonic Vibrations-Assisted Pelleting of Cellulosic Biomass
» X. Zong, Z.J. Pei

Droplet Formation and Fabrication of Soft Structures Using Laser
» R. Xiong, Z. Zhang, B. Davis, A. Compaan, Y. Huang

Experimental Investigation of the Grinding Wheel Dynamics in Atherectomy
» Y. Zheng, B. Belmont, A. Shih

Droplet Formation and Settlement of Phase-Change Ink in High Resolution Electrohydrodynamic (EHD) Jet Printing
» Y. Han, C. Wei, J. Dong

Numerical Study of Friction Extrusion Process
» H. Zhang, X. Li, X. Deng, A. Reynolds, M. Sutton

Droplet Formation and Fabrication of Cellular Structures Using Inkjetting
» Z. Zhang, K. Christensen, A. Compaan, Y. Jin, C. Xu, Y. Huang

Optothermal Study of Plasmonic Nanofocusing Lens Under Picosend Laser Irradiation
» Z. Du, C. Chen, L. Traverso, X. Xu, L. Pan, I.H. Chao, A. Lavine

Precision Machining Process Dynamics and Surface Quality Monitoring
» C. Cheng, Z. Wang, W. Hung, S. Bukapatnam, R. Komanduri

Development of a Binder Jetting 3D Printing Method for Production of Dental Porcelain Ceramic Structures
» S. Zhanga, H. Miyanajia, L. Yanga, A. Zandinejadb, B. Stuckera

Custom Cervical Orthotic Based on Patient's Anthropometry
» L. Yang, R. Nazar, G. T. Holman, H. Miyanaji

1:30 PM - 3:00 PM SALON I	MSEC 4-3: Maintenance for Advanced Manufacturing Systems *Chair: Lin Li, University of Illinois at Chicago*	*Co-Chair: Zhaoliang Jiang, Shandong University*
MSEC2015-9375	Zhaoliang Jiang, Wenping Liu, Qingyue Wei, Zhishen Li	Temperature Simulation And Control System For Automobile Coating Line Drying Rooms
MSEC2015-9389	Prahalad Rao, Zhenyu Kong, Jia (Peter) Liu, David Roberson	Sensor-based Online Process Fault Detection in Additive Manufacturing
MSEC2015-9393	Masoumeh Aminzadeh, Thomas Kurfess	Layerwise Automated Visual Inspection In Laser Powder-Bed Additive Manufacturing

1:30 PM - 3:00 PM
SALON II

MSEC Panel: State of the Art, Challenges, and Research Need to Further Additive Manufacturing

Session Chair: Y. Kevin Chou

- Mr. Bryan Dods, GE Power and Water – Manufacturing Chief Engineer
- Mr. Rajeev Kulkarni, 3D Systems – VP Global Engineering
- Dr. Rob Ivester, DOE
- Dr. Shawn Moylan, NIST
- Dr. Suresh Babu, University of Tennessee Knoxville
- Dr. Yong Chen, University of Southern California

1:30 PM - 3:00 PM SALON III	MSEC 3-1: Advances in Manufacturing Processes for Biomedical Materials and Devices - III *Chair: Jason Moore, The Pennsylvania State University*	*Co-Chair: Yong Lei, Zhejiang University*
MSEC2015-9266	Marco Giovannini, Newell Moser, Xinsheng Wang, Kornel Ehmann	Computational And Experimental Study Of Vibrational Motions On Tissue Cutting For Solid Biopsy Needles
MSEC2015-9268	Dedong Gao, Yong Lei, Bin Yao, Qiang Li, Huiquan Bai	Steerability and Kinematics of Bevel-Tip Flexible Needle
MSEC2015-9353	Andrew C Barnett, Malorie Feidner, Jason Z Moore	Vibration Needle Tissue Cutting with Varying Tip Geometry
1:30 PM - 3:00 PM **SALON IV**	**MSEC 2-14: Laser, Process Innovations, and Energy Field Manufacturing I** ***Chair: John Roth, Penn State Erie, The Behrend College***	***Co-Chair: Chetan Nikhare, Penn State Erie***
MSEC2015-9238	Rong Cheng, Xiaoyu Wu, Shiquan Ling	Rapid Resistance Welding of Fe78Si9B13 Bulk Metallic Glasses
MSEC2015-9377	Junjie Luo, Luke J. Gilbert, Chuang Qu, Jacob S. Wilson, Edward Kinzel, Douglas Bristow, Robert G. Landers	Wire Fed Additive Manufacturing of Transparent Glass Parts
MSEC2015-9433	Brandt Ruszkiewicz, Christopher Scriva, Zachary C Reese, Chetan Nikhare, John Roth, Ihab Ragai	Direct Electric Current Spot Treatment's Effect On Springback Of 90 Degree Bent 2024-T3 Aluminum

1:30 PM - 3:00 PM	MSEC 2-10: Welding II	
Walden	***Chair: Wayne Cai, General Motors***	***Co-Chair: Chenhui Shao, University of Michigan, Ann Arbor***
MSEC2015-9251	Hongze Wang, Yansong Zhang	Modeling of Heat Affected Zone Softening in Laser Welding of M1500
MSEC2015-9262	S. Shawn Lee, Tae Hyung Kim, S. Jack Hu, Wayne Cai, Jeffrey A. Abell	Analysis Of Weld Formation In Multilayer Ultrasonic Metal Welding Using High-Speed Images
MSEC2015-9370	Hao Du, S. Jack Hu, Pei-chung Wang, Jingjing Li	Estimation Of Weld Bead Geometry In Gas Metal Arc Welding Of Aluminum Using Electrical Signals And Liquid Surface Mode
1:30 PM - 3:00 PM	**NAMRC: Forming I**	
Keynes	***Chairs: Durul Ulutan and Jyhwen Wang***	
NAMRC43-46	M. Ramezani, S. Schmid	Bio-based Lubricants for Forming of Magnesium
NAMRC43-70	E. Simenotto, S.Bruschi, A. Ghiotti, E. Savio	Prediction of Distortions in Hot Forged Martensitic Stainless Steel Turbine Blades by Numerical Simulation
NAMRC43-85	A. Nassari, C. Campbell, G. Chini, B. Kinsey	Analytical Model and Experimental Validation of Single Turn, Axi-Symmetric Coil for Electromagnetic Forming and Welding
1:30 PM - 3:00 PM	**NAMRC: Abrasive Machining**	
Burnham	***Chairs: Barbara Linke and John Patten***	
NAMRC43-21	W. Grzesik, J. Rech, K. Zak	High-Precision Finishing Hard Steel Surfaces Using Cutting, Abrasive and Burnishing Operations
NAMRC43-125	Y. Zheng, B. Belmont, A. Shih	Experimental Investigation of the Grinding Wheel Dynamics in Atherectomy
NAMRC43-90	D. Sun, M. Sealy, Z. Liu, C. Fu, Y. Guo, F. Fang, B. Zhang	Finite Element Analysis of Machining Damage in Single-Grit Grinding of Ceramic Knee Implants
1:30 PM - 3:00 PM	**MSEC 2-10: Assembly**	
Audubon	***Chair: Weihong Guo, University of Michigan, Ann Arbor***	***Co-Chair: Xi Gu, University of Michigan***
MSEC2015-9292	Changhui Liu, Sun Jin, Xinmin Lai, Jie Luo, Bo He, Fei Li,	The Assembly Variation Modeling for the Rear Casing Wax Part Based on Polar Coordinate
MSEC2015-9210	Wei Xu, Alexander Mamutov, Dangxin Wu, Xin Sun, John Bonnen, Quochung Le, Sergey Golovashchenko	Multiphysics modeling and simulation of electromagnetic pulse welding

1:30 PM - 3:00 PM	MSEC 2-5: Advances in Non-traditional Manufacturing IV	
Olmstead	*Chair: Lin Gu, Shanghai Jiao Tong University*	*Co-Chair: Hyung Wook Park, Ulsan National Institute of Science and Technology*
MSEC2015-9233	Jisoo Kim, Hyung Wook Park	The Large Pulsed Electron Beam (Lpeb)-Assisted Hybrid Deburring Process Of The Patterned Metal Masks
MSEC2015-9301	Jipeng Chen, Lin Gu, Hui Xu, Wansheng Zhao	Research on the Machining Performance of SiC/Al Composites Utilizing the BEAM Process
MSEC2015-9497	Shiv Shailendar, Murali Sundaram	Corrosion Study On Liquid Marble Based Localized Electrochemical Deposition On Cold Rolled Steel

