



 CINCINNATI

NAMRC 49 / MSEC 2021



NORTH AMERICAN MANUFACTURING RESEARCH CONFERENCE



MANUFACTURING SCIENCE AND ENGINEERING CONFERENCE

CONFERENCE PROGRAM

JUNE 22-25, 2021
Virtual Conference



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Welcome Note from the University of Cincinnati Organizing Committee

As the organizers of NAMRC49 /MSEC2021, and on behalf of the Cincinnati, Ohio, manufacturing community and the College of Engineering and Applied Science at the University of Cincinnati, we warmly welcome you to the co-located conferences of SME NAMRC 49 and ASME MSEC 2021. It is our honor and pride to welcome you virtually to Cincinnati, well known for its manufacturing and machine tool industries. Cincinnati, also known as the “Queen City,” is one of the three major business hubs in Ohio and serves as the US headquarters of several major manufacturing, consumer goods, and service industries, including Procter & Gamble, Kroger, Makino, Milacron, Ethicon Endo-Surgery, AK Steel, GE Aviation, and Fifth Third Bank. Due to the ongoing Covid-19 pandemic, the organizing committee decided to change the conference from in-person to virtual mode. In addition to the pre-recorded technical and keynote symposium sessions, the conference includes sessions on Women in Advanced Manufacturing, Blue Sky competition, Student Design competition, Doctoral symposiums, presentations by Federal Officers, NSF Directors, and Poster sessions. The technical sessions will have pre-recorded video presentations and will be available for viewing up to 90 days after the conference. Keynote presentations from various industry and federal agency leaders in advanced manufacturing are scheduled at the start of each day of the conference.

Our sincere appreciations go out to all of our conference sponsors, whose support is key to the success of the conference. We would like to thank our UC staff members, Ms. Katy Marston, Associate Director of Conference & Events Services, and Sarah M. Mullins, Web Communications Manager. We would also like to recognize graduate student Mr. Sourabh Deshpande, who has been working tirelessly to organize this online conference event. We are grateful to the NAMRI/SME Scientific Committee and the ASME Technical Program Committee for overseeing the technical paper submissions and editorial processes that have resulted in an outstanding technical program. We are excited to be hosting this conference and welcoming all of you. You will find the conference valuable in expanding your technical knowledge, as well as your network of contacts in the manufacturing research community.

Finally, we wish all of you an enjoyable time listening to the sessions and interacting virtually with the participants. We hope you will find inspiration and excitement in this first-ever online conference event in the long history of NAMRC /MSEC.

Sam Anand, PhD

Professor, CEAS - Mechanical Engineering

University of Cincinnati

Chair, Conference Organizing Committee

sam.anand@uc.edu



Jing Shi, PhD

Professor, CEAS - Mechanical Engineering

University of Cincinnati

shij3@ucmail.uc.edu



Murali Sundaram, PhD

Professor, CEAS - Mechanical Engineering

University of Cincinnati

murali.sundaram@uc.edu



Welcome Note from ASME Manufacturing Engineering Division (MED)

On behalf of the ASME Manufacturing Engineering Division (MED) Executive Committee whose members include Dr. Moneer Helu from NIST, Prof. Frank Pfefferkorn from the University of Wisconsin-Madison, Assoc. Prof. Barbara S. Linke from the University of California Davis, Dr. Jarred Heigel from Third Wave Systems and myself from Clemson University, I would like to thank you for your interest, participation and support of the ASME International Manufacturing Science and Engineering Conference (MSEC), co-located with the North American Manufacturing Research Conference (NAMRC) of SME.

This year, due to the ongoing coronavirus (COVID-19) pandemic concerns, the co-located conferences of MSEC 2021 and NAMRC 49 will be held virtually in order to protect the health and wellness of our community. We look forward to a well-managed and prosperous interaction of attendees.

Manufacturing is a very important branch of the world's economy and is essential to the generation of wealth and building a national economy to enhance living standards for citizens. Manufacturing fosters innovation and thus directly impacts energy creation and utilization, environment health, economic stability, and societal sustainability. Therefore, it is vital to advance the science and technology of manufacturing and collaborate to overcome faster the challenges raised by the growing needs of the society.

The co-location of these conferences fosters increased collaboration and enables cross-pollination of new ideas that refresh the manufacturing research and development field. At the core of the collaboration is the joint annual conference that brings together ASME/MED and NAMRI/SME. Every three years, The Japan Society of Mechanical Engineering (JSME) also joins, enabling a truly grand event; due to the cancellation of the conference last year this partnership will again arise in 2023. On behalf of our organization, MED leadership would like to thank the NAMRI team led by Prof. Ihab Ragai for their enthusiastic and productive collaboration and contributions to the joint conference and field of manufacturing.

This conference has a unique position in the history of MED as we will be celebrating 100 years since the Division formation. Several commemorative activities are planned, including a special anniversary publication, a series of articles in ASME's Mechanical Engineering magazine and a special virtual reception at MSEC 2021. MED will continue to offer technical leadership and partnership opportunities to the manufacturing community, leveraging its flagship conference, MSEC, as a platform for manufacturing researchers and practitioners to exchange new ideas, foster innovations, and forge professional networks and collaborations. Our members are energized by the increase in visibility and role of Manufacturing in

society by the current trends associated with the fourth industrial revolution. Currently, we have nine technical committees: Additive Manufacturing, Manufacturing Processes, Manufacturing Equipment and Automation, Manufacturing Systems, Quality and Reliability, Life Cycle Engineering, Nano/Micro/Meso Manufacturing, Biomanufacturing, and Advanced Materials Manufacturing.

Transforming this year's efforts into a success despite the challenges raised by the virus pandemic, would not have been possible without the hard work of our Program Chairs, Assoc. Prof. Karl R. Haapala of Oregon State University and Prof. Yong Chen from the University of Southern California, and the contributions of our technical committee leadership and members. I would also like to acknowledge Prof. Sam Anand and his team from the University of Cincinnati, the hosts who secured the virtual platform and planned an excellent event despite the virtual nature.

Finally and most importantly, I would like to thank to all of you who contribute to the success of this conference through papers and poster submissions, and serve as reviewers, panelists, and symposium organizers each year. We thank you for this service and look forward to your continued active involvement with the division and future MSEC events.

Sincerely,

Laine Mears

Clemson University

Chair, ASME MED Executive Committee, 2020 – 2021



Welcome Note from the Chairs of NAMRI Scientific Committee

On behalf of the NAMRI Scientific Committee, we welcome you to the 49th North American Manufacturing Research Conference (NAMRC 49), sponsored by the North American Manufacturing Research Institution of SME (NAMRI/SME) and hosted by the University of Cincinnati. The event is taking place virtually from June 21 – 25, 2021. As a leading world-class society in the Manufacturing Engineering field, SME acts as an effective bridge between industries, government laboratories, and academic institutions. NAMRC symbolizes the continued collaboration between these esteemed organizations in research exchange and knowledge dissemination.

NAMRC 49 received over 130 technical paper submissions. Following the review process, 94 papers were accepted for publication in the Proceedings of NAMRI/SME and presentation at the conference in 18 technical sessions. The papers included in the conference address a wide range of basic and applied manufacturing research topics in six tracks: (1) Manufacturing Systems, (2) Manufacturing Processes, (3) Material Removal, (4) Additive Manufacturing, (5) Smart Manufacturing and Cyber-Physical Systems, and (6) Industrial Applications and Manufacturing Education. NAMRC 49 also includes a Student Research Presentations Competition. Every single paper submitted to the conferences was put through a rigorous peer review process. We are in debt to all reviewers for their critical assessment of such large number of submissions.

For the first time, the Scientific Committee is pleased to sponsor the Workshop on Manufacturing Engineering Education that will be held on June 21, 2021. The workshop aims to mobilize the manufacturing community to reach a new generation of undergraduate engineers in the classroom with a modern manufacturing curriculum. Additionally, the collocated NAMEC 49/ASME MSEC 2021 continues to feature the annual Manufacturing Blue Sky Competition, funded by the National Science Foundation (NSF) and SME. The winner of the Blue Sky Competition will receive the NAMRI/SME Dornfeld Manufacturing Vision Award, named in honor of the late Professor David Dornfeld, to recognize outstanding vision and leadership within the manufacturing community.

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. We also express our gratitude to all the organizers for their dedicated management of the tracks as well as for guarding the quality of the papers to be presented, which has contributed a great deal to the success of the conference technical program. We would also like to thank the Host Organizing Committee, the Conference Coordinating Committee, the NAMRI/SME Scientific

Committee (as illustrated in Fig. 1), and the ASME MED Executive and Technical Committees. Our thanks also go to the SME and ASME staff for their outstanding job in presenting conference information on the Internet, managing the submitted technical papers, and ensuring high-quality publication of the conference proceedings for both NAMRC 49 and MSEC 2021. We would like to extend our gratitude to the Advanced Manufacturing Program within the Civil, Mechanical, and Manufacturing Innovation (CMMI) Division of NSF for sponsoring the Early Career Forum, the Blue Sky Competition, and for providing registration support for selected student participants from US universities.

We wish you a productive and enjoyable conference experience. We hope that the proceedings are beneficial and we sincerely wish that you have a long-lasting affiliation with NAMRC and MSEC. Finally, we would like to take this opportunity to invite you to NAMRC 50, hosted by Purdue University. We wish to see you there.

Sincerely,

Ihab Ragai, Ph.D., PE, FASME
Penn State University
NAMRI/SME Scientific Committee Chair



Robert Gao, Ph.D., FSME, FASME
Case Western Reserve University
NAMRI/SME Scientific Committee Chair-Elect



Welcome Note from the MSEC Technical Program Chairs

As Technical Program Chair and Co-Chair, we welcome you to this year's virtual ASME International Manufacturing Science and Engineering Conference (MSEC 2021), after an unprecedented year leading to the cancellation of MSEC 2020! This year's conference is sponsored by the Manufacturing Engineering Division of ASME, and held jointly with the 49th North American Research Conference (NAMRC 49), sponsored by the North American Research Institution of SME (NAMRI/SME). The conference also includes two joint symposia with the Japan Society of Mechanical Engineers (JSME).

While the conferences are held jointly, the paper submission, review, and acceptance processes were conducted separately for MSEC and NAMRC. Of the 186 technical papers received, MSEC's peer review process accepted 150 papers for publication in the MSEC 2021 proceedings. In addition, 49 technical posters were submitted, with 33 accepted for inclusion in the online paper site and for presentation at the conference. This year's conference welcomes 18 Ph.D. students and recent graduates to the new Doctoral Symposium, enabling these young engineers to present their doctoral research to the manufacturing community. Two industry practitioners will present their work in a presentation-only format. Seven leading experts were nominated and selected as Invited Symposium Speakers and will present their visions in long-form presentations. A special MED 100th anniversary session welcomes five authors to present recent work related to their state-of-the-art reviews presented at MSEC 2019 and published in the ASME Journal of Manufacturing Science and Engineering.

All talks for MSEC 2021 will be prerecorded and available for viewing for one month after the conference. Presenters will be available for live discussions for the final half hour of each of the 38 technical sessions. Twenty-six symposia have been organized under nine technical tracks:

- Additive Manufacturing (Chair: Dr. Jarred Heigel, Third Wave Systems)
- Advanced Materials Manufacturing (Chair: Prof. Srikanth Pilla, Clemson University)
- Biomanufacturing (Chair: Prof. Roland Chen, Washington State University)
- Life Cycle Engineering (Chair: Prof. Nancy Diaz-Elsayed, University of South Florida)
- Manufacturing Equipment and Automation (Chair: Prof. Burak Sencer, Oregon State University)
- Manufacturing Processes (Prof. Ihab Ragai, Penn State University, The Behrend College)
- Manufacturing Systems (Chair: Dr. Michael Brundage, National Institute of Standards & Technology)

- Nano/Micro/Meso Manufacturing (Chair: Prof. Rajiv Malhotra, Rutgers, The State University of New Jersey)
- Quality and Reliability (Chair: Prof. Yong Wang, Binghamton University)

We would like to thank all the symposium organizers, technical committee and track chairs, authors, and reviewers for their dedication in support MSEC 2021, in spite of the accompanying personal, educational, and work hardships brought on by the global pandemic. We have witnessed the collegial desire for the important work toward the future of manufacturing to go on. This year's conference demonstrates innovations from the nano to macro scales, including advances in materials, additive, subtractive, and deformation processes; robotics and smart manufacturing; and quality, reliability, and sustainability, among numerous other topics.

Finally, we would like to thank everyone at ASME for their support over the past year. We especially wish to thank Lori Lee for her attention to detail and patience in answering every question we put her way in navigating the paper and poster submission and review process!

Dr. Karl R. Haapala, Associate Professor

Oregon State University

MSEC 2021 Technical Program Chair



Dr. Yong Chen, Professor

University of Southern California

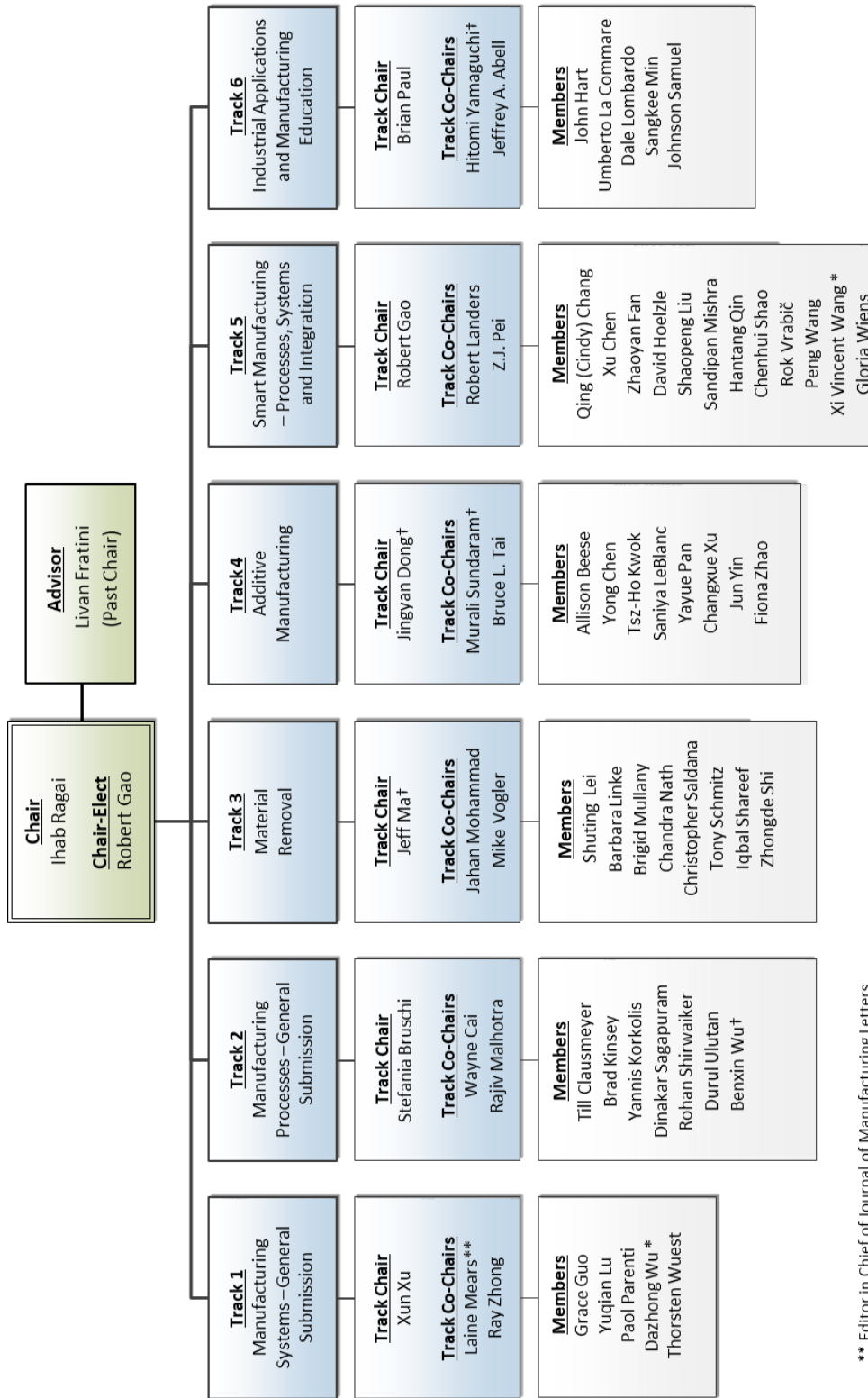
MSEC 2021 Technical Program Co-Chair



Sponsors



NAMRI/SME Scientific Committee



** Editor in Chief of Journal of Manufacturing Letters
 * Associate Editor of Journal of Manufacturing Systems
 † Associate Editor of Journal of Manufacturing Processes

Student Travel Award Recipients

Aarush Sood, *University of North Carolina at Charlotte*

Abdullah Al Mamun, *Mississippi State University*

Abhinav Bhardwaj, *Texas A&M University*

Aditya Nagaraj, *University of Wisconsin-Madison*

Aishwarya A Deshpande, *University of Wisconsin Madison*

Al Mazedur Rahman, *Texas A&M University*

Alec R Passarelli, *Rensselaer Polytechnic Institute*

Alejandro Najera-Acosta, *New Mexico State University*

Alex Brodsky, *Rensselaer Polytechnic Institute*

Alexander R Riensche, *University of Nebraska-Lincoln*

Amit Bajirao Deshpande, *Clemson University*

Ana Paula Clares, *Penn State University*

Andon Rosato, *University of Texas at Dallas*

Andrea Grisell, *University of Cincinnati*

Andrew S Eyring, *Brigham Young University*

Aniruddha Gaikwad, *University of Nebraska-Lincoln*

Ankit Varma, *Clemson University*

Areej A SH A Albahar, *Virginia Tech*

Michael Buckley, *University of Tennessee, Knoxville*

Michael Grzenda, *Rutgers University*

Ming Li, *Texas A&M University*

Mingman Sun, *Kansas State University*

Mingxun Du, *Rensselaer Polytechnic Institute*

Mitchell R Woodside, *Missouri University of Science and Technology*

Mohammad Ali Ansari, *University of Wisconsin-Madison*

Mohammadamin Moghadasi, *Texas A&M University*

Muhammad Shuja Syed, *University of Cincinnati*

Muyue Han, *University of Illinois at Chicago*

Natalie Anne Reed, *University of Cincinnati*

Nathan Hertlein, *University of Cincinnati*

Nesar Ahmed Titu, *University of Tennessee, Knoxville*

Nilesh Ashok Kharat, *Clemson University*

International Center for Automotive Research

Nishant Ojal, *University of North Carolina at Charlotte*

Obehi Georgina Dibua, *University of Texas at Austin*

Olalekan O Olowo, *University of Louisville*

Omey Mohan Manyar, *University of Southern California*

Arvind Shankar Raman, *Oregon State University*

Asmaa Harfoush, *Oregon State University*

Benjamin Stuhr, *Rochester Institute of Technology*

Benjamin Bevans, *University of Nebraska-Lincoln*

Bhaskar Botcha, *Texas A&M University*

Botao Zhang, *University of Cincinnati*

Brandon James Bethers, *San Diego State University*

Cartwright Nelson, *Keene State College*

Chang Liu, *Miami University*

Chao Liu, *New York State College of Ceramics*

Chao Sui, *University of Arkansas*

Chen Li, *University of Virginia*

Cheng Zhu, *University of Virginia*

Cheolhei Lee, *Virginia Tech*

Christopher W Indrarto, *Oregon State University*

Cuiyuan Lu, *University of Cincinnati*

Daniel Joseph Franke, *University of Wisconsin Madison*

Danming Wei, *University of Louisville*

David Omotayo Adeniji, *University of Kentucky*

Dylan Joralmon, *Arizona State University*

Eddie T Lee, *Oregon State University*

Ehsan Malekipour, *University of Michigan*

Elizabeth Marie Mamros, *University of New Hampshire*

Padmalatha Kakanuru, *Stevens Institute of Technology*

Partha Protim Mondal, *University of Illinois at Urbana Champaign*

Patrick Chernjavsky, *Worcester Polytechnic Institute*

Petro John, *University of Texas at Dallas*

Prahar Bhatt, *University of Southern California*

Pu Han, *University of Louisville*

Purvee Bhatia, *University of South Florida*

Qinqin Xiao, *University of Rochester*

Rafi Marandi, *University of North Carolina at Charlotte*

Rana Dabaja, *University of Michigan*

Reza Yavari, *University of Nebraska-Lincoln*

Rishi Malhan, *University of Southern California*

Ritin Mathews, *University of Texas at Dallas*

Roman Savinov, *University of Cincinnati*

Ru Yang, *Northwestern University*

Rui Dai, *Arizona State University*

Ryan Stebbins, *Penn State University*

Ryan Khawarizmi, *Michigan State University*

S M Abu Naser Shovon, *The University of Maine*

Saereh Mirzababaei, *Oregon State University*

Sahand Hajifar, *University at Buffalo*

Samantha Webster, *Northwestern University*

Santosh K Rauniyar, *University of Louisville*

Ethan Wescoat, *Clemson University*

Farjana Sultana, *University of North Carolina at Charlotte*

Felicia F Fashanu, *University of California Davis*

Fucheng Zhang, *Stevens Institute of Technology*

Glenn Gleason, *University of Texas at Dallas*

Gopee Krishnan Radhakrishna Pillai, *University of Cincinnati*

Gowtham Vadivel Parvathy, *Clemson University*

Gregory Corson, *University of Tennessee, Knoxville*

Guangchao Song, *Michigan State University*

Guanxiong Miao, *Texas A&M University*

Halil Tetik, *Kansas State University*

Han Xu, *University of Southern California*

Hao-Yu Liao, *University of Florida*

Hemant Agiwal, *University of Wisconsin-Madison*

Hui Lin, *Northwestern University*

Hunter G Andrieu, *Virginia Tech*

Ian C Garretson, *University of California Davis*

India Dykes, *Washington State University*

Jacob Whiton, *Washington State University*

Jaime Berez, *Georgia Institute of Technology*

Jake Dvorak, *University of Tennessee, Knoxville*

James Bentley Bevis, *Clemson University*

James T Frandsen, *Brigham Young University*

Sara A Frunzi, *Worcester Polytechnic Institute*

Scott R Kerner, *Clemson University*

Sepehr Sadeh, *University of Texas at Dallas*

Shamali Laxman Nevase, *Clemson University International Center for Automotive Research*

Shenghan Guo, *Rutgers University*

ShohanuzzAMAN Shohan, *North Carolina State University*

Shuheng Liao, *Northwestern University*

Shyam Sundar Balasubramanian, *Texas A&M University*

Siddhi G Mehta, *Texas A&M University*

Slesha Tuladhar, *Keene State College*

Sohan Nagaraj, *University of South Florida*

Sourabh Prashant Deshpande, *University of Cincinnati*

Srijana Shah, *University of Cincinnati*

Stanislau Niauzorau, *Arizona State University*

Suchana Akter Jahan, *Purdue University*

Sujithra Chandrasekaran, *University of North Carolina at Charlotte*

Suk Bum Kwon, *University of Wisconsin Madison*

Sumair Sunny, *University of Texas at Dallas*

Suman Bhandari, *Northwestern University*

Suprita Surendra Vispute, *University of Cincinnati*

Suryanarayanan Gunasekar, *Clemson University*

Swarn Jha, *Texas A&M University*

Taieba Tuba Rahman, *University of Texas Rio Grande Valley*

Jared Flowers, *University of Florida*
 Jianchi Huang, *Texas A&M University*

Jianjing Zhang, *Case Western Reserve University*
 Jin Wang, *University of Cincinnati*
 Jing Zhao, *University of Illinois at Chicago*
 Jingjing You, *University of Kentucky*
 Jinwoo Song, *Syracuse University*