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3:30 PM - 5:00 PM	**MSEC 2-9: Equipment Design and Tooling to Enhance Manufacturing Processes**	
SALON I	***Chair: Johnson Samuel, Rensselaer Polytechnic Institute***	
MSEC2015-9332	Fujun Wang, Cunman Liang, Yanling Tian, Xingyu Zhao, Dawei Zhang, Placid Ferreira	Mechanism And Characteristics Of A Piezoelectric Actuated Wire Clamp For Thermosonic Wire Bonding
MSEC2015-9333	Jun Zhao, xianhua tian, feng gong, wemzhen qin, qingzhong xu	Development of Si3N4/(W, Ti)C/Co graded nano-composite ceramic tools and its performance in turning GH2132 alloy
MSEC2015-9430	Brandt Ruszkiewicz, Zachary C Reese, John Roth	Feasibility of End Mill Cooling Using the Venturi Effect with Compressed Air
3:30 PM - 5:00 PM	**NAMRC: Cyber-Physical Systems in Manufacturing II**	
SALON II	***Chairs: Zhenhua Wu and Xi Wang***	
NAMRC43-81	M. Givechi, A. Haghighi, L. Wang	Generic Machining Process Sequencing Through a Revised Enriched Machining Feature Concept
NAMRC43-29	D. Wu, J. Terpenny, W. Gentzsch	Cloud-based Design, Engineering Analysis and Manufacturing: A Cost-Benefit Analysis
NAMRC43-71	A. Syberfelt, O. Danielsson, M. Holm, L. Wang	Visual Assembly Guidance Using Augmented Reality
3:30 PM - 5:00 PM	**MSEC 2-12: Substitution and Enhancement of Traditional Processes with Laser-based Techniques: Technical and Economic Feasibility**	
SALON III	***Chair: Alessandro Fortunato, University of Bologna***	***Co-Chair: Erica Liverani, University of Bologna***
MSEC2015-9293	Adrian Lutey, Alessandro Fortunato, Simone Carmignato, Filippo Zanini, Alessandro Ascari	Laser Profiling Of Aluminum Oxide Grinding Wheels
MSEC2015-9478	Erica Liverani, Alessandro Fortunato, Donato Sorgente, Leonardo Daniele Scintilla, Gianfranco Palumbo, Alessandro Ascari	A Thermal Model for Laser Hardening Simulation
MSEC2015-9216	Chad Hase	GF Machining Solutions - Laser Texturing
3:30 PM - 5:00 PM	**MSEC 2-14: Laser, Process Innovations, and Energy Field Manufacturing I**	
SALON IV	***Chair: Hongtao Ding, University of Iowa***	***Co-Chair: Wenwu Zhang, Ningbo Industrial Techno. Research Institute, Chinese Academy of Sciences***
MSEC2015-9323	Ninggang Shen, Hongtao Ding	Cryogenic Cutting of AZ31B-O Mg Alloy for Improved Surface Integrity – Part I: Experimental Analysis and Material Modeling
MSEC2015-9324	Ninggang Shen, Hongtao Ding, Jiaying Gao	Cryogenic Cutting of AZ31B-O Mg Alloy for Improved Surface Integrity – Part II: Physics-based Process Modeling of Surface Microstructural Alteration
MSEC2015-9336	Yuanfeng He, Wenwu Zhang	Research on a Novel High-Speed Pulsating Turning Technology

3:30 PM - 5:00 PM	**MSEC 2-8: Renewable Energy Manufacturing**	
Walden	***Chair: Xuewei Yang, North Carolina State University***	***Co-Chair: Hao Lu, North Carolina State University***
MSEC2015-9340	Xiaoxu Song, Meng Zhang, Zhijian Pei, Donghai Wang	Ultrasonic-assisted dilute acid pretreatment of poplar wood biomass for biofuel manufacturing: A preliminary study
MSEC2015-9444	Changwei Liang, Junxiao Ai, Lei Zuo	Design, Fabrication, Simulation and Testing of a Novel Ocean Wave Energy Converter
MSEC2015-9449	Xuewei Yang, Wenqiao Yuan	Development and challenge of micro-biofuel cell for medical application
3:30 PM - 5:00 PM	**NAMRC: Forming II**	
Keynes	***Chairs: Wayne Cai and Steve Schmid***	
NAMRC43-113	Y. Zhang, M. Dhaigude, J. Wang	The Anvil Effect in the Spherical Indentation Testing on Sheet Metals
NAMRC43-84	T. Bakhtiani, H. El-Mounayri, J. Zhang	Modeling and simulating of extrusion process of a condenser tube for optimizing the mandrel geometry
NAMRC43-129	H. Heinzel, M. Ramezani, T. Neitzert	Experimental investigation of the formability of organic coated steel sheet metal
3:30 PM - 5:00 PM	**MSEC 2-4: Machining III**	
Burnham	***Chair: Xueping Zhang, Shanghai Jiao Tong University***	***Co-Chair: Demeng Che, Northwestern University***
MSEC2015-9284	Gaiyun He, Longzhen Guo, Wenjie Tian, Xiangsong Zhao	The Prediction of Fixture Comprehensive Influence on the Machining Error of Features Pattern
MSEC2015-9315	Vivek Bajpai, Ineon Lee, Hyung Wook Park	FE Simulation of Cryogenic Cooled Machining of Ti Alloy (Ti6ai4v)
MSEC2015-9401	Xueping Zhang, Rajiv Shivpuri, Anil Srivastava	Role of Tool Flank Wear and Machining Speed in Developing of Residual Streses in Machined Surface during High Speed Machining of Titanium Alloys
3:30 PM - 5:00 PM	**MSEC 2-11: Incremental Forming II**	
Audubon	***Chair: Yannis Korkollis***	***Co-chair: Rajiv Malhotra***
MSEC2015-9406	Goran Grzancic, Christoph Becker, Nooman Ben Khalifa, A. Erman Tekkaya	Basic Investigations in Incremental Profile Forming
MSEC2015-9408	Huaqing Ren, Newell Moser, Zixuan Zhang, Ebot Ndip-Agbor, Jacob Smith, Kornel Ehmann, Jian Cao	Effects of Tool Positions in Accumulated Double-Sided Incremental Forming on Part Geometry
MSEC2015-9438	Zachary C Reese, Brandt Ruszkiewicz, John Roth, Chetan Nikhare	Step Down Size, IO Versus OI Forming, and Final Part Geometry's Effect on Springback of 2024-T3 Aluminum During Single Point Incremental Forming

3:30 PM - 5:00 PM	MSEC 2-4: System Modeling	
Olmstead	***Chair: Arif Malik, Saint Louis University***	***Co-Chair: Sunday, J. Ojolo, University of Lago***
MSEC2015-9240	Jeff Irwin, Pan Michaleris	A Line Heat Input Model for Additive Manufacturing
MSEC2015-9246	Teng Liu, Weiguo Gao, Yifan Zhang, Guanwei Zhang, Dawei Zhang	Supply Power Design of Oil Cooling Strategies for Precision Ball Screw Unit
SEC2015-9417	Xianguang Kong, Shing I Chang, Zheng Zhang	A Novel Method Based On Adjusted Sample Entropy For Process Capability Analysis In Complex Manufacturing Processes

NOTES

UNC Charlotte Manufacturing/Metrology Tours

In the Energy Production and Infrastructure Center (EPIC) see the Leitz PMM-F 30-20-16 coordinate measuring machine that can accept large, heavy components with very complex geometry, and quickly measure every dimension, angle and radius with an accuracy of a few micrometer. Also visit the high-bay lab which provides a one stop shop for industry partners to assess, create, modify, test, and verify a variety of materials in multi-scenario contitions.

In the Center for Optics and Optoelectronic Communications see the Fabrication facilities which support the integration of optical and electronic functionality for next generation photonic devices and systems as well as the facility dedicated to optical dimensional metrology.

The Center for Precision Metrology has a 3000 sq ft dimensional metrology lab housing Fizeau flatness interferometers, roundness/cylindricity measuring machines, 1D length measuring machines, ID/OD gage block comparator gage block interferometer, and coordinate measuring machines (Zeiss, Leitz etc). Also visit facilities for the development of precision manufacturing and the required static and dynamic metrology of fabrication machines, laboratories for precision polishing, diamond turning, X-ray dimensional metrology, and others.