Joan Isichei, *North Carolina A&T University*
 Joseph Kubalak, *Virginia Tech*
 Joshua Penney, *University of Tennessee, Knoxville*
 Joshua G Grose, *University of Texas at Austin*
 Julianne Emily Jonsson, *University of California at Davis*
 Karl G Schuchard, *North Carolina State University*
 Katerina Angjeli, *Worcester Polytechnic Institute*
 Kellen Robert Mitchell, *University of Nevada, Reno*
 Ketan Thakare, *Texas A&M University*
 Kun-Hao Yu, *University of Southern California*
 Lauren E Heinrich, *Georgia Institute of Technology*
 Laxmi P Poudel, *University of Arkansas*
 Lei Di, *University of Texas at Arlington*
 Liangkui Jiang, *Iowa State University*
 Lily A Raymond, *University of Nevada, Reno*
 Luis Javier Segura, *University at Buffalo*
 Luis Roy Araya, *University of Florida*
 Lun Li, *University of Cincinnati*

Tian Yu, *University of Virginia*
 Tim Lutz, *Virginia Tech*
 Timothy Taehoon No, *University of Tennessee, Knoxville*
 Tobias J Hynes, *University of Texas at Dallas*
 Tom Zhang, *Columbia University*
 Trent Sakakini, *University of Texas at Dallas*
 Tyler Grimm, *Clemson University*
 Vignesh Selvaraj, *University of Wisconsin Madison*
 Vysakh Venugopal, *University of Cincinnati*
 Weijun Shen, *Iowa State University*
 Wenchao Du, *Texas A&M University*
 Wenhao Yang, *Rochester Institute of Technology*
 Xiangge Wang, *University of California at Davis*
 Xin Li, *North Carolina State University*
 Xuepeng Jiang, *Iowa State University*
 Yang Liu, *University of Cincinnati*
 Yang Xu, *University of Southern California*
 Yaoke Wang, *Northwestern University*
 Yi Wang, *North Carolina State University*
 Yinan Wang, *Virginia Tech*
 Yujie Shan, *Purdue University*
 Yunqing Li, *North Carolina State University*
 Yunze Li, *Texas Tech University*
 Yunzhi Xu, *Northwestern University*
 Yutai Su, *University of Cincinnati*

Marisa Bisram, *Northwestern University*

Maryam Hashemitaheri, *University of North Carolina at Charlotte*

Masafumi Endo, *Oregon State University*

Mason John Makulinski, *University of Cincinnati*

Matthew Russell, *University of Kentucky*

Md Moinuddin Shuvo, *Penn State University*

Md Shakil Arman, *University of Texas Rio Grande Valley*

Michael A Ogunsanya, *North Carolina A&T State University*

Michael Alexander Liu, *Texas A&M University*

Michael B Seger, *University of Texas at Dallas*

Zach Lowery, *University of Wisconsin-Madison*

Zhangcong She, *Rensselaer Polytechnic Institute*

Zhangyue Shi Shi, *Oklahoma State University*

Zhicheng Rong, *Miami University Oxford*

Zhicheng Xu, *University of Wisconsin Madison*

Zihao Luo, *Rensselaer Polytechnic Institute*

Zilin Jiang, *Northwestern University*

Zipeng Guo, *University at Buffalo*

Ziyad M. Smoqi, *University of Nebraska-Lincoln*

Conference Schedule

| Day 1- Tuesday 06/22/2021 | | |
|----------------------------------|--|--|
| Time* | Event | Organizers |
| 10:15 AM to 10:20 AM | Welcome Note from the Organizing Committee- University of Cincinnati | Dr. Sam Anand |
| 10:20 AM to 10:30 AM | Welcome Note from Dr. John W. Weidner, Dean of the University of Cincinnati College of Engineering and Applied Science | Dr. Sam Anand |
| 10:30 AM to 10:55 AM | Welcome Note from David J. Adams, Chief Innovation Officer and Architect of the Cincinnati Innovation District | Dr. Sam Anand |
| 10:55 AM to 11:25 AM | Keynote Session 1 (Live Event) by Mike Molnar, Director of the Advanced Manufacturing National Program Office & the Office of Advanced Manufacturing (OAM) at the National Institute of Standards & Technology (NIST) | Dr. Sam Anand & Dr. Frank Pfefferkorn |
| 11:25 AM to 11:55 AM | Keynote Session 2 (Live Event) by Jutapat (Air) Boonvongsakorn, Global Transformational Engineering Senior Director at P&G | Dr. Sam Anand |
| 12:00 PM to 1:30 PM | Technical Presentations | |
| | Women in Advanced Manufacturing Forum –Panel of Advanced Manufacturing Leaders & Virtual Networking | Dr. Li, Dr. McGovern, Ms. Reslan, Dr. Linke, Dr. Wiens |
| | Student Manufacturing Design Competition –Session I | Dr. Pfefferkorn |
| 1:30 PM to 3:00 PM | Technical Presentations | |
| | Women in Advanced Manufacturing Forum –Panel of Advanced Manufacturing Leaders & Virtual Networking | Dr. Li, Dr. McGovern, Ms. Reslan, Dr. Linke, Dr. Wiens |
| | Student Manufacturing Design Competition –Session II | Dr. Pfefferkorn |
| 3:10 PM to 4:40 PM | ASME Awards Ceremony | Dr. Pfefferkorn |

Day 2- Wednesday 06/23/2021

| Time* | Event | Organizers |
|---------------------------------|---|---|
| 10:50 AM to 11:20 AM | Keynote Session by Sarah Kleinbaum, Technology Manager at United States Department of Energy (DOE) (Pre-recorded Event) | Dr. Sam Anand & Dr. Mihaela (Miki) Banu |
| 11:25 AM to 11:55 AM | Keynote Session 4 (Live Event) by Kevin Eustace, Senior Vice President and General Manager, Engineering and Consulting Services, Siemens Digital Industry Software (Siemens Digital Industry) | Dr. Sam Anand |
| 12:00 PM to 1:30 PM | Technical Presentations Blue Sky Competition- I | Dr. Pfefferkorn |
| 1:30 PM to 3:00 PM | Technical Presentations Blue Sky Competition- II | Dr. Pfefferkorn |
| 3:10 PM to 4:40 PM | NSF Early Career Forum | Dr. Linke, Dr. Z J Pei |

Day 3- Thursday 06/24/2021

| Time* | Event | Organizers |
|---------------------------------|--|--|
| 10:50 AM to 11:20 AM | Keynote Session 5 (Pre-Recorded Event) by Dr.-Ing. Christian Brecher, Ordinary Professor for Machine Tools at the Laboratory for Machine Tools and Production Engineering (WZL) of the RWTH Aachen & Director of the Department for Production Machines at the Fraunhofer Institute for Production Technology IPT | Dr. Sam Anand & Dr. Brigid Mullaney |
| 11:25 AM to 11:55 AM | Keynote Session 6 (Live Event) by Dr. Robert Ivester, Acting MEP Director and the Deputy Director of the Hollings Manufacturing Extension Partnership (MEP) Program at the National Institute of Standards & Technology (NIST) | Dr. Sam Anand |

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|--------------------------------|--|-----------------|
| 12:00 PM to 1:30 PM | Technical Presentations Federal Agencies Perspective on Advanced Manufacturing | Dr. Pfefferkorn |
| 1:30 PM to 3:00 PM | Technical Presentations NSFs Advanced Manufacturing Program: Overview, Update and Q&A | Dr. Z J Pei |
| 3:10 PM to 4:40 PM | SME Awards Ceremony | Suzy Marzano |

Day 4- Friday 06/25/2021

| Time* | Event | Organizers |
|---------------------------------|--|-----------------------|
| 11:25 AM to 11:55 AM | Keynote Session 7 (Live Event) by Dr. Gen Satoh, Associate Director at the Raytheon Technologies Additive Manufacturing Process Capability Center | Dr. Sam Anand |
| 12:00PM to 1:30 PM | Technical Presentations Doctoral Symposium-I | Dr. Chen, Dr. Haapala |
| 1:30 PM to 3:00 PM | Technical Presentations Doctoral Symposium-II | Dr. Chen, Dr. Haapala |
| 3:10 PM to 4:40 PM | Doctoral Symposium-III Poster Session | Dr. Chen, Dr. Haapala |

*All times indicated are as per Eastern Daylight Time (EDT)

Tuesday, June 22, 2021

| Time* | Event | Organizers |
|-------------------------|--|---------------|
| 10:15 AM to 10:20 AM | Welcome Note from the Organizing Committee- University of Cincinnati | Dr. Sam Anand |
| 10:20 AM to 10:30 AM | Welcome Note from Dr. John W. Weidner, Dean of the University of Cincinnati College of Engineering and Applied Science | Dr. Sam Anand |
| 10:35 AM to 10:55 AM | Welcome Note from David J. Adams, Chief Innovation Officer and Architect of the Cincinnati Innovation District | Dr. Sam Anand |
| 10:55 AM to 11:25 AM | Keynote Session 1 (Live Event) by Mike Molnar, Director of the Advanced Manufacturing National Program Office & the Office of Advanced Manufacturing (OAM) at the National Institute of Standards & Technology (NIST) | Dr. Sam Anand |
| 11:25 AM to 11:55 AM | Keynote Session 2 (Live Event) by Jutapat (Air) Boonvongsakorn, Global Transformational Engineering Senior Director at P&G | Dr. Sam Anand |
| 12:00 PM to 1:00 PM | Pre-recorded Technical Presentations <ul style="list-style-type: none"> ▪ NAMRC Track 1- Manufacturing Systems Session 1 ▪ NAMRC Track 2- Manufacturing Processes Session 1 ▪ NAMRC Track 3- Material Removal Session 1 ▪ MSEC 01-01-01 Advances in Metal Additive Manufacturing Processes 1 ▪ MSEC 04-01-01 Smart Manufacturing for Resilient and Environmentally- Efficient Systems 1 ▪ MSEC 05-02-01 Innovations in the Design and Control of Manufacturing Machines and Equipment (ASME- JSME Joint Symposium) 1 | |

| | | |
|----------------------------|--|--|
| | <ul style="list-style-type: none"> ▪ MSEC 06-01 Advances in Mechanics of Materials in Modern Manufacturing and Materials Processing Techniques ▪ MSEC 07-06-01 Industrial Internet, Cloud and Digital Twins in the Wake of COVID-19 (1) | |
| 12:00 PM to 1:30 PM | Women in Advanced Manufacturing Forum– Panel of Advanced Manufacturing Leaders & Virtual Networking (Live Event) | Dr. Li, Dr. McGovern, Ms. Reslan, Dr. Linke, Dr. Wiens |
| 12:00 PM to 1:30 PM | Student Manufacturing Design Competition –Session I (Live Event) | Dr. Pfefferkorn |
| 1:00 PM to 1:30 PM | Live discussion for Technical Presentations | |
| 1:30 PM to 2:30 PM | Pre-recorded Technical Presentations <ul style="list-style-type: none"> ▪ NAMRC Track 4- Additive Manufacturing Session 1 ▪ NAMRC Track 5- Smart Manufacturing and Cyber Physical Systems Session 1 ▪ NAMRC Track 6- Manufacturing Education Session 1 ▪ MSEC 01-01-02 Advances in Metal Additive Manufacturing Processes 2 ▪ MSEC 04-01-02 Smart Manufacturing for Resilient and Environmentally- Efficient Systems 2 ▪ MSEC 05-02-02 Innovations in the Design and Control of Manufacturing Machines and Equipment (ASME- JSME Joint Symposium) 2 ▪ MSEC 06-02 Tool Wear Mechanisms, Measurements, and Monitoring ▪ MSEC 07-06-02 Industrial Internet, Cloud and Digital Twins in the Wake of COVID-19 (2) | |
| 1:30 PM to 3:00 PM | Women in Advanced Manufacturing Forum –Panel of Advanced Manufacturing Leaders & Virtual Networking (Live Event) | Dr. Li, Dr. McGovern, Ms. Reslan, Dr. Linke, Dr. Wiens |

| | | |
|-------------------------------|--|-----------------|
| 1:30 PM to 3:00 PM | Student Manufacturing Design Competition –Session II (Live Event) | Dr. Pfefferkorn |
| 2:30 PM to 3:00 PM | Live discussion for Technical Presentations | |
| 3:10 PM to 4:40 PM | ASME Awards Ceremony (Live Event) | Dr. Pfefferkorn |