THURSDAY, JUNE 11, 2015

7:30 AM - 8:30 AM	Continental Breakfast	Glenwaters
8:00 AM - 5:00 PM	Registration	Midway
8:30 AM - 5:00 PM	Exhibits	Glenwaters
8:30 AM - 10:00 AM	MSEC Panel Discussion: National Network for Manufacturing Innovation – How to Get Involved in the NNMI	SALON I
8:30 AM - 10:00 AM	MSEC 2-7: Design Aspects in Additive Manufacturing	SALON II
8:30 AM - 10:00 AM	MSEC 5-2: Sustainable Manufacturing Systems	SALON III
8:30 AM - 10:00 AM	NAMRC: Joining and Assembly I	SALON IV
8:30 AM - 10:00 AM	MSEC 2-4: Nano-scale Modeling	Welwyn
8:30 AM - 10:00 AM	MSEC 4-4: Competitive Manufacturing Engineering	Walden
8:30 AM - 10:00 AM	NAMRC: Drilling and Turning	Keynes
8:30 AM - 10:00 AM	MSEC 1-2: Ceramic and Metal Matrix Composites	Burnham
8:30 AM - 10:00 AM	NAMRC: Manufacturing System Controls	Audubon
8:30 AM - 10:00 AM	MSEC 2-2: Micro-level Applications in Assisted Manufacturing Processes	Olmstead
8:30 AM - 10:00 AM	MSEC 2-8: Energy Efficiency	Lakeview
10:30 AM - 11:00 AM	Morning Break	Glenwaters
10:30 AM - 12:00 PM	NAMRC Panel Discussion: Manufacturing Education, Workforce Development, and Outreach	SALON I
10:30 AM - 12:00 PM	MSEC 2-7: Electrohydrodynamic Jet Printing	SALON II
10:30 AM - 12:00 PM	MSEC 5-2: Sustainable Manufacturing Processes	SALON III
10:30 AM - 12:00 PM	NAMRC: Joining and Assembly II	SALON IV
10:30 AM - 12:00 PM	MSEC 2-2: Assisted Manufacturing Processes II	Welwyn
10:30 AM - 12:00 PM	NAMRC: Metal Additive Manufacturing I	Walden
10:30 AM - 12:00 PM	NAMRC: Milling I	Keynes
10:30 AM - 12:00 PM	MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes I	Burnham
10:30 AM - 12:00 PM	NAMRC: Path Planning	Audubon
10:30 AM - 12:00 PM	MSEC 2-4: Thermal Processing	Olmstead
10:30 AM - 12:00 PM	MSEC 4-1: Key Technologies for Cloud Manufacturing I	Lakeview

12:30 PM - 2:00 PM	SME Awards Luncheon • NAMRC Outstanding Paper Awards • NAMRI/SME Student Research Presentation Awards • SME Dennis S. Bray Outstanding Young Manufacturing Engineer Award • NAMRI Founder's Lecture: Prof. David Dornfeld • S.M. Wu Research Implementation Award • NAMRI/SME Outstanding Lifetime Service Award	UNIVERSITY BALLROOM
1:30 PM - 3:00 PM	NAMRC: Manufacturing Machines I	SALON I
1:30 PM - 3:00 PM	NAMRC: Manufacturing Systems - Sustainability	SALON II
1:30 PM - 3:00 PM	MSEC 5-2: Sustainable Manufacturing Methods	SALON III
1:30 PM - 3:00 PM	NAMRC: Manufacturing Systems - Modeling	SALON IV
1:30 PM - 3:00 PM	NAMRC: Non-traditional Manufacturing Processes I	Welwyn
1:30 PM - 3:00 PM	NAMRC: Metal Additive Manufacturing II	Walden
1:30 PM - 3:00 PM	NAMRC: Milling II	Keynes
1:30 PM - 3:00 PM	MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes II	Burnham
1:30 PM - 3:00 PM	MSEC 2-7: Novel Material Extrusion Processes	Audubon
1:30 PM - 3:00 PM	NAMRC: Non-traditional Manufacturing Processes II	Olmstead
1:30 PM - 3:00 PM	MSEC 4-1: Key Technologies for Cloud Manufacturing II	Lakeview
3:30 PM - 4:00 PM	Afternoon break	Glenwaters
3:30 PM - 5:00 PM	NAMRC: Manufacturing Machines II	SALON I
3:30 PM - 5:00 PM	NAMRC: Manufacturing Systems – Design for Manufacturing	SALON II
3:30 PM - 5:00 PM	MSEC 5-3: Industrial Energy Efficiency	SALON III
3:30 PM - 5:00 PM	MSEC 2-9: Equipment Design and Tooling II	SALON IV
3:30 PM - 5:00 PM	NAMRC: Micro Manufacturing	Welwyn
3:30 PM - 5:00 PM	NAMRC: Novel Additive Processes II	Walden
3:30 PM - 5:00 PM	NAMRC: Cutting Tools and Mechanics I	Keynes
3:30 PM - 5:00 PM	MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes III	Burnham
3:30 PM - 5:00 PM	MSEC 2-2: Assisted Manufacturing Processes I	Audubon
3:30 PM - 5:00 PM	NAMRC: Non-traditional Manufacturing Processes III	Olmstead
3:30 PM - 5:00 PM	MSEC 4-1: Key Technologies for Cloud Manufacturing III	Lakeview
5:00 PM - 8:00 PM	NSF Early Career Forum	Lakeview
5:30 PM - 9:00 PM	Tours • Discovery Place – Networking Social • IMAX Theater Presentation: Mysteries of the Unseen World (Buses leave from hotel lobby)	Off-site

ADVANCES IN ABRASIVE MACHINING PROCESSES

Thursday, June 11, 8:30 AM

DEVELOPMENT OF SMART CUTTING TOOLS FOR HIGH PRECISION SMART MACHINING

Dr. Professor Kai Cheng

BEng MSc PhD FIMechE FIET CEng

Chair in Manufacturing Systems

Institute of Materials & Manufacturing

College of Engineering, Design and Physical Sciences

Brunel University, UK

Abstract

High precision smart machining has tremendous potential and is becoming the next generation of precision machining technology. Smart machining processes will enable a new level of machining capability and adaptability, including high process reliability, high precision, machining process optimization, plug-and-produce operations, and bespoke high value applications.

This presentation will present some innovative design concepts and, in particular, the development of a number of smart tooling devices: a force-based smart cutting tool, a temperature-based internally-cooled smart cutting tool, smart collet and smart diamond cutting tool as required for precision and micro manufacturing purposes. Practical implementation and application issues for these smart cutting tools are explored and discussed, taking account of the requirements for smart machining against a number of industrial applications, such as contamination-free machining, high speed smart drilling, machining of tool-wear-prone Si-based infra-red devices and medical applications. Additional research on smart tooling implementation and application perspectives will also be presented, including: (a) plug-and-produce design principle, (b) novel cutting force modelling and the associated implementation algorithms, (c) piezoelectric

film and surface acoustic wave transducers to measure cutting forces, (d) critical cutting temperature reduction and control in real-time machining, (e) Multi-physics based design and analysis of smart cutting tools, and (f) application exemplars on smart machining.

The presentation will conclude with further discussion on the potentials and applications of smart tooling development for future manufacturing industry.

Biography

Professor Kai Cheng holds the chair professorship in Manufacturing Systems at Brunel University. His current research interests focus on precision and micro manufacturing, design of high precision machines, smart tooling, and sustainable manufacturing and systems. Professor Cheng has published over 180 papers in learned international journals and referred conferences, authored/edited 6 books and contributed 6 book chapters.

Professor Cheng is a fellow of the IMechE and IET. He is the head of the Micro/Nano Manufacturing Theme at Brunel University, which consists of 12 academics and over 50 research assistants/fellows and PhD students. Professor Cheng and the team are currently working on a number of research projects funded by the EPSRC, EU 7th Framework Programs, Technology Strategy Board (UK), KTP Programs and the industry. Professor Cheng is the European editor of the International Journal of Advanced manufacturing Technology and a member of the editorial board of International Journal of Machine Tools and Manufacture. Professor Cheng is also honored with the visiting professorship at Harbin Institute of Technology.

CYBER-PHYSICAL SYSTEMS IN MANUFACTURING

Thursday, June 11, 8:30 AM

CURRENT STATUS AND ADVANCEMENT OF CYBER-PHYSICAL SYSTEMS IN MANUFACTURING

Dr. Lihui Wang

Professor and Chair of Sustainable Manufacturing

Department of Production Engineering

KTH Royal Institute of Technology

Stockholm, Sweden

Abstract

In recent years, research and applications of Cyber-Physical Systems (CPS) have been active in such areas like transportation, smart home, robotic surgery, aviation, defense, critical infrastructure, etc. CPS also positively affected manufacturing in form of Cyber-Physical Production Systems (CPPS) in process automation and control. On the other hand, advancements in Web-/Internet-/Cloud-based systems and applications have opened up the possibility for industries to utilize the cyber workspace to conduct efficient and effective daily collaborations from anywhere in distributed manufacturing environments. For example, remote robot control becomes relevant not only in rescue operations but also in cyber and/or cloud manufacturing environments where distant operations can be done quickly and economically. Due to the huge application potentials of CPS in manufacturing and yet the lack of common understanding of CPS in manufacturing sector, there is a need to systematically review and understand the current status and the latest advancement of CPS with future trends clearly identified. This talk will cover the current status and the latest advancement of CPS in manufacturing, particularly in cloud environment. In order to understand CPS and its future potential in manufacturing, definitions and characteristics of CPS will be explained and compared with cloud manufacturing concept. Research and applications will be outlined to highlight the latest advancement in the field. In summary, CPS shows great promise in factories of the future in the areas of future trends to be identified in this talk.

Biography

Lihui Wang is a Professor and Chair of Sustainable Manufacturing at KTH Royal Institute of Technology, Sweden. His research interests are focused on cyber-physical systems, cloud manufacturing, web-based real-time monitoring and remote control, human-robot collaborations, and adaptive process planning. The ultimate goal of his research is to achieve sustainability in human society with better living environment. Professor Wang is actively engaged in various professional activities. He is the Editor-in-Chief of International Journal of Manufacturing Research, Editor of Robotics and Computer-Integrated Manufacturing, Editor (Europe) of Journal of Intelligent Manufacturing, and Associate Editor of Journal of Manufacturing Systems. He is a Fellow of SME (Society of Manufacturing Engineers), a Fellow of ASME (American Society of Mechanical Engineers), an Associate Member of CIRP (International Academy for Production Engineering), a Board Director of North American Manufacturing Research Institution, and a registered Professional Engineer in Canada. He has published seven books and authored in excess of 300 scientific articles in archival journals and refereed conference proceedings. His accomplishment has won him 14 international and institutional awards.

NATIONAL NETWORK FOR MANUFACTURING INNOVATION

Thursday, June 11, 8:30 AM Salon I

HOW TO GET INVOLVED IN THE NATIONAL NETWORK FOR MANUFACTURING INNOVATION

Purpose and Objective:

The purpose of this panel is to provide a forum for conference participants to engage in a discussion about how university faculty can interact and participate with the Manufacturing Innovation Institutes (MIIs) under the National Network for Manufacturing Innovation (NNMI). The ASME Manufacturing Science and Engineering Conference (MSEC), being collocated with the SME North American Manufacturing Research Conference (NAMRC), has over 500 manufacturing researchers, many who do not know what the NNMI is and how it is shaping manufacturing research and education. A panel of Institute directors and academic researchers will provide perspectives on how to get involved in MIIs including specific examples of how academic researchers have benefited in terms of research and education.

Panelists:

Dr. Dean Bartles (Digital Manufacturing and Design Innovation Institute: Executive Director)

Mr. Ralph Resnick (NCDMM: President & Executive Director; America Makes: Founding Director)

Dr. Janis Terpenny (Iowa State University: Joseph Walkup Professor and Department Chair, Industrial and Manufacturing Systems Engineering; Digital Manufacturing and Design Innovation Institute: Technical Lead, Advanced Manufacturing Enterprise)

Dr. Steve Schmid (University of Notre Dame: Professor of Aerospace and Mechanical Engineering)

Moderator:

Dr. Brian Paul (Oregon State University)

Organizers:

Dr. Brian Paul (Oregon State University)

MANUFACTURING EDUCATION

Thursday, June 11, 10:30 AM Salon I

MANUFACTURING EDUCATION, WORKFORCE DEVELOPMENT AND OUTREACH

Purpose and Objective:

The renaissance in US manufacturing cannot be undertaken and sustained unless it is supported by a skilled workforce at all levels of the manufacturing organization. The goal of this session is to exchange ideas in order to improve manufacturing education to better meet current and future industry needs. Panelists have taken a variety of career paths and are members of global agencies including academia, industry, national laboratories, and governmental agencies. Panelists dealing with education (community college and advanced-degree institutions), industry, and government will discuss their experiences, talk about current education trends, and suggest keys to shape the future of US manufacturing.

Panelists:

Mr. Mark Pringle (Siemens Energy: Director of Operations, Siemens Charlotte Energy Hub)

Dr. Keith Miller (Greenville Technical College: President)

Dr. Steven Liang (Georgia Institute of Technology: Morris M. Bryan, Jr. Professor, Mechanical Engineering for Advanced Manufacturing Systems)

Mr. Michael Realon (Olympic Community of Schools: Olympic Careers Development Coordinator)

Moderator:

Bryan Dods (GE Power and Water: Chief Engineer, Manufacturing Engineering)

Organizers:

John Ziegert, Dean Bartles, Bryan Dods, Mark Stratton, Hitomi Yamaguchi

NOTES

8:30 AM - 10:00 AM
SALON I

MSEC Panel: National Network for Manufacturing Innovation: How to get Involved in the National Network for Manufacturing Innovation

Session Chair: Brian Paul

- Dr. Dean Bartles, Digital Manufacturing and Design Innovation Institute – Executive Director
- Mr. Ralph Resnick, NCDMM - Director
- Dr. Janis Terpenny, Iowa State University
- Dr. Steve Schmid, University of Notre Dame

8:30 AM - 10:00 AM
SALON II

MSEC 2-7: Design Aspects in Additive Manufacturing

Chair: Kira Barton, University of Michigan — ***Co-Chair: Shawn Moylan, National Institute of Standards and Technology***

MSEC2015-9439	Shaw Feng, Paul Witherell, Gaurav Ameta, Duck Bong Kim	Fundamental Requirements for Data Representations in Laser-based Powder Bed Fusion
MSEC2015-9448	Rajit Ranjan, Rutuja Samant, Sam Anand	Design For Manufacturability In Additive Manufacturing Using A Graph Based Approach
MSEC2015-9459	Dongping Deng, Yong Chen	4D Printing: Design and Fabrication of 3D Shell Structures with Curved Surfaces Using Controlled Self-Folding

8:30 AM - 10:00 AM
SALON III

MSEC 5-2: Sustainable Manufacturing Systems

Chair: Moneer Helu, National Institute of Standards and Technology — ***Co-Chair: Paul Harris, University of California, Davis***

MSEC2015-9232	Rebecca Ilsen, Hermann Meissner, Jan C. Aurich	Virtual Test Field for Sustainability Assessment of Cybertronic Production Systems
MSEC2015-9281	Lujia Feng, Laine Mears	Analysis of HVAC Energy in Automotive Paint Shop
MSEC2015-9378	Shaw Feng, Senthilkumaran K, Xiufang Sun	Energy Assessment Methodology For Product Assembly Processes

8:30 AM - 10:00 AM
SALON IV

NAMRC: Joining and Assembly I

Chairs: Ali Nassiri and Brad Kinsey

NAMRC43-33	X. Wu, T. Liu, W. Cai	Microstructure, Welding Mechanism, And Failure Of Al/Cu Ultrasonic Welds
NAMRC43-66	A. Shrivastava, M. Zinn, N. Duffie, N. Ferrier, F. Pfefferkorn	Analysis of Force Transients during Friction Stir Welding
NAMRC43-41	V. Chauhan, B. Surgenor	A Comparative Study of Machine Vision Based Methods for Fault Detection in an Automated Assembly Machine