Welcome Note- University of Cincinnati

John Weidner

Dean of the University of Cincinnati College of Engineering and Applied Science

John W. Weidner is Dean of the College of Engineering and Applied Science at the *University of Cincinnati*. Prior to being appointed dean in August of 2019, he was the Chair of the Department of Chemical Engineering at the University of South Carolina (UofSC), Director of their Hydrogen and Fuel Cell Center, and a Distinguished Scientist at the Savannah River National Laboratory. He received his BS degree in chemical engineering from the *University of Wisconsin-Madison* in 1986 and his PhD in chemical engineering from NC State University in 1991. Professor Weidner has advised 24 PhD students, generated over \$10 million in research funding, and published over 120 refereed journal articles in the field of electrochemical engineering, particularly in the synthesis and characterization of electrocatalysts and electrochemically active materials, and the mathematical modeling of advanced batteries, fuel cells, and hydrogen production processes. He has been a visiting scientist at NASA's Jet Propulsion Laboratory, the University of California-Berkeley, Los Alamos National Laboratory, and the Fraunhofer Institute for Solar Energy Systems. For his leadership role as director of the department's NSF-REU (Research Experience for Undergraduates) program and his mentoring of undergraduates in his lab, Professor Weidner was awarded the Golden Key Faculty Award by UofSC in 2006 for "Excellence in Integrating Undergraduate Teaching and Research". In 2008 and 2010, he received the Energy Research Award from the E.ON International Research Initiative and the Research Award from the Energy Technology Division of the Electrochemical Society (ECS), respectively, for his work on solar-hydrogen production. For his overall contributions to electrochemical research, Professor Weidner received the UofSC Educational Foundation Award for Research in Science, Mathematics and Engineering (2013), the Education Leadership Award at the Energy Inc. Summit in Charlotte, NC (2016), and the Breakthrough Leadership in Research Award from UofSC (2016). In 2019 he received the Carl Wagner Memorial Award from ECS and he was named a Fellow of the Graduate School at the *University of Cincinnati*. Dr. Weidner was inaugural editor of ECS Transactions and past Technical Editor for the Journal of the Electrochemical Society. He is a Fellow of ECS and the American Institute of Chemical Engineers (AIChE), and a Program Evaluator (PEV) for ABET.



Welcome Note- University of Cincinnati

David J. Adams

Chief Innovation Officer and Architect of the Cincinnati Innovation District

David J. Adams is the lead architect of the Cincinnati Innovation District, University of Cincinnati's Chief Innovation Officer and Chief Executive Officer of the 1819 Innovation Hub. Before joining UC, he was the Chief Administrative Officer and CEO of the Institute for Product Realization at the University of Louisville. As CAO, he oversaw the \$1.2B financial and operational aspects of the university, implemented financial reporting and operational efficiencies, and developed the emerging innovation ecosystem.

Prior to his work in academia, David was recruited by Governor Mitch Daniels to lead the operational improvement and merger of Indiana's \$30B pension systems. During his tenure, David turned a problematic public pension system into a world class operation. He was also a founding member of the executive team that grew i2 Technologies from \$4M to \$1.1B in 7 years, becoming a NASDAQ 50 company in the process. David has held senior management positions in North and South America, and leading sales and consulting roles Europe, the Middle East, and Africa. He has a breadth of experience that is a great asset to UC and the region as a whole.



Keynote Speaker

Mike Molnar

Director of the Advanced Manufacturing National Program Office & the Office of Advanced Manufacturing (OAM) at the National Institute of Standards & Technology (NIST)

Mike Molnar is the founding director of the Advanced Manufacturing National Program Office, the interagency team responsible for the Manufacturing USA program. Mike also leads the NIST Office of Advanced Manufacturing and serves as co-chair of the National Science and Technology Council, Subcommittee on Advanced Manufacturing for the White House – the team responsible for the National Strategic Plan for Advanced Manufacturing. Prior to joining federal service in 2011 Mike had a successful industry career, including 25 years as a manufacturing leader with Cummins, a U.S. based global company that designs, manufactures, and distributes engines and power generation products.



Title: Manufacturing USA: Today and Tomorrow

Abstract:

The Manufacturing USA program was formally established in 2014 as a public-private partnership to accelerate advanced manufacturing research on transformational technologies important to industry. The institute model was designed to create an effective collaboration space for academia and industry on translational applied research, as well as how to best address workforce skills gaps in these emerging technologies. Now with 16 institutes, from additive manufacturing to sustainable manufacturing, the program has just achieved a new milestone: over 2,300 members from all 50 states have participated in over 1,600 projects. This keynote session will present on where Manufacturing USA is today, including impactful stories on how the institutes contributed to national needs from the COVID-19 pandemic. The program has been reauthorized by Congress with additional responsibilities and authorities, and future plans will be shared on how Manufacturing USA can increase U.S. leadership in global advanced manufacturing.

Keynote Speaker

Jutapat (Air) Boonvongsakorn

Global Transformational Engineering Senior Director at P & G

Transformation and Change Leader. More than 20 years of experiences in driving Breakthrough Transformation in Global Corporate Environment with Local Insight and Entrepreneurial Leadership. Has Lived and worked in USA, Singapore, Japan and Thailand. Global Track record in End to End Innovation, Engineering and Supply Chain Leadership. Led large-complex organization, Top 5 most complex and biggest one of Global P&G supply chains and factories, export to more than 30 countries. Certified Advanced Project Management (CMO) and Certified Advanced Innovation Management. Leading Business Platform Strategy, Portfolio Management, Holistic End to End Supply Chain Design, Re-platforming Programs, Technology Integration and Manufacturing Operation. Currently leading the transformation of Global Engineering. Passionate, Champion and Dedicate to transform organization to next S-Curve to deliver breakthrough business results in the fast-changing world.



Title: Modernize Engineering and Manufacturing with Models, Data Engineering and Data Science Integration

Abstract: In the VUCA world and the rapid changes of consumer behaviors, business requires agility and resiliency of supply chain in delivering speed of innovation and operation. Modernizing Engineering and Manufacturing Work Processes with the integrated hybrid-virtual strategies can step changes Quality, Speed, Cost and Productivity. The power of computing power today with the connectedness of principle models, data engineering and data science techniques enables the deeper understanding of product, process, material and equipment development like never before. Real time consumers inputs, 100% quality assurance, high speed data record for all process parameters and transformations have modernized the way we do Engineering and Engineering Work Process to create bigger, faster and more value innovation for business in the most effective and efficient approaches.



MSEC

Women in Advanced Manufacturing -
The Diverse Next Generation

June 22, 2021
12pm – 3pm (ET)

Virtual Conference
Hosted by the University of Cincinnati



2nd Women in Advanced Manufacturing (WIAM) Virtual Forum 2021

Description

Following its inaugural event in 2019, the WIAM Forum 2021 will continue to showcase successful career paths, discuss next generation technologies, and address the diversity gap in the field of manufacturing engineering. This forum is organized by the ASME Manufacturing Engineering Division (MED) and sponsored by MED, the ASME Technical and Engineering Communities (TEC), and SME.

The WIAM 2021 virtual forum will feature (i) a panel discussion with panelists from government, academia, and industry, (ii) a networking event, (iii) a professional development workshop, and (iv) post-forum presentations by the SME society and ASME Volunteer Orientation and Leadership Training (VOLT) program. In the panel discussion, the panelists will showcase their successful career paths and discuss new technologies and opportunities for the diverse next generation in manufacturing engineering.

The panel discussion will be followed by a networking event to promote interactions among the panelists and attendees. In the professional development workshop, participants will learn the difference between empowering leadership and controlling leadership. The post-forum presentation will feature introductions of the SME society and the ASME VOLT program.

We sincerely welcome all genders and diverse professionals to join us to together foster career growth and identify next steps for building diversity in manufacturing engineering!

Program

Session I: Panel of Advanced Manufacturing Leaders [12-1 pm ET]

Panel Topic: Career Pathways and Leadership Experiences in Advanced Manufacturing

Panelists: **Jennifer Fielding**, Government – Air Force Research Laboratory, Chief, Composites Branch

Jian Cao, Academia – Northwestern University, Associate VP for Research, Director, NIMSI, Cardiss Collins Professor

Delcie Durham, Academia – University of South Florida, Professor Emerita

Chandra Brown, Manufacturing USA Institute – MxD, CEO

Sarah Krasley, Industry – Shimmy Technologies, Founder and CEO

Session II: Virtual Networking [1-1:30 pm ET]

Session III: Professional Development Workshop [1:30-2:30 pm ET]

Moderator: **Crystal Morrison**, EverRise, Founder & CEO

Live Interactive Session: Leadership skills are absolutely necessary, even for scientists and engineers. In this session, participants will learn the difference between empowering leadership and controlling leadership. In addition, participants will receive guidance on how to clarify roles and responsibilities to advocate for themselves and/or empower their team. Tools gained in this session can be used immediately whether working in an office, lab or virtual environment.

Post-Forum Discussions [2:30-3 pm ET]

Discussion I: **SME Presentation**

Discussion II: **ASME's Volunteer Orientation and Leadership Training (VOLT) Presentation**

WIAM 2021 Organizing Committees



Annie Dian-Ru Li

Zap Surgical Systems – R&D Mechanical Engineer



Megan McGovern

General Motors Global R&D Center – Senior Researcher



Maya Reslan

NIST – Associate Researcher



Barbara S. Linke

University of California Davis – Associate Professor



Gloria Wiens,

University of Florida – Associate Professor





namri



2021 ASME/SME Student Manufacturing Design Competition

Tuesday, June 22, 2021

12:00 PM – 3:00 PM Eastern Time

The purpose of the competition is to foster interest in manufacturing, provide the manufacturing engineering community with fresh new perspectives on design, and create a forum for students to share their new and innovative ideas. Original student designs that focus on manufacturing engineering and science are sought. Any design of a system, component, or process that can be used to promote the art, science, and practice of manufacturing engineering is acceptable.

2021 Finalists

| Eastern Time | Title | Student Authors | University |
|---------------|--|---|-----------------------------------|
| 12:00 - 12:20 | Customized protective visor against COVID-19 enabled by 4D Printing | Qinglei Ji | KTH Royal Institute of Technology |
| 12:20 - 12:40 | Hybrid Manufacturing Work Cell for Fabrication of Large-Scale Metal Parts | Joshua Penney; Aaron Cornelius; Ethan Vals; Jake Dvorak; Michael Buckley; Leah Jacobs; Gregory Corson | University of Tennessee Knoxville |
| 12:40 - 13:00 | Analysis of a Closed-Loop Digital Twin | Andrew Eyring | Brigham Young University |
| 13:00 - 13:20 | 4D Thermal Scanner for Additive Manufacturing Systems | Christopher Henson; Nathan Decker | University of Southern California |
| 13:30 - 13:50 | Development of a Handheld Biopsy Device for Needle Biopsy Procedures | Roy Araya; Zachary Tupper | University of Florida |
| 13:50 - 14:10 | Development of Manufacturing Automation for the Sorting and Assembly of Nasopharyngeal Swabs | Trent Sakakini; Josiah Go; Petro John; Thien Nguyen; Tobias Hynes; Jayaram Rajagopalan | University of Texas Dallas |

| | | | |
|------------------|---|-------------------------------|---------------------------|
| 14:10 - 14:30 | Rotating Internal Mandrel Printhead Design for Material Extrusion Manufacturing of Artificial Muscles in Low Gravity Environments and Spaceflight | Kellen Mitchell; Lily Raymond | University of Nevada Reno |
| 14:30 - 14:50 | UR Cobot Digital Twins to Assist SMEs with Robot Integration | JT Frandsen | Brigham Young University |

Judges:

- Ihab Ragai (Associate Professor, Penn State Behrend)
- Jarred Heigel (R&D Manager, Third Wave Systems, Inc.)
- Dale Lombardo (Special Process Technologies Leader, GE Aviation)

The First, Second, and Third Place awardees will be recognized at at the ASME Awards Ceremony on Tuesday, June 22, 2021 starting at 3:00 PM Eastern Time. The Student Manufacturing Design Competition will be announced towards the end of the ASME awards ceremony.