8:30 AM - 10:00 AM	**MSEC 2-4: Nano-scale Modeling**	
Welwyn	***Chair: Sunday, J. Ojolo, University of Lagos***	***Co-Chair: Demeng Che, Northwestern University***
MSEC2015-9282	Jhonatam Cordeiro, Salil Desai	Process Parameter Studies of Molecular Dynamics Models to Control Substrate Wettability
MSEC2015-9460	Rapeepan Promyoo, Hazim El-Mounayri, Kody Varahramyan	Nanoindentation Models with Realistic AFM Tip Geometries
8:30 AM - 10:00 AM	**MSEC 4-4: Competitive Manufacturing Engineering**	
Walden	***Chair: Mohamed Gadalla, Alabama A&M University***	***Co-Chair: Vishnu Wakchaure, Amrutvahini CoE, University of Pune, Pune***
MSEC2015-9273	Maral Zafar Allahyari, Ahmed Azab	Improved Bi-level Programming and Heuristics for the Cellular Manufacturing Facility Layout Problem
MSEC2015-9277	Vishnu Wakchaure, Keshav N. Nandurkar, Shrikant P. Kallurkar, Mohamed Gadalla	A Conceptual Framework For Effective Implementation Of Integrated Manufacturing Practices
MSEC2015-9298	Mohamed Gadalla, Mohamed Seif	Evaluation of the Impact of Process Modeling on Opportunity Losses/Gain in a Manufacturing Environment
8:30 AM - 10:00 AM	**NAMRC: Drilling and Turning**	
Keynes	***Session Chairs: Bruce Tai and Marko Kirschner***	
NAMRC43-11	D. Biermann, M. Kirschner	Experimental Investigations on Single-Lip Deep Hole Drilling of Superalloy Inconel 718 with Small Diameters
NAMRC43-112	A. Chaudhari, M. Sankaranarayanasamy	The Effects of Pilot Hole Geometry on Tool-Work Engagement Efficacy in Deep Hole Drilling
NAMRC43-18	G. Zhang, C. Guo	Modeling of Cutting Force Distribution on Tool Edge in Turning Process
8:30 AM - 10:00 AM	**MSEC 1-2: Ceramic and Metal Matrix Composites**	
Burnham	***Chair: Ramasubramanian Kannan, Indian Institute of Technology, Madras***	***Co-Chair: Mina Bastwros, Iowa State University***
MSEC2015-9409	Ramasubramanian Kannan, Arunachalam Narayanaperumal, M S Ramachandra Rao	Nanocrystalline Diamond Coated Tool Performance In Machining Of Lm6 Aluminium Alloy/Alumina Mmc
MSEC2015-9469	Mina Bastwros, Miao Liu, Nicholas Orlowsky, Gap-yong Kim	Effects of Reinforcement Particle Size on Cold Roll Bonded (CRB) Laminate Composites
MSEC2015-9359	T. Barriere, T. Tourneroche, J. Gelin, M. Sahli	Development And Characterization Of Inconel-Based Mixtures For Metal Injection Molding Applications

Thursday, June 11, 2015

8:30 AM - 10:00 AM	**NAMRC: Manufacturing System Controls**	
Audubon	***Chairs: Robert Gao and Barney Klemecki***	
NAMRC43-107	C. DiMarco, J. Ziegert, C. Vermillion	Exponential and Sigmoid-Interpolated Machining Strategies
NAMRC43-48	A. Bharathi, J. Dong	A Smooth Trajectory Generation Algorithm for Addressing Higher-Order Dynamic Constraints in Nanopositioning Systems
NAMRC43-15	W. Li, H. Dai, D. Zhang	The Relationship between Maximum Completion Time and Total Completion Time in Flowshop Production
8:30 AM - 10:00 AM	**MSEC 2-2: Micro-level Applications in Assisted Manufacturing Processes**	
Olmstead	***Chair: Ihab Ragai, Penn State University***	
MSEC2015-9327	Hossein Mohammadi, John Patten	Scratch Tests on Granite Using Micro-Laser Assisted Machining Technique
MSEC2015-9372	Bryan Chu, Eklavya Singh, Johnson Samuel, Nikhil Koratkar	Graphene Oxide Colloidal Suspensions As Cutting Fluids for Micromachining - Part 1: Fabrication and Performance Evaluation
MSEC2015-9373	Bryan Chu, Johnson Samuel	Graphene Oxide Colloidal Suspensions As Cutting Fluids for Micromachining - Part 2: Droplet Dynamics and Film Formation
8:30 AM - 10:00 AM	**MSEC 2-8: Energy Efficiency**	
Lakeview	***Chair: TBD***	
MSEC2015-9278	Fadwa Dababneh, Mariya Atanasov, Zeyi Sun, Lin Li	Simulation-Based Electricity Demand Response For Combined Manufacturing And Hvac System Towards Sustainability
MSEC2015-9355	Amin Mirkouei, Karl R. Haapala	A Network Model to Optimize Upstream and Midstream Biomass-To-Bioenergy Supply Chain Costs
MSEC2015-9387	Paul Mativenga, Norshah Shuaib	Energy Intensity and Quality of Recyclate in Composite Recycling

10:30 AM - 12:00 PM | **NAMRC Panel: Manufacturing Education, Workforce Development, and Outreach**

SALON I | ***Session Chairs: Bryan Dods - GE***

- Mr. Mark Pringle, Siemens Energy – Director of Operations, Charlotte Energy Hub
- Dr. Keith Miller, Greenville Technical College - President
- Dr. Steven Liang, Georgia Tech – Morris M. Bryan Professor of Advanced Manufacturing
- Mr. Michael Realon, Olympic Community of Schools

10:30 AM - 12:00 PM | **MSEC 2-7: Electrohydrodynamic Jet Printing**

SALON II | ***Chair: Sam Anand, University of Cincinnati*** | ***Co-Chair: Yong Chen, University of Southern California***

MSEC2015-9403	Lai Yu Leo Tse, Kira Barton	Airflow Assisted Electrohydrodynamic Jet Printing: An Advanced Micro-additive Manufacturing Technique
MSEC2015-9487	Yuan-Shin Lee, Jingyan Dong, Hantang Qin	Electrohydrodynamic Jet Printing of Silver Seeds: Micro Scale Patterning by Electroless Copper Deposition

10:30 AM - 12:00 PM | **MSEC 5-2: Sustainable Manufacturing Processes**

SALON III | ***Chair: Bruce L. Tai, Texas A&M University*** | ***Co-Chair: Rebecca Ilsen, University of Kaiserslautern***

MSEC2015-9296	Pil-Ho Lee, Jung Soo Nam, Jung Sub Kim, Sang Won Lee	Experimental Study on Micro-Grinding Process of Titanium Alloy Using Electro-Hydro-Dynamic Spray with Nanofluid And Compressed Air
MSEC2015-9402	Kuldip Singh, Jatinder Madan	Sustainability Performance Assessment of Alternate Machining Technologies
MSEC2015-9498	Molong Duan, Chinedum Okwudire	Energy Efficiency and Performance Optimized Control of a Hybrid Feed Drive

10:30 AM - 12:00 PM | **NAMRC: Joining and Assembly II**

SALON IV | ***Chairs: Roland Chen and Wayne Cai***

NAMRC43-45	G. Buffa, D. Campanelli, A. Ducato, M. Cammalleri, L. Fratini, A. Astarita, A. Squillace, S. Esposito	Experimental and Numerical Analysis of Microstructure Evolution During Linear Friction Welding of Ti6Al4V Titanium Alloys
NAMRC43-123	D. Bian, T. Bucher, H. Tan, Y. Yao	Effect of Deep Penetration of Interleaf on Delamination Resistance in GFRP
NAMRC43-17	M. Hutyala, A. Javadi, J. Zhao, T. Lin, W. Tang, X. Li	Scalable Platform for Batch Fabrication Micro/Nano Devices on Engineering Substrates of Arbitrary Shapes and Sizes

Thursday, June 11, 2015

10:30 AM - 12:00 PM	**MSEC 2-2: Assisted Manufacturing Processes II**	
Welwyn	***Chair: Yujie Chen, Caterpillar***	
MSEC2015-9429	Brandt Ruszkiewicz, David H. Johnson, John Roth	Locally Applied Direct Electric Current's Effect on Springback of 2024-T3 Aluminum After Single Point Incremental Forming
MSEC2015-9446	Justin D. Morrow, Qinghua Wang, Neil Duffie, Frank Pfefferkorn	A Hybrid Surface Processing Method Using Surface Alloying and Pulsed Laser Micro Melting on S7 Tool Steel
MSEC2015-9435	Jamie D Skovron, Durul Ulutan, Laine Mears, Duane Detwiler, Daniel Paolini, Boris Baeumler, Laurence Claus	Effect Of Thermal Assistance On The Joining Of Al6063 During Flow Drill Screwdriving
10:30 AM - 12:00 PM	**NAMRC: Metal Additive Manufacturing I**	
Walden	***Chairs: Murali Sundaram and Bahir Khoda***	
NAMRC43-27	J. Romano, L. Ladani, M. Sadowski	Modeling of Temperature Distribution and Melt Geometry in DMLS Processes – A Comparison among Common Materials
NAMRC43-8	M. Doyle, K. Agrawal, W. Sealy, K. Schull	Effect of Layer Thickness and Orientation on Mechanical Behavior of Binder Jet Stainless Steel 420 + Bronze Parts
NAMRC43-117	T. Do, C. Shin, P. Kwon	Improving Structural Integrity with Boron-Based Additives for 3D printed 420 Stainless Steel
10:30 AM - 12:00 PM	**NAMRC: Milling I**	
Keynes	***Chairs: Larry Yao and David Stephenson***	
NAMRC43-91	Z.Y. Liu, M. Sealy, Y. Guo, Z.Q. Liu	Energy Consumption Characteristics in Finish Hard Milling of Tool Steels
NAMRC43-79	T. Komatsu, Y. Musha, T. Yoshino, T. Matsumura	Surface Finish and Affected Layer in Milling of Fine Crystal Grained Stainless Steel
NAMRC43-95	H. Onozuka, K. Utsumi, I. Knon, J. Harai, Y. Numata, T. Obikawa	High Speed Milling Processes with Long Oblique Cutting Edges
10:30 AM - 12:00 PM	**MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes I**	
Burnham	***Chairs: Chair: Xiaoning Jin, University of Michigan***	
MSEC2015-9420	Huanyi Shui, Xiaoning Jin, Jun Ni	An Anomaly Detection And Diagnosis Method Based On Real-Time Health Monitoring For Progressive Stamping Processes
MSEC2015-9428	Chenhui Shao, Tae Hyung Kim, S. Jack Hu, Jionghua (Judy) Jin, Jeffrey A. Abell, J. Patrick Spicer	Tool Wear Monitoring for Ultrasonic Metal Welding of Lithium-ion Batteries
MSEC2015-9422	Dennis J.L. Siedlak, Paul R. Schlais, Olivia J. Pinon, Dimitri N. Mavris	Supporting Affordability-Based Design Decisions in the Presence of Demand Variability

10:30 AM - 12:00 PM	NAMRC: Path Planning	
Audubon	*Chairs: Sara McMains and Scott Miller*	
NAMRC43-106	S. Pananaskar, S. Pande, Y. Kwon, A. Sheffer, S. McMains, Z. Hu	Energy-Efficient Vector Field Based Toolpaths for CNC Pocket Machining
NAMRC43-111	E. Korkmaz, B. Gozen, B. Bediz, B. Ozdoganlar	High-Frequency Compensation of Dynamic Distortions in Micromachining Force Measurements
NAMRC43-13	L. Berglind, J. Ziegert	Modulated Tool Path (MTP) Machining for Threading Applications
10:30 AM - 12:00 PM	**MSEC 2-4: Thermal Processing**	
Olmstead	***Chair: Sunday, J. Ojolo, University of Lagos***	***Co-Chair: Xueping Zhang, Shanghai Jiao Tong University***
MSEC2015-9250	Alireza Shirazi, Ahmad Varvani-Farahani, Hua Lu	Fatigue behaviour of Leadfree Solder Interconnections in Life Prediction of Trilayer Structures Subjected to Thermal Cycling
MSEC2015-9395	Zhichao (charlie) Li	Heat Treatment Response Of Steel Fatigue Sample During Vacuum Carburization And High Pressure Gas Quenching Process
MSEC2015-9455	Yamin Shao, Omar Fergani, Torgeir Welo, Steven Liang	Prediction of Residual Stress in Multi-Step Orthogonal Cutting
10:30 AM - 12:00 PM	**MSEC 4-1: Key Technologies for Cloud Manufacturing I**	
Lakeview	***Chair: Xun Xu, Department of Mechanical Engineering***	***Co-Chair: Lihui Wang, Department of Production Engineering***
MSEC2015-9485	Matthias Hemmje, Tobias Vogel, Holger Brocks, Franz Miltner, Lihui Wang, Benjamin Gernhardt	A Semantic Representation For Process-Oriented Knowledge Management Based On Functionblock Domain Models Supporting Distributed And Collaborative Production Planning
MSEC2015-9388	Liang Zhang, Lin Zhang, Xuesong Zhang, Chun Zhao	Cloud Manufacturing Resource Management Based On Metadata
MSEC2015-9382	Yuqian Lu, Xun Xu	Process And Production Planning In A Cloud Manufacturing Environment

SME AWARDS LUNCHEON

Thursday, June 11, 12:00 PM **University Ballroom**

- S.M. Wu Research Implementation Award
- NAMRI/SME Outstanding Lifetime Service Award
- NAMRC Outstanding Paper Awards
- NAMRI/SME Student Research Presentation Awards
- SME Dennis S. Bray Outstanding Young Manufacturing Engineer Award
- NAMRI Founder's Lecture: Prof. David Dornfeld

1:30 PM - 3:00 PM	**NAMRC: Manufacturing Machines I**	
SALON I	***Chairs: Matthew Davies and Placid Ferreira***	
NAMRC43-94	Y. Alammari, M. Sanati, T. Freiheit, S. Park	Investigation of Boring Bar Dynamics for Chatter Suppression
NAMRC43-52	H. Yagashita, J. Osawa	Hole Making Machine based on Double Eccentric Mechanism for CFRP/TiAl6V4 Stacks
NAMRC43-74	M. Law, H. Rentzsch, S. Ihlenfeldt	Development of a Dynamic Substructuring Framework to Facilitate in Situ Machining Solutions Using Mobile Machine Tools
1:30 PM - 3:00 PM	**NAMRC: Manufacturing Systems - Sustainability**	
SALON II	***Chairs: Moneer Helu and Zhenhua Wu***	
NAMRC43-114	A. Pleta, D. Ulutan, L. Mears	An Investigation of Alternative Path Planning Strategies for Machining of Nickel-Based Superalloys
NAMRC43-127	H-M. Wang, S-P. Chang, P. Williams, B. Koo, Y-R. Qu	Using Balanced Scorecard for Sustainable Design-centered Manufacturing
NAMRC43-60	Q. Hatim	A Simulation Based Methodology of Assessing Environmental Sustainability and Productivity for Integrated Process and Production Plans
1:30 PM - 3:00 PM	**MSEC 5-3: Sustainable Manufacturing Methods**	
SALON III	***Chair: Lin Li, University of Illinois at Chicago***	***Co-Chair: Chris Yuan, University of Wisconsin Milwaukee***
MSEC2015-9229	Bingbing Li, Hong-Chao Zhang, Chris Yuan	Thermodynamic analysis of TiO2 nanotube synthesis process for sustainability improvement
MSEC2015-9371	Harsha Malshe, Hari Nagarajan, Yayue Pan, Karl R. Haapala	Profile Of Sustainability In Additive Manufacturing And Environmental Assessment Of A Novel Stereolithography Process
MSEC2015-9466	Patrick Kwon, Trung Nguyen, Dihn Nguyen, Peter Howes, Kyung-Hee Park	A Study On Application Of Minimum Quantity Lubrication (Mql) Using Vegetable Oil Mixed With Nano-Platelet Solid Lubricant In Milling Ti-6al-4v
1:30 PM - 3:00 PM	**NAMRC: Manufacturing Systems - Modeling**	
SALON IV	***Chairs: James Kong and Dazhong Wu***	
NAMRC43-54	J. Loizou, W. Tian, J. Robertson, J. Camelio	Automated Wear Characterization for Broaching Tools Based on Machine Vision Systems
NAMRC43-101	P. Wang, R. Gao	Enhanced Particle Filtering for Parameter Estimation
NAMRC43-39	S M. Givechi, A. Haghighi, L. Wang	Generic Machining Process Sequencing Through a Revised Enriched Machining Feature Concept

Thursday, June 11, 2015

1:30 PM - 3:00 PM Welwyn	NAMRC: Non-traditional Manufacturing Processes I *Chairs: Jason Moore and Shuting Lei*	
NAMRC43-68	P. Prakasam, S. Castagne, S. Subbiah	Mechanism of Surface Evolution in Vibratory Media Finishing
NAMRC43-119	H. Mohammadi, D. Ravindra, S. Kode, J. Patten	Experimental Work on Micro Laser-Assisted Diamond Turning of Silicon (111)
1:30 PM - 3:00 PM Walden	**NAMRC: Metal Additive Manufacturing II** ***Chairs: Prahalad Rao and James Yang***	
NAMRC43-44	P. Kattire, S. Paul, R. Singh, W. Yan, R. Singh	Experimental Characterization of Laser Cladding of CPM 9V on H13 Tool Steel for Die Repair Applications
NAMRC43-128	G. Manogharan, R. Wysk, O. Harrysson, R. Aman	AIMS- a Metal Additive-Hybrid Manufacturing System: System Architecture and Attributes
NAMRC43-25	X. Wang, X. Gong, K. Chou	Scanning Speed Effect on Mechanical Properties of Ti- 6Al-4V Alloy Processed by Electron Beam Additive Manufacturing
1:30 PM - 3:00 PM Keynes	**NAMRC: Milling II** ***Chairs: Laine Mears and John Agapiou***	
NAMRC43-132	C. Nath, Z. Brooks, T. Kurfess	On Machinability Study and Process Optimization in Face Milling of Some Alloys with Indexable Mill Inserts
NAMRC43-102	O. Yousefian, J. Tarbutton	Prediction of Cutting Force in 3-Axis CNC Milling Machines Based on Voxelization Framework for Digital Manufacturing
NAMRC43-37	K. Zou, Y. Wan, Y. Cai, X. Liang, Z Liu	Burr Controlling in Micro Milling with Supporting Material Method
1:30 PM - 3:00 PM Burnham	**MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes II** ***Chairs: Chair: Hui Wang, Florida State University***	
MSEC2015-9218	Michael Brundage, Qing Chang, Jorge Arinez, Guoxian Xiao	Reducing Costs in the Manufacturing Industry: An Energy Economic Perspective
MSEC2015-9365	Yachao Wang, Jing Shi, Yun Wang	Reinforcing Inconel 718 Superalloy By Nano-Tic Particles In Selective Laser Melting
MSEC2015-9397	Steve Wang, Teresa J. Williams	Feasibility Analysis Of Using Local Remanufactured Products – A Case Study Of Industrial Starters And Alternators