Competition Organizer:

- Professors Frank Pfefferkorn (frank.pfefferkorn@wisc.edu)




ASME Manufacturing Engineering Division

AWARDS

Tuesday, June 22, 2021

3:00 – 4:30 PM EDT

| | |
|--|---|
|  <p>University of CINCINNATI</p> | <p>NAMRC 49/MSEC 2021 hosted by University of Cincinnati June 22-25, 2021</p> <p>https://ceas.uc.edu/events/namrc-msec-2021/info.html</p> |
|--|---|

Welcome

Laine Mears and Radu Pavel

Chair and Past Chair, MED Exec. Committee

Recognition of Collocated Conference Chair

Prof. Sam Anand

Presented by *Radu Pavel*

Past Chair, MED Executive Committee

Recognition of 2021 MSEC Technical Program

Chairs: Karl Haapala & Yong Chen

Presented by *Laine Mears*

Chair, MED Executive Committee

Best Paper Award

Presented by *Karl Haapala*

Recognition of Retiring Associate Editors

Journal of Micro and Nano-Mfg.

Presented by *Nicholas Xuanlai Fang*

Editor, Journal of Micro- and Nano-Mfg.

Blackall Machine Tool and Gage Award

Presented by *Moneer Helu*

Vice-Chair, MED Executive Committee

William T. Ennor Mfg. Technology Award

Presented by *Moneer Helu*

Vice-Chair, MED Executive Committee

M. Eugene Merchant Mfg. Medal

Announced by *Moneer Helu*

Vice-Chair, MED Executive Committee



MSEC Technical Program Chair
Best Organizer of Symposium & Session (BOSS) Award
 Presented by *Karl Haapala*
 MSEC Technical Program Chair
Recognition of Track and Symposium Organizers (E-Certificates)
 Presented by *Karl Haapala*
 MSEC Technical Program Chair
Recognition of Retiring Editor, Journal of Mfg. Science and Engineering
 Presented by *Radu Pavel*
 Past Chair, MED Executive Committee
Recognition of Retiring Associate Editors Journal of Mfg. Science and Engineering
 Presented by *Y. Lawrence Yao*
 Editor, Journal of Mfg. Sci. and Eng.

Milton C. Shaw Mfg. Research Medal
 Presented by *Moneer Helu*
 Vice-Chair, MED Executive Committee
Chao & Trigger Young Mfg. Engineer Award
 Presented by *Moneer Helu*
 Vice-Chair, MED Executive Committee
Kornel F. Ehmann Manufacturing Medal
 Presented by *Moneer Helu*
 Vice-Chair, MED Executive Committee
Recognition of New ASME Fellows
 Presented by *Radu Pavel*
 Past Chair, MED Executive Committee
MED Outstanding Service Award
 Presented by *Laine Mears*
 Chair, MED Executive Committee
Student Mfg. Design Competition Award
 Presented by *Frank Pfefferkorn*
 Program Chair, MED Executive Committee

TRAJECTORY-DEPENDENT COMPENSATION SCHEME TO REDUCE

MANIPULATOR EXECUTION ERRORS FOR MANUFACTURING APPLICATIONS

Prahar M. Bhatt, Rishi K. Malhan, Pradeep Rajendran, Aniruddha V. Shembekar, and Satyandra K. Gupta

HYBRID-LIGHT-SOURCE STEREOLITHOGRAPHY FOR FABRICATING

MACRO-OBJECTS WITH MICRO-TEXTURES

Wenxuan Jia, Yuen-Shan Leung, Han Xu, and Yong Chen, Huachao Mao, and Chi Zhou

VIBRATION-ASSISTED INSERTION OF FLEXIBLE NEURAL MICROELECTRODES WITH

BIO-DISSOLVABLE GUIDES FOR MEDICAL IMPLANTATION

Yi Wang, Yen Yu Ian Shih, Yuan-shin Lee

MSEC Best Paper Award

Finalists

(listed by first author's last name)

2020 Blackall Machine Tool and Gage Award

The Blackall Machine Tool and Gage Award is presented for the best current original paper or papers (not published elsewhere) which has/have been presented before ASME and/or published by ASME during the two calendar years immediately preceding the year of the award.

Chabum Lee
 Texas A&M University

2021 William T. Ennor Manufacturing Technology Award

The William T. Ennor Manufacturing Technology Award, established in 1990, is presented to an individual or team for developing or contributing significantly to an innovative manufacturing technology, the implementation of which has resulted in substantial economic and/or societal benefits.

Albert Shih
University of Michigan

2021 M. Eugene Merchant Manufacturing Medal

Established in 1986, the M. Eugene Merchant Mfg. Medal is awarded to an individual who has had significant influence and responsibility for improving the productivity and efficiency of the manufacturing operation(s).

Scott Smith
Oak Ridge National Laboratory

2020 Milton C. Shaw Manufacturing Research Medal

Established 2009, Milton Shaw Medal recognizes significant fundamental contributions to the science and technology of manufacturing processes.

Jian Cao
Northwestern University

2021 Chao & Trigger Young Manufacturing Engineer Award

This award recognizes a young manufacturing researcher with potential for significant contributions to the science and technology of manufacturing processes. Nominees must not have reached their 40th birthday before the nomination deadline.

Chenhui Shao
University of Illinois Urbana-Champaign

Kornel F. Ehmann Manufacturing Medal

This award recognizes the best current original ASME journal paper on micro- or nano-scale manufacturing processes and systems.

2020 Medal
Michael Cullinan, Obehi G. Dibua, Anil Yuksel,
Nilabh K. Roy, Chee S. Foong
University of Texas and NXP Semiconductors

Kornel F. Ehmann Manufacturing Medal

This award recognizes the best current original ASME journal paper on micro- or nano-scale manufacturing processes and systems.

2021 Medal
Yang Yang and Keyu Chen
The Chinese University of Hong Kong
Ping Guo
Northwestern University

ASME Fellows

Fellow is the highest elected grade of membership within ASME, the attainment of which recognizes exceptional engineering achievements and contributions to the engineering profession.

Salil Desai
North Carolina A&T State University

William Emblom
University of Louisiana-Lafayette

Xiaoqi Chen
Swinburne University of Technology

2021 MSEC Host Organizing Committee

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Jing Shi, Co-Chair
Sourabh Deshpande, Special Assistant

Murali Sundaram, Co-Chair
Katy Marston, Coordinator

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MED & Friends

Frank Pfefferkorn

Amit Bagchi



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<https://event.asme.org/Events/media/library/resources/msec/MSEC-Sponsor-Opportunities.pdf>



Presentation Details for Tuesday, June 22, 2021

| Tuesday, June 22 NAMRC Track 1 Manufacturing Systems 1 | | |
|--|--|---|
| 12:00 PM – 1:30 PM Session Chair: Xun Xu Session Co-chair: Shiv Kapoor | | |
| NAMRC Paper 10 | Wei Li, Barrie R. Nault, Jingjing You and Briscoe Bilderback | Balancing Trade-offs in One-Stage Production with Processing Time Uncertainty |
| NAMRC Paper 71 | Zhangyue Shi, Soumya Mandal, Sandip Harimkar and Chenang Liu | Surface Morphology Analysis Using Convolutional Autoencoder in Additive Manufacturing with Laser Engineered Net Shaping |
| NAMRC Paper 111 | Santhana Pandiyan Muniraj and Xun Xu | An Implementation of OPC UA for Machine-to-Machine Communications in a Smart Factory |
| NAMRC Paper 104 | Matthew Krugh and Laine Mears | Pervasive Environmental Sensing for Industry 4.0 as an Educational Tool |
| NAMRC Paper 99 | Partha Protim Mondal, Placid Matthew Ferreira, Shiv Gopal Kapoor and Patrick N Bless | Monitoring and Diagnosis of Multistage Manufacturing Processes Using Hierarchical Bayesian Networks |
| Tuesday, June 22 NAMRC Track 2 Manufacturing Processes 1 | | |
| 12:00 PM – 1:30 PM Session Chair: Brad Kinsey Session Co-chair: Brigid Mullany | | |
| NAMRC Keynote | Brad Kinsey | Driving Manufacturing Process Innovations through Fundamental Science Phenomena |
| NAMRC Paper 119 | Nakul Ghate and Amber Shrivastava | Power Spectral Analysis of Surface Microtopography Formed in CW Laser Surface Texturing |
| NAMRC Paper 90 | Aarush Sood and Brigid Mullany | Advanced Surface Analysis to Identify Media Workpiece Contact Modes in a Vibratory Finishing Processes |
| Tuesday, June 22 NAMRC Track 3 Material Removal 1 | | |
| 12:00 PM – 1:30 PM Session Chair: Tony Schmitz Session Co-chair: Muhammad Jahan | | |
| NAMRC Paper 3 | Al Mazedur Rahman, S M Abdur Rob and Anil K. Srivastava | Modeling and Optimization of Process Parameters in Face Milling of Ti6Al4V Alloy using Taguchi and Grey Relational Analysis |
| NAMRC Paper 15 | Timothy No, Michael Gomez, Jaydeep Karandikar, Jarred Heigel, Ryan Copenhaver and Tony Schmitz | Propagation of Johnson-Cook Flow Stress Model Uncertainty to Milling Force Uncertainty using Finite Element Analysis and Time Domain Simulation |

| | | |
|-----------------|--|--|
| NAMRC Paper 32 | Mark Gueli, Jianfeng Ma, Nicholas Cococchetta, David Pearl and Muhammad Jahan | Experimental Investigation into Tool Wear, Cutting Forces, and Resulting Surface Finish During Dry and Flood Coolant Slot Milling of Inconel 718 |
| NAMRC Paper 43 | Takenori Ono | Sharpening and Re-Shaping of the Diamond Tool Edge by the Ar Ion Beam Machine Tool |
| NAMRC Paper 106 | Gustavo Fernandes, Guilherme Lopes, Lucas Barbosa, Paulo Martins and Álisson Machado | Wear Mechanism of Diamond-like Carbon Coated Tools in Tapping of AA6351 T6 Aluminium Alloy |

Tuesday, June 22 12:00 PM – 1:30 PM MSEC 01-01-01 Advances in Additive Manufacturing Processes 1
Session Chair: Wenchao Zhou | Session Co-chair: Qiong Nian

| | | |
|----------------|---|---|
| MSEC2021-60448 | Sebastian Greco, Kevin Gutzeit, Hendrik Hotz, Marc Schmidt, Marco Zimmermann, Benjamin Kirsch and Jan C. Aurich | Influence of Machine Type and Powder Batch During Laser-Based Powder Bed Fusion (L-PBF) of AISI 316L |
| MSEC2021-61726 | Jin Fu, Shuo Qu, Junhao Ding, Xu Song and Ming Wang Fu | Effect of Heat Treatment on Microstructure and Mechanical Property of 316L Stainless Steel by Micro Selective Laser Melting |
| MSEC2021-64108 | Yash Parikh and Mathew Kuttolamadom | Selective Laser Melting of Stainless Steel 316L for Mechanical Property-Gradation |
| MSEC2021-63402 | Dipesh Kumar Mishra and Pulak Mohan Pandey | Experimental Investigation into the Fabrication of Porous Biodegradable Fe Scaffold by Microwave Sintering of 3D Printed Green Body |
| MSEC2021-64111 | Michael Liu and Mathew Kuttolamadom | Manufacturing of Co-Cr-Mo Alloy via Directed Energy Deposition |

Tuesday, June 22 12:00 PM – 1:30 PM MSEC 04-01-01 Smart Manufacturing for Resilient and Environmentally- Efficient Systems 1
Session Chair: Nancy Diaz-Elsayed | Session Co-chair: KC Morris

| | | |
|----------------|--|---|
| MSEC2021-72892 | Björn Johansson | Tradeoff Analysis Using Digital Tools for Sustainable Manufacturing |
| MSEC2021-62227 | Nancy Diaz-Elsayed, KC Morris and Julius Schoop | Towards a Digital Depot to Support Sustainable Manufacturing During Crisis Response |
| MSEC2021-62394 | Arpita Chari, Johan Vogt Duberg, Emma Lindahl, Johan Stahre, Mélanie Despeisse, Erik Sundin, Björn Johansson and Magnus Wiktorsson | Swedish Manufacturing Practices Towards a Sustainability Transition in Industry 4.0: A Resilience Perspective |

Tuesday, June 22 12:00 PM – 1:30 PM **MSEC 05-02-01 Innovations in the Design and Control of Manufacturing Machines and Equipment (ASME-JSME Joint Symposium) 1**
 Session Chair: Martin Jun | Session Co-chair: Chandra Nath

| | | |
|----------------|--|--|
| MSEC2021-72999 | Yuefeng Luo | An Investigation into the Equipment Robustness of 3d Printing/L-PBF |
| MSEC2021-63900 | Yi-Wei Chen, Rex Joseph, Alec Kanyuck, Shahwaz Khan, Rishi Malhan, Omey Manyar, Zachary McNulty, Bohan Wang, Jernej Barbic and Satyandra Gupta | A Digital Twin for Automated Layup of Prepreg Composite Sheets |
| MSEC2021-64036 | Eunseob Kim, Huitaek Yun, Kyunghyun Kim, Suk-Won Cha and Martin Jun | Multiple Sound Sensors and Fusion in Modern CNN-Based Machine State Prediction |

Tuesday, June 22 12:00 PM – 1:30 PM **MSEC 06-01 Advances in Mechanics of Materials in Modern Manufacturing and Materials Processing Techniques**
 Session Chair: Dinakar Sagapuram | Session Co-chair: Koushik Viswanathan

| | | |
|----------------|---|--|
| MSEC2021-59877 | Elizabeth Mamros, Matthew Eaton, Jinjin Ha and Brad Kinsey | Numerical Analysis of Stainless Steel 316L Biaxial Cruciform Specimens Under Proportional Loading Paths |
| MSEC2021-63417 | Fabian Stiebert, Heinrich Traphöner, Rickmer Meya and A. Erman Tekkaya | Characterization of Flow Curves for Ultra-Thin Steel Sheets with the In-Plane Torsion Test |
| MSEC2021-63614 | Haseung Chung, Guangchao Song, Bibek Poudel, Patrick Kwon, Zachary Detweiler and Guangchun Quan | Development of Magnetic-Field Assisted Finishing (MAF) Process for Chromium-Alloyed Low Carbon Steel Sheet Metal |
| MSEC2021-63790 | Wolfgang Lortz and Radu Pavel | Advanced Modeling of Drilling - Realistic Process Mechanics Leading to Helical Chip Formation |
| MSEC2021-64005 | Mainak Pal, Vandit Pandya and Anupam Agrawal | Study of Formability Limit Based on Ductile Damage Criteria of Incremental Sheet Forming of Titanium Grade 2 Sheet |

Tuesday, June 22 12:00 PM – 1:30 PM **MSEC 07-06-01 Industrial Internet, Cloud and Digital Twins in the Wake of COVID-19 (1)**
 Session Chair: Xi (Vincent) Wang | Session Co-chair: Yujie Chen

| | | |
|----------------|---|--|
| MSEC2021-72937 | Thomas Kurfess | Democratizing Advanced Manufacturing – Ensuring Prosperity and Security |
| MSEC2021-64237 | Jay Lee, Xiang Li, Qibo Yang, Xiaodong Jia and Keyi Sun | Collaborative Platform for Remote Manufacturing Systems Using Industrial Internet and Digital Twin in the Covid-19 Era |

Tuesday, June 22 **NAMRC Track 4 Additive Manufacturing 1**
1:30 PM – 3:00 PM **Session Chair: Tsz-Ho Kwok | Session Co-chair: Sam Anand**

| | | |
|----------------|--|---|
| NAMRC Paper 9 | Michael Borish and Charles Wade | A GPU-based Approach for Path Planning Optimization via Travel Length Reduction |
| NAMRC Paper 23 | Yunlong Tang, Guoying Dong, Yi Xiong and Qiusen Wang | Data- driven Design of Customized Porous Lattice Sole Fabricated by Additive Manufacturing |
| NAMRC Paper 26 | Vysakh Venugopal, Nathan Hertlein and Sam Anand | Multi-Material Topology Optimization Using Variable Density Lattice Structures for Additive Manufacturing |
| NAMRC Paper 30 | Halil Tetik, Keren Zhao, Nasrullah Shah and Dong Lin | 3D Freeze- printed Cellulose-based Aerogels: Obtaining Truly 3D Shapes, and Functionalization with Cross-linking and Conductive Additives |
| NAMRC Paper 37 | Nathan Decker and Qiang Huang | Optimizing the Expected Utility of Shape Distortion Compensation Strategies for Additive Manufacturing |

Tuesday, June 22 **NAMRC Track 5 Smart Manufacturing – Processes, Systems and Integration 1**
1:30 PM – 3:00 PM **Session Chair: Peng Wang | Session Co-chair: Carlos Escobar**

| | | |
|-----------------|---|--|
| NAMRC Keynote | S Jack Hu | Industrial Internet of Things and smart, personalized manufacturing |
| NAMRC Paper 132 | Carlos Escobar, Debejyo Chakraborty, Megan McGovern, Daniela Macias and Ruben Morales-Menedez | Quality 4.0 – Green Belt, Black Belt and Master Black Belt Curricula |
| NAMRC Paper 117 | Bhaskar Botcha, Ashif Sikandar Iquebal and Satish Bukkapatnam | Efficient Manufacturing Processes and Performance Qualification via Active Learning: Application to a Cylindrical Plunge Grinding Platform |

Tuesday, June 22 **NAMRC Track 6 Industrial Applications and Manufacturing Education**
1:30 PM – 3:00 PM **Session Chair: Brian Paul | Session Co-chair: Albert Shih**

| | | |
|-------------------------|---|---|
| NAMRC Keynote Paper 133 | Brian Paul, Laine Mears and Albert Shih | Teaching Manufacturing Processes from an Innovation Perspective |
| NAMRC Paper 84 | Suryanarayanan Gunasekar, Scott Kerner, Matthew Krugh and Laine Mears | Wearable Shear Force-Sensing for Augmenting Manual Hose Connections in an Automotive Assembly |
| NAMRC Paper 81 | John Hart, Dawn Wendell, John Liu, John Lewandowski, Miguel Funes and Albert Shih | Teaching Manufacturing Processes Using a Flipped Classroom Model |

Tuesday, June 22 1:30 PM – 3:00 PM **MSEC 01-01-02 Advances in Metal Additive Manufacturing Processes 2**
Session Chair: Ho Yeung | Session Co-chair: Wenchao Zhou

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| MSEC2021-63263 | Basil Paudel, Garrett Marshal and Scott Thompson | Monitoring and Modeling of Ti-6Al-4V Thin Wall Temperature Distribution During Blown Powder Laser Directed Energy Deposition |
| MSEC2021-63632 | Hanyu Zhu, Nanzhu Zhao, Sandeep Patil, Amit Bhasin and Wei Li | A Method to Predict Fatigue Life of Additively Manufactured Metallic Parts |
| MSEC2021-63841 | Lauren Heinrich, Thomas Feldhausen, Kyle Saleeby, Christopher Saldana and Thomas Kurfess | Prediction of Thermal Conditions of DED with FEA Metal Additive Simulation |
| MSEC2021-63877 | Bilal Taha, Sandeep Patil and Brian Dennis | Design and Manufacturing of Topology Optimized Heat Sinks Made of Copper Using 3D Printing |

Tuesday, June 22 1:30 PM – 3:00 PM **MSEC 04-01-02 Smart Manufacturing for Resilient and Environmentally Efficient Systems 2**
Session Chair: Julius Schoop | Session Co-chair: Nancy Diaz-Elsayed

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| MSEC2021-63460 | David Adeniji and Julius Schoop | In-Situ Calibrated Digital Process Twin Models for Resource Efficient Manufacturing |
| MSEC2021-63822 | Lei Di, Gaurav Manish Shah, Yiran Yang and Weiwei Cui | Greenhouse Gas Emission Analysis of Integrated Production-Inventory-Transportation Supply Chain Enabled by Additive Manufacturing |
| MSEC2021-63966 | Hao-Yu Liao, Willie Cade and Sara Behdad | Forecasting Repair and Maintenance Services of Medical Devices Using Support Vector Machine |

Tuesday, June 22 1:30 PM – 3:00 PM **MSEC 05-02-02 Innovations in the Design and Control of Manufacturing Machines and Equipment (ASME-JSME Joint Symposium) 2**
Session Chair: Chandra Nath | Session Co-chair: Martin Jun

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|----------------|---|---|
| MSEC2021-60227 | Weitao Li, Liping Wang and Guang Yu | Time Domain Study on the Construction Mechanism of Milling Stability Lobe Diagrams with Multiple Modes |
| MSEC2021-63302 | Kotaro Mori, Iwao Yamaji, Daisuke Kono, Atsushi Matsubara, Takehiro Ishid, Yuki Kaitani, Eiji Higashi and Taisuke Urakami | Influence of Contact Positioning of Pivot Support on Machining Vibration |
| MSEC2021-63615 | Christopher Martin, Alexandrina Unataroiu, Kemu Xu and S M Mahbobur Rahman | A Study of the Efficacy of Flame Electrical Resistance for Standoff Measurements During the Oxyfuel Cutting Process |

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| MSEC2021-63617 | Prahar Bhatt, Rishi Malhan, Pradeep Rajendran, Aniruddha Shembekar and Satyandra Gupta | Trajectory-Dependent Compensation Scheme to Reduce Manipulator Execution Errors for Manufacturing Applications |
| MSEC2021-63693 | Yesiliang Qiu, Janet Dong and Caroline "Niki" Harrison Moretto | Platform Development of Tick Collection Robot |
| Tuesday, June 22 1:30 PM – 3:00 PM | MSEC 06-02 Tool Wear Mechanisms, Measurements, and Monitoring Session Chair: Rui Liu Session Co-chair: Steven Liang | |
| MSEC2021-62021 | Ben Stuhr and Rui Liu | A Flexible Similarity Based Algorithm for Tool Condition Monitoring |
| MSEC2021-63468 | Zongwei Ren, Zhenglong Fang, Takuhiro Arakane, Toru Kizaki, Yannan Feng, Junshi Kugo, Tsukasa Nishikawa and Eiji Nabata, Naohiko Sugita | Predictions of Cutting Force and Tool Wear in Gear Power Skiving |
| MSEC2021-63510 | Patrick Kwon, Ryan Khawarizmi, Dave Kim, Md Abdulla Sayem and Yinyin Han | The Effect of Carbon Fiber Types on Tool Wear During Edge Trimming of 0°, 45°, 90°, and 135° carbon Fiber Reinforced Plastic Laminates |
| MSEC2021-63573 | Guisen Wang, Fuzhu Han and Liang Zhu | Evolution of White Layer and Residual Stress in Electrical Discharge Machining |
| MSEC2021-63576 | Kuo Liu, Yongqing Wang, Mengmeng Niu, Honghui Wang, Mingrui Shen and Bo Qin | Tool Condition Monitoring Method Based on Generative Adversarial Network for Data Augmentation |
| Tuesday, June 22 1:30 PM – 3:00 PM | MSEC 07-06-02 Industrial Internet, Cloud and Digital Twins in the Wake of COVID-19 (2) Session Chair: Yujie Chen Session Co-chair: Xi (Vincent) Wang | |
| MSEC2021-63647 | Chuan Xiao, Chun Zhao, Yue Liu and Lin Zhang | A FPGA-Based Cloud-Edge Collaboration Platform in Cloud Manufacturing |
| MSEC2021-63700 | Xiaobin Li and Chao Yin | A Cloud Solution for Service Oriented Workshop Management |
| MSEC2021-63857 | Xiaobin Li and Chao Yin | An OSGi-Based Adaptation Access of Machine Tool in the Cloud Manufacturing Environment |
| MSEC2021-64438 | Huiyue Huan and Xun Xu | Edge Computing Enhanced Digital Twins for Smart Manufacturing |