1:30 PM - 3:00 PM Audubon	MSEC 2-7: Novel Material Extrusion Processes *Chair: Yuan-Shin Lee, North Carolina State University*	*Co-Chair: Shaw Feng, NIST*
MSEC2015-9396	Emmett Hull, Weston Grove, Meng Zhang, Xiaoxu Song, Zhijian Pei, Weilong (Ben) Cong	Effects of Process Variables on Extrusion of Carbon Fiber Reinforced ABS Filament for Additive Manufacturing
MSEC2015-9436	Weilong (Ben) Cong, Fuda Ning, Junhua Wei, Shiren Wang, Meng Zhang	Additive Manufacturing of CFRP Composites using Fused Deposition Modeling: Effects of Carbon Fiber Content and Length
MSEC2015-9462	Roland Chen, Terris Lo, Lei Chen, Albert Shih	Nano-CT Characterization of Structural Voids and Air Bubbles in Fused Deposition Modeling for Additive Manufacturing
1:30 PM - 3:00 PM **Olmstead**	**NAMRC: Non-traditional Manufacturing Processes II** *Chairs: Jason Moore and Shuting Lei*	
NAMRC43-16	S M. Mutyala, J. Zhao, T. Lin, X. Li	Study on Materials and Fabrication of Functional Thin Film AlN Force Sensors
NAMRC43-32	A. Kamaraj, V. Shaw, M. Sundaram	Novel Fabrication of Un-Coated Super-Hydrophobic Aluminum via Pulsed Electrochemical Surface Modification
NAMRC43-56	X. Yu, J. Ma, S. Lei	Femtosecond Laser Scribing of Mo Thin Film on Flexible Substrate Using Axicon Focused Beam
1:30 PM - 3:00 PM **Lakeview**	**MSEC 4-1: Key Technologies for Cloud Manufacturing II** *Chair: Lihui Wang, Department of Production Engineering*	*Co-Chair: Lin Zhang, Beihang University*
MSEC2015-9479	Goran Adamson, Magnus Holm, Lihui Wang, Philip Moore	Adaptive Robot Control as a Service in Cloud Manufacturing
MSEC2015-9245	Jin Cui, Lei Ren, Lin Zhang, Qiong Wu	An Optimal Allocation Method for Virtual Resource Considering Variable Metrics of Cloud Manufacturing Service
MSEC2015-9274	Bitao Yao, Zude Zhou Wenjun Xu, Yilin Fang, Qiang Wang, Aiming Liu	Service-oriented Predictive Maintenance for Large Scale Machines Based on Perception Big Data

3:30 PM - 5:00 PM **SALON I**	**NAMRC: Manufacturing Machines II** ***Chairs: Tony Schmitz and Brian Paul***	
NAMRC43-49	B. Linke, P. Harris, M. Zhang	Development of Desktop Multipurpose Grinding Machine for Educational Purposes
NAMRC43-98	J. Correa, P. Ferreira	Analysis and design for rapid prototyping mechanism using hybrid flexural pivots
NAMRC43-118	B. Lahevardi, I. Garretson, B. Paul, K. Haapala	Manufacturing Energy Analysis of a Microchannel Heat Exchanger for High-Density Servers
3:30 PM - 5:00 PM **SALON II**	**NAMRC: Manufacturing Systems – Design for Manufacturing** ***Chairs: Steve Wang and James Kong***	
NAMRC43-131	S. Mukherjee, A. Malshe, G. Salamo	Energy Demand Analysis of Photovoltaic Device – Material and Nanomanufacturing Process Discovery
NAMRC43-28	A. Das, P. Franciosa, D. Ceglarek	Fixture Design Optimisation Considering Production Batch of Compliant Non-Ideal Sheet Metal Parts
NAMRC43-75	M. Helu, T. Hedberg	Enabling Smart Manufacturing Research and Development using a Product Lifecycle Test Bed
3:30 PM - 5:00 PM **SALON III**	**MSEC 5-3: Industrial Energy Efficiency** ***Chair: Karl R. Haapala, Oregon State University***	***Co-Chair: Bingbing Li, California State University Northridge***
MSEC2015-9458	Samuel Brannon, Brian K. Paul	The Development of Formed Microchannel Flow Inserts for High Temperature Waste Heat Recuperators
MSEC2015-9354	Jinkyoo Park, Raunak Bhinge, Nishant Biswas, Amrita Srinivasan, Kincho Law, David Dornfeld, Moneer Helu, Sudarsan Rachuri	A Generalized Data-driven Energy Prediction Model With Uncertainty For A Milling Machine Tool Using Gaussian Process
MSEC2015-9398	Junling Xie, Chris Yuan	Factorial Study Of Thin Layer Ring On Improving Thermal Performance Of Building Thermal Storage System
3:30 PM - 5:00 PM **SALON IV**	**MSEC 2-9: Equipment Design and Tooling II** ***Chair: Johnson Samuel, Rensselaer Polytechnic Institute***	
MSEC2015-9335	Anhai Li, Jun Zhao, Fenghua Lin	Wear Mechanism Analysis of Coated Carbide Tools in High-Speed Milling of Ti-6Al-4V alloy via Cross-Section Characterization of Worn Cutting Edge
MSEC2015-9361	LVRSV Prasad Chilamkurti, Naga Lakshmi Pavani Puvvada, Ramji Koona, Venkata Ramana Swarna	Experimental Investigations to Evaluate the Performance of Alternate Striped Coated Carbide Inserts in Turning of AISI 1040 Steel
NAMRC43-31	Paul Anderson, John Ziegert	Subscale Machining of Large Components

3:30 PM - 5:00 PM **Welwyn**	**NAMRC: Micro Manufacturing** ***Chairs: Shreyes Melkote and Albert Shih***	
NAMRC43-100	Y. Zhang, L. Wu, H. El-Mounayri, J. Zhang	Molecular Dynamics Study of the Strength of Laser Sintered Nanoparticles
NAMRC43-87	B. Jayasena, S. Melkote	A Preliminary Investigation of PDMS Stamp Assisted Mechanical Exfoliation of Large Area Graphene
NAMRC43-65	Z. Kong, P. Rao	Quantification of Ultraprecision Surface Morphology using an Algebraic Graph Theoretic Approach
3:30 PM - 5:00 PM **Walden**	**NAMRC: Novel Additive Processes II** ***Chairs: Denis Cormier and Bashir Khoda***	
NAMRC43-50	Y. Han, C. Wei, J. Dong	Droplet Formation and Settlement of Phase-Change Ink in High Resolution Electrohydrodynamic (EHD) 3D Printing
NAMRC43-59	A. Brant, M. Sundaram	A Novel System for Cloud-Based Micro Additive Manufacturing of Metal Structures
NAMRC43-14	C. Lee, J. Tarbutton	Electric poling-assisted additive manufacturing process for lead-free piezoelectric device fabrication
3:30 PM - 5:00 PM **Keynes**	**NAMRC: Cutting Tools and Mechanics I** ***Chairs: Tatsuya Sugihara and Bryan Dods***	
NAMRC43-26	J. Yu, G. Wang, Y. Rong	Experimental Study on the Surface Integrity and Chip Formation in the Micro Cutting Process
NAMRC43-35	J. Sheikh-Ajmad, D. Ulutan, L. Mears	Effect of Cutting Edge Geometry on Thermal Stresses and Failure of Diamond Coated Tools
NAMRC43-55	F. Niaki, D. Ulutan, L. Mears	In-Process Tool Flank Wear Estimation in Machining Gamma-Prime Strengthened Alloys Using Kalman Filter
3:30 PM - 5:00 PM **Burnham**	**MSEC 25-1: Sustainability Considerations for Manufacturing Technologies and Processes III** ***Chairs: Steve Wang, University of Alaska Anchorage***	
MSEC2015-9256	Yang Li, Xiaoning Jin, Qing Chang, Jun Ni	Markov Decision Models For Optimal Decision Making In Bottlenecks Identification And Mitigation In Advanced Manufacturing Systems
MSEC2015-9257	Yang Li, Qing Chang, Jun Ni, Xiaoning Jin	Stochastic Energy Opportunity Windows In Advanced Manufacturing Systems
MSEC2015-9384	Steve Wang, Shu-Ping Chang, Jing Shi	Determination Of Sustainable Design-Centered Factors For Manufacturing Bioprinting Material Of Polylactic Acid