[Back to Conference Schedule](#)

Wednesday, June 23, 2021

| Time* | Event | Organizers |
|-------------------------|--|-----------------|
| 10:50 AM to 11:20 AM | Keynote Session 3 (Pre-Recorded Event) by Sarah Kleinbaum, Program Manager for Materials Technology in the Department of Energy's (DOE) Vehicle Technologies Office | Dr. Sam Anand |
| 11:25 AM to 11:55 AM | Keynote Session 4 (Live Event) by Kevin Eustace, Senior Vice President and General Manager, Engineering and Consulting Services, Siemens Digital Industry Software (Siemens Digital Industry) | Dr. Sam Anand |
| 12:00 PM to 1:00 PM | Pre-recorded Technical Presentations <ul style="list-style-type: none"> ▪ Student Competition ▪ NAMRC Track 1- Manufacturing Systems Session 2 ▪ NAMRC Track 2- Manufacturing Processes Session 2 ▪ MSEC 01-05 Smart Additive Manufacturing ▪ MSEC 05-02-03 Innovations in the Design and Control of Manufacturing Machines and Equipment (ASME-JSME Joint Symposium) 3 ▪ MSEC 06-03 Advances in Finishing Processes: Hard Machining, Grinding, and Abrasive Finishing ▪ MSEC 08-03-01 Advances in Micro- and Nano-scale Additive Manufacturing 1 | |
| 12:00 PM to 1:30 PM | Blue Sky Competition- I (Live Event) | Dr. Pfefferkorn |
| 1:00 PM to 1:30 PM | Live discussion for Technical Presentations | |
| 1:30 PM to 2:30 PM | Pre-recorded Technical Presentations <ul style="list-style-type: none"> ▪ Student Competition ▪ NAMRC Track 3- Material Removal Session 2 ▪ NAMRC Track 4- Additive Manufacturing Session 2 | |

| | | |
|---------------------------|--|------------------------|
| | <ul style="list-style-type: none"> ▪ NAMRC Track 5- Smart Manufacturing and Cyber Physical Systems Session 2 ▪ MSEC 01-02 Advances in Bioinspired Additive Manufacturing ▪ MSEC 06-04 Advances in Processing of Polymers and Polymer Composites ▪ MSEC 07-05 Robotic Manufacturing and Assembly in Smart Factories ▪ MSEC 08-03-02 Advances in Micro- and Nano-scale Additive Manufacturing 2 | |
| 1:30 PM to 3:00 PM | Blue Sky Competition- II (Live Event) | Dr. Pfefferkorn |
| 2:30 PM to 3:00 PM | Live discussion for Technical Presentations | |
| 3:10 PM to 4:40 PM | NSF Early Career Forum (Live Event) | Dr. Linke, Dr. Z J Pei |

Keynote Speaker

Sarah Kleinbaum

Program Manager for Materials Technology in the Department of Energy's (DOE) Vehicle Technologies Office

Sarah Kleinbaum is the Program Manager for Materials Technology in the Department of Energy's Vehicle Technologies Office. The Materials Technology program funds research on advanced materials and processing technologies to increase fuel economy and decrease greenhouse gas emissions of vehicles. The team assesses the materials related challenges facing the automotive industry to increase efficiency in vehicles and



sponsors technical research projects including academia, national laboratory, and industry partners to address those challenges. Sarah also serves as co-chair of the USDRIVE Materials Tech Team which is a public-private partnership between Ford, GM, Stellantis, and US DOE. Prior to her work at the Department of Energy, Sarah managed the Materials Analysis and Approval Laboratory for North America at Whirlpool Corp. Sarah received both her Masters of Science and Bachelor's degree in Materials Engineering from Purdue University.

Title: Decarbonizing the Transportation Sector through Advanced Materials

Abstract: Reducing the weight of a vehicle by 10% results in a 6-8% improvement in fuel economy because it takes less energy to move a lighter object. Electric vehicles also benefit from light weighting because fewer batteries are needed to achieve a given range. Advanced high strength steel and aluminum are being used in increasing amounts by the automotive industry for this reason. Polymer composites and magnesium offer even greater weight savings but face significant challenges that limit implementation. Multi-functional materials also provide new opportunities for efficiency in both electric and conventional combustion vehicles. The Department of Energy funds research to advance materials technology and address the technical challenges that prevent the widespread use of lightweight, multi-functional materials to enable more fuel-efficient vehicles.

Keynote Speaker

Kevin Eustace

Senior Vice President and General Manager, Engineering and Consulting Services, Siemens Digital Industry Software (Siemens Digital Industry)



Kevin is responsible for driving engineering and consulting services worldwide that combines consulting expertise on PLM, Manufacturing and Digitalization processes and value definition together with the application of our software on customer projects and strategic initiatives.

Kevin has considerable experience in working with strategic deployments of Siemens DI Software Solutions world-wide. He has expertise and knowledge of a broad range of engineering, manufacturing and data management disciplines and continues to be involved in both technical and management review boards with Siemens DI Software customers across all industries.

Kevin holds a Bachelor's degree and Master of Science in Aeronautical Engineering from Imperial College, University of London. He also has an MBA from University of Cincinnati.

Title: Siemens Industry 4.0 – Digital Enterprise journey from Lean Digital Factory to Factory Digitalization

Abstract: As a leader in both Factory Automation and Industry Software, Siemens is in a unique position to bring these two often separate elements of IT and OT or Virtual and Physical together to enable a true Digital Enterprise and validate key elements and their impact on Plant Productivity.

This presentation will lay out Siemens internal journey starting in 2018 with the initial kickoff of the Lean Digital Factory (LDF) initiative. This Digitalization initiative focused on improving productivity across 30 plants based on defining and validating changes to current processes (e.g. Engineering/Manufacturing Communication, End to End Manufacturing) and introducing new ways of working and new processes/technology (e.g. IOT, Additive Manufacturing, AGV, Advanced Robots). How this initiative was planned and executed, the impact achieved and the lessons learned will be discussed.

After the success of LDF, a new Siemens wide Factory Digitalization (FD) initiative has been launched this year. This will be discussed in terms of leverage of the LDF work and the addition of new elements to take productivity improvement to the next level.



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NSF Manufacturing Blue Sky Competition and SME David Dornfeld Manufacturing Vision Award

Wednesday, June 23, 2021

12:00 PM – 3:00 PM Eastern Time

<https://www.sme.org/aboutsme/awards/blue-sky-competition/>

The aim of this annual competition is to influence the future of manufacturing research and education in the United States through new, visionary ideas of the future. Such visionary ideas are often described as “radical,” “outrageous,” “transformational,” “unconventional,” “convergent,” and “breakthrough.” Presentations should pose grand challenges to be addressed by pursuing the manufacturing research vision, describing the intersections between disparate disciplines necessary to advance that vision. Topical areas should extend beyond the scope of a single investigator and show potential for transformative impact in areas of interest to federal agencies.

2021 Finalists

| Eastern Time | Abstract Title | Abstract Authors |
|----------------------|--|---|
| 12:00 PM to 12:20 PM | Physics Aware Machine Learning Surrogates for Real-Time Digital Twin in Additive Manufacturing | Baskar Ganapathysubramanian; Soumik Sarkar; Aditya Balu; [Iowa State University] |
| 12:20 PM to 12:40 PM | Manufacturing In-Vitro Living Neural Computing Chips for Efficient AI Learning and Computation | Binil Starly [North Carolina State University] |
| 12:40 PM to 1:00 PM | There Is Only One Existential Threat. Let’s Talk About It. | Carly Gayle [International Society for Ecology and Culture]; Carol Handwerker [Purdue University]; Frank Gayle [NIST] |

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|-------------------------------|--|--|
| 1:00 PM to 1:20 PM | Product in a Patient: In Vivo Surgical Manufacturing | Michael McPhail; Juergen Neubauer; David Lott [Mayo Clinic] |
| 1:30 PM to 1:50 PM | Convergent Systems of Systems Manufacturing (Convergent SoS Manufacturing) | Mihaela (Miki) Banu; Albert Shih; Alan I. Taub; Bogden I. Epureanu [University of Michigan] |
| 1:50 PM to 2:10 PM | From Self-Aware to Self-Healing for "Perpetual" Manufacturing | Noel Greis [North Carolina State University] |
| 2:10 PM to 2:30 PM | Self-sensing Smart-connected Products in Smart Manufacturing Systems | Thorsten Wuest [West Virginia University]; Juergen Lenz [INNEO Solutions]; Eric MacDonald [UT El Paso]; Ramy Harik [University of South Carolina] |
| 2:30 PM to 2:50 PM | Lifelike metallic structures using Origami & Compliant Mechanism | Vanshika Singh [University of Tennessee Knoxville]; Suresh Babu [University of Tennessee, Knoxville; Oak Ridge National Laboratory]; Michael Kirka [Oak Ridge National Laboratory] |

Selection Committee: <https://www.sme.org/aboutsme/awards/blue-sky-competition/david-dornfeld-manufacturing-vision-award-selection-committee-members/>

The winner of the 2021 SME David Dornfeld Manufacturing Vision Award will be announced at the SME Awards Ceremony on Thursday, June 24, 2021 at 3:00 PM Eastern Time.

Competition Organizers:

- Professors Frank Pfefferkorn (frank.pfefferkorn@wisc.edu)
- ZJ Pei (zjpei@tamu.edu)
- Tony Schmitz (tony.schmitz@utk.edu)

June 23, 2021 (Wednesday), 3.10 - 4.40 pm ET

Research Professions in Academia, Industry & National Laboratories: An Early Career Forum

Organized by: ASME/MED, and NAMRI/SME

Sponsored by: NSF (providing travel support to students)

Hosted by: The University of Cincinnati, College of Engineering and Applied Science, Ohio

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

Date/ Place: Wednesday, June 23, 2021, afternoon from 3.10 – 4:40 pm ET, online. The forum is held during the co-located manufacturing conferences: the NAMRI/SME 49th North American Manufacturing Research Conference (NAMRC49) and the ASME 2021 International Manufacturing Science and Engineering Conference (MSEC2021).

Agenda (Wednesday, June 23, 2021):

3:10 – 3:55 pm ET: Opening Remarks and Welcome Up to 5-minute spoken introduction by each panelist

3:55 – 4:40 pm ET: Breakout room discussions

Forum Format:

1. Each panelist will introduce themselves and share career advice during the panel session. They have experience in conducting and leading research and engineering projects in academia, government labs, and industrial sectors.
2. Breakout room discussions will follow, where participants can discuss careers in academia, government, and industry. Panelists will discuss topics such as how to search for a job, career management, funding for research, etc. Participants can move between breakout rooms.
3. Participants are encouraged to engage in conversations/ discussions related to their particular/personal interests.

Fee: Free for registered conference participants

Attendance: Open to all registered conference participants;



Mandatory for NSF Travel Grant student applicants

Early Career Forum Chairs:

Barbara S. Linke, Dr.-Ing. habil.

Associate Professor Department of Mechanical and
Aerospace Engineering

University of California Davis, Davis, CA

Email: bslinke@ucdavis.edu

Zhijian (ZJ) Pei, PhD, FASME, FSME

Professor

Department of Industrial and Systems Engineering

Texas A&M University, College Station, TX

Email: zjpei@tamu.edu

The 9 panelists have experience working in academia, government/national labs, and industry. Many of the panelists have experience in more than one of these sectors.

| Breakout room | Panelist | Academia | Government/ National Labs | Industry |
|----------------------|--|-----------------|--------------------------------------|-----------------|
| Room 1 | Hitomi Yamaguchi Greenslet (University of Florida) | X | X | X |
| Room 2 | Jingjing Li (Pennsylvania State University) | X | | X |
| Room 3 | Dale Lombardo (GE Aviation) | | | X |
| Room 4 | Brigid Mullany (University of North Carolina at Charlotte) | X | X | |
| Room 5 | Subramanian Ramalingam (Saint-Gobain Research North America) | | | X |
| Room 6 | Miguel Saez (GM) | | | X |
| Room 7 | Alyssa Sullivan (MxD) | | X | |
| Room 8 | Scott Smith (Oak Ridge National Laboratory) | X | X | |
| Room 9 | Sarah Wolff (Texas A&M University) | X | X | |

Hitomi Yamaguchi, University of Florida

Hitomi Yamaguchi is currently an associate professor in the Department of Mechanical and Aerospace Engineering at the University of Florida. The path that led her to UF includes positions in industry, national laboratories, and academia both inside and outside her native Japan. When she was studying for her master's degree, she interned for three months at the Paul Scherrer Institut in Switzerland. This experience and a previous supervisor inspired her to explore academia. In 1996, she received her doctorate from Utsunomiya University, Japan, and started her professional career as research associate at the University of Tokyo. She soon realized that industrial experience was necessary in order to effectively teach Manufacturing Engineering, and she left the university in 1997 to work as a research engineer at Extrude Hone Corporation in Pennsylvania. After gaining some industrial experience, she returned to her alma mater where she became a research associate and later associate professor. In 2002-2003, she spent her sabbatical working as a researcher abroad at NASA Glenn Research Center in Ohio. She left Utsunomiya University in 2007 and moved to UF.



Her research interests have evolved throughout her career and now include ultra-precision finishing (such as magnetic field-assisted finishing), surface functionalization, and medical-device development. Her work has been published in over 90 refereed journal papers, and she has been granted 8 patents. She has received several awards, including Outstanding Young Engineer awards from JSME in 1995, SME in 2000, and JSAT in 2003. She served as the president of the North American Manufacturing Research Institute of SME for the 2018-2019 term. She is currently the vice chair of the Scientific Technical Committee for Abrasive Processes (STC-G) of CIRP (the International Academy for Production Engineering). In recognition of her contributions, she has been elected as a fellow of both ASME and SME. In addition to her research, she is passionate about working in the areas of Manufacturing Education and Workforce

Development. She is the faculty advisor of the UF chapter of Pi Tau Sigma. She hosts students (from K-12 to university) in her laboratory every summer and has hosted events where professionals can share their experiences in engineering education and career development.

Jingjing Li, Pennsylvania State University

Jingjing Li is an Associate Professor of Industrial and Manufacturing Engineering at the Pennsylvania State University, University Park, USA. She holds a PhD and MA from the University of Michigan, Ann Arbor, an MS from Tsinghua University and a BS from Beihang University, Beijing, China. She worked in General Motors R&D Center as an intern for one year. Her primary research interest focuses on materials processing and characterization, particularly on in-situ material characterization, mechanical behavior, failure analysis, and the effect of microstructure on macroscopic properties with applications in sheet metal forming, joining of dissimilar materials, additive manufacturing, and composite manufacturing. She is an Associate Editor of Journal of Manufacturing Science and Engineering, Manufacturing Letters, and Journal of Manufacturing Processes, and a recipient of the Chao and Trigger Young Manufacturing Engineer Award from the American Society of Mechanical Engineers, NSF CAREER Award, and several best paper awards



Dale Lombardo, General Electric Aviation

Dale Lombardo leads a diverse global team of manufacturing special process technologists for GE Aviation. The GEA Special Process Technology Center links materials to design performance and product safety through special processes including machining, joining, heat treatment, additive, chemistry, composites, and inspection. The SPTC team fulfills a specification, monitoring, and control function for manufacturing of GEA parts. In 1992, Dale graduated from Rensselaer Polytechnic Institute with MSME joined GE Research developing control



strategies for machining as a special process. In 1996, Dale worked for GE Aviation and expanded in-process machining monitoring and diagnostics and led the shot peening special process team. Dale joined GE Power in 2005 as part of an internal manufacturing technology startup organization and expanded into high speed machining and surface treatment and metrology. From 2013 to 2020, Dale led the GE Research Manufacturing Technology team as manager and principal engineer working across GE's products and external engagements in advancing manufacturing.

Brigid Mullany, University of North Carolina at Charlotte

Brigid Mullany received her Bachelor of Engineering Degree and Doctorate in Mechanical Engineering from University College Dublin in Ireland. Upon graduation she received a twoyear EU Marie Curie postdoctoral research position at Carl Zeiss in Germany. In 2004 she joined the Department of Mechanical Engineering and Engineering Science at the University of North Carolina at Charlotte where she is now a Professor and the Associate Dean for Research in the College of Engineering. Her research areas include surface finishing, surface analysis and advanced manufacturing. She received the SME Kuo K Wang Outstanding Young Manufacturing Engineer Award in 2007, and the NSF CAREER award in 2008. She was a Program Director in the Advanced Manufacturing Cluster at the National Science Foundation from 2017-2019. She is a CIRP fellow, the Chair of the CIRP Scientific Technical Committee on Surfaces (STC-S), and the president elect for the North American Manufacturing Research Institute (NAMRI) of SME.



Subramanian Ramalingam, Saint-Gobain Research North America



Dr. Subramanian Ramalingam is a Senior Research Engineer with Saint-Gobain Research North America where he leads projects in the Bonded Abrasives Group on development of new grinding wheels and improvement of processes /testing techniques to better characterize the abrasive grinding performance. Subramanian received his Ph.D. in Materials Science from the Colorado School of Mines in 2013 and a B. S. in Metallurgical and Materials Engineering from National Institute of Technology, Trichy in India. Before joining Saint-Gobain, Subramanian was a Research Fellow at the Colorado School of Mines leading a research project and advising undergraduate students. During his time at Mines, Dr. Ramalingam's research focus has been on processing and characterization of glasses, ceramics and composites. His work on using food waste as raw materials for glass making received widespread media attention and is the basis for several ongoing research projects to find use for the waste as it presents a disposal problem despite having various waste management practices. Subramanian is an active member of the American Ceramic Society and he has authored numerous international journal publications and holds 2 patents with several in process. In his current role, Subramanian is using his strong technical and leadership skills to develop next generation grinding wheels with improved performance and also better understand the structure-property-performance relations to drive future product development efforts.

Miguel Saez, General Motors



Dr. Miguel Saez is currently a researcher for General Motors Research and Development, Manufacturing Systems Research Lab in Warren, Michigan. In his current role, he develops novel industrial robotics and automation solutions to advance the technology used for manufacturing electric vehicles. He holds a Bachelor's Degree in Mechanical Engineering from La Universidad del Zulia, Venezuela and both a Master's Degree in Automotive and Manufacturing and a Ph.D. in Mechanical Engineering

from the University of Michigan, USA. After obtaining his Bachelor's Degree, Miguel led multiple projects developing manufacturing and assembly systems for alternative fuel vehicle programs. During his graduate studies at the University of Michigan, Miguel developed new methods for modeling and control of manufacturing systems for multi-objective optimization of plant floor operations. After graduation, Miguel joined General Motors Research and Development in June 2018 as a researcher. In his current role, Miguel has been able to capitalize on his strong technical and leadership skills to develop new technology in the field of robotics. His work aims to enable coordinated movement of multi-arm systems using artificial vision and force sensing data fusion for robotic assembly operations.

Scott Smith, Oak Ridge National Laboratory

In 2019, Dr. Scott Smith joined Oak Ridge National Laboratory as Senior Distinguished R&D Staff Member in the Energy and Environmental Sciences Directorate. Prior to that he was Professor and Chair of Mechanical Engineering at the University of North Carolina at Charlotte, where he was a faculty member from 1995-2019. During 2012-13 he served as the Assistant Director for Technology at the US Advanced Manufacturing National Program Office in Washington DC. From 2019 – 2020 he served on the MForesight Leadership Council.



He received his PhD from the University of Florida in 1987, his MS from the University of Florida in 1985, and his BSME from Tennessee Technological University in 1983. He has been an engineering researcher and educator for more than 30 years at the University of Florida, and at the University of North Carolina at Charlotte. His teaching and research areas include high-speed machining, process optimization, and machine dynamics. He has taught numerous industrial short courses. He holds 11 patents. He has worked as a consultant on machining and machine tools for

Alcoa, Bell Helicopter, Boeing, Cooper Tire, General Motors, Georgia Pacific, Goodrich, Sikorsky, and many others.

Smith is one of 17 US Fellows of the International Academy for Production Engineering (CIRP), and he is a Fellow of both SME and ASME. Smith served as the Chair of the Manufacturing Engineering Division of ASME, and as President of the North American Manufacturing Research Institute of SME. He served as Chair of the SME International Awards and Recognition Committee, as member of the CIRP Council, as Chair of the CIRP Editorial Committee, and as Chair of the CIRP Machines Technical Committee. He was a founder of both of Manufacturing Laboratories, Inc., and BlueSwarf LLC. He is author of more than 100 technical papers, and he is co-author of the books *Machining Dynamics: Frequency Response to Improved Productivity* and *Mechanical Vibrations: Modeling and Measurement*. Smith has received numerous awards including the ASME William T. Ennor Award, the ASME Blackall Award, the NAMRI/SME S.M. Wu Research Implementation Award, the SME Education Award, the AMT Charles F. Carter Advancing Manufacturing Award, the American Helicopter Society Pinckney Award, an R&D 100 Award, and the NAMRI/SME Lifetime Service Award.

Alyssa Sullivan, MxD



Alyssa Sullivan is the Senior Director of External Relations at MxD, the nation's digital manufacturing institute and the National Center for Cybersecurity in Manufacturing as designated by the U.S. Department of Defense. MxD, which stands for "manufacturing times digital," helps manufacturers build every part better than the last using digital technologies.

Alyssa manages MxD's entire public-facing portfolio including media relations, digital presence, messaging, branding, and corporate events. Prior to joining MxD in 2014, Alyssa was the Chief of Staff to the head of energy efficiency programs at the U.S. Department of Energy where she completed

a Presidential Management Fellowship. She has also held roles at the International Energy Agency, the U.S. House of Representatives, and the U.S. Office of Management and Budget. Alyssa has a master's in American Government and a bachelor's in Government and Spanish from Georgetown University.

Sarah Wolff, Texas A&M University



Dr. Sarah Wolff is an assistant professor in the Industrial and Systems Engineering department at Texas A&M as of Fall 2019. She focuses on manufacturing processing, particularly monitoring additive manufacturing of metallic and composite materials with high-speed cameras and at the small scale. She completed her PhD in mechanical engineering at Northwestern University in 2018 with her thesis work on understanding the directed energy deposition additive manufacturing process. For the following year, she was an Enrico Fermi fellow at Argonne National Laboratory where she built a directed energy deposition system and used high energy X-rays at the Advanced Photon Source to monitor additive manufacturing processes in real time.

Presentation Schedule for Wednesday, June 23, 2021-

Wednesday, June

23

NAMRC Student Competition 1

12:00 PM – 1:30

Session Chair: Xi Vincent Wang | Session Co-chair: Tony Schmitz

PM

| | | |
|-----------------|--|--|
| NAMRC Paper 80 | Scott Kerner, Suryanarayanan Gunasekar, Rishabh Vedant, Matthew Krugh and Laine Mears | Parametrization of Manual Work in Automotive