Thursday, June 11, 2015

3:30 PM - 5:00 PM Audubon	MSEC 2-2: Assisted Manufacturing Processes I *Chair: Ihab Ragai, Penn State University*	
MSEC2015-9445	Satyabrata Mohanty, Kornel Ehmann, Jian Cao	Numerical Analysis Of The Effect Of Non Uniform Electric Field On The Trajectory Of Micro Water Jet
MSEC2015-9465	Durul Ulutan, Abram Pleta, Laine Mears	Electrically-Assisted Machining of Titanium Alloy Ti-6Al-4V and Nickel-Based Alloy IN-738: An Investigation
MSEC2015-9366	Hera Wu, Shuting Lei	A Review of Bone Graft Substitutes made from HA-polymer Composite Scaffolds and Fabrication Potential with Laser-based Additive Manufacturing Processes
3:30 PM - 5:00 PM **Olmstead**	**NAMRC: Non-traditional Manufacturing Processes III** ***Chairs: Hazim El-Mounayri and YB Guo***	
NAMRC43-67	Q. Wang, J. Morrow, N. Duffie, F. Pfefferkorn	Surface Prediction Model for Thermocapillary Regime Pulsed Laser Micro Polishing of Metals
NAMRC43-86	J. Liu, Y. Guo	Process Capability of Wire-EDM of Nitinol at Main Cut and Trim Cut Modes
NAMRC43-89	C. Fu, M. Sealy, Y. Guo, X. Wei	Finite Element Simulation and Experimental Validation of Pulsed Laser Cutting Nitinol
3:30 PM - 5:00 PM **Lakeview**	**MSEC 4-1: Key Technologies for Cloud Manufacturing III** ***Chair: Xun Xu, Department of Mechanical Engineering***	***Co-Chair: Xi Vincent Wang, KTH, Royal Institute of Technology, Sweden***
MSEC2015-9255	Yongquan Xie, Zude Zhou, Duc T. Pham, Quan Liu, Wenjun Xu, Chunqian Ji, Ping Lou, Sisi Tian	A Forager Adjustment Strategy Used by the Bees Algorithm for Solving Optimization Problems in Cloud Manufacturing
MSEC2015-9303	Xi Vincent Wang, Lihui Wang,	Function Block-Based Integration Mechanisms For Adaptive And Flexible Cloud Manfuacturing
MSEC2015-9328	Ying Cheng, Fei Tao, Lin Zhang, Dongming Zhao	Dynamic Supply-Demand Matching For Manufacturing Resource Services In Service-Oriented Manufacturing Systems: A Hypernetwork-Based Solution Framework

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RESEARCH PROFESSIONS IN ACADEMIA, INDUSTRY & NATIONAL LABORATORIES: AN EARLY CAREER FORUM

Organized by AMSE/MED and NAMRI/SME

Sponsored by the National Science Foundation and University of North Carolina at Charlotte

Thursday, June 11th, 2015, 5:00 – 8:00 PM, University of North Carolina at Charlotte. The forum will be held during the collocated manufacturing conferences: the ASME 2015 International Conference on Manufacturing Science and Engineering (MSEC2015) and the 43rd North American Manufacturing Research Conference (NAMRC43).

The goal of this forum is to provide current students at both levels of graduate and undergraduate programs as well as recent graduates with better information/knowledge of various research positions in industry, academia, as well as national laboratories available. The forum will further discuss how to be successful professionally in the various settings of research positions.

Tentative Agenda (Thursday, June 11th, 2015)

5:00 – 5:15 PM: Opening
5:15 – 6:00 PM: 5-minute spoken introductions by panelists
6:00 – 7:15 PM: Breakout round-table panels (Panel I: academia, Panel II: government and industry)
7:15 – 7:30 PM: Wrap-up discussion, open questions and answers
7:30 - 8:00 PM: Light reception

Forum Format:

The forum will start with the introduction of the panelists from academia, government, and industrial sectors. Each panelist will introduce themselves in approximately 5 minutes each.

3 Breakout round-table panels (parallel) will follow: one for academia, one for government and the other for industry. The round-table panels will each have 3 to 4 panelists from diverse background/positions. Panelists will discuss such topics as how to search for a job, career management, funding for research, etc.

At the conclusion, a light reception will be served, offering ample time for participants to be more easily engaged in conversations/discussions related to their particular/personal interests.

Fee: Free for conference participants

Attendance: Mandatory for NSF Travel Grant student applicants

ECF Chair: Prof. Ihab Ragai, 814-898-6369, The Penn State University, Erie.

As one of the leading hands-on science centers in the country, Discovery Place offers visitors the opportunity to gain a greater understanding of science, technology, engineering and mathematics in a fun, interactive and informal setting. Located in one of the nation's fastest growing metropolitan areas, Charlotte, N.C., Discovery Place offers a family-friendly experience surrounded by the excitement of a bustling urban community.

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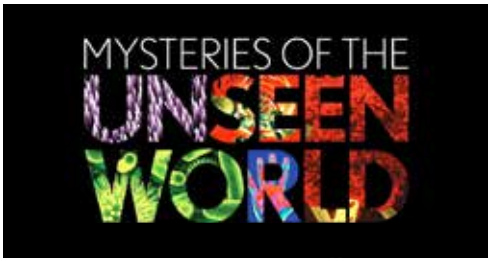

Presented by MetLife Foundation

MYSTERIES OF THE UNSEEN WORLD

You won't believe your eyes.

Mysteries of the Unseen World will transport audiences to places on this planet they have never been before, to see things that are beyond their normal vision, yet literally right in front of their eyes.

Mysteries of the Unseen World will reveal phenomena that can't be seen with the naked eye, taking audiences into earthly worlds secreted away in different dimensions of time and scale.

Experience events that unfold too slowly for human perception.

"See" the beauty, drama, and even humor of phenomena of that occur in the flash of a microsecond Enter the microscopic world once reserved only for scientists, now accessible to the rest of us through Mysteries of the Unseen World.

Begin to understand that what we actually see is only a fraction of what there is to see on this Earth.

High-speed and time-lapse photography, electron microscopy and nanotechnology are just a few of the advancements in science that now allow us to see a whole new universe of things, events, creatures and processes we never even knew existed and now give us new "super powers" to see beyond what is in front of us.

Visually stunning and rooted in cutting-edge research, Mysteries of the Unseen World will leave audiences enthralled as they begin to understand the enormity of the world they can't see, a world that exists in the air they breathe, on their own bodies and in all of the events that occur around them minute-by-minute and nanosecond-by-nanosecond.

With this understanding comes a new appreciation of the wonder and possibilities of science.

TOUR 1: SIEMENS ENERGY, CHARLOTTE, NC

Siemens Energy operates its largest North American manufacturing facility at its Charlotte Hub, where it designs and manufactures electrical generation equipment for electric utilities around the world; including large gas and steam turbines and generators; and employs over 1800 people. The Siemens Charlotte Energy Hub is the company's worldwide hub for 60 Hz power generating equipment. On this tour you will get a behind-the-scenes look at their manufacturing and assembly operations for generators and turbines, including their newly opened 450,000 square-foot gas turbine facility.

Tour date: Friday, June 12, 2015; bus leaves conference hotel at 8:00 AM and returns around noon.

Cost: $25

TOUR 2: 3D SYSTEMS, ROCK HILL, SC

3D Systems is a global leader in 3D digital design and fabrication solutions, including 3D printers, print materials, and cloud-sourced custom parts from a wide array of materials including plastics, metals, ceramics, and edibles. 3D Systems was the first to commercialize 3D printing with its Stereolithography (SLA) printer in 1989. Their corporate headquarters are located in Rock Hill, SC, about 30 miles from UNC Charlotte. On this tour you will learn about their engineering processes for developing 3D printers, tour their recently expanded manufacturing space for building 3D printers, and learn about their comprehensive solutions for digital capture, design, and manufacture.

Tour date: Friday, June 12, 2015; bus leaves conference hotel at 8:00 AM and returns around noon.

Cost: $25

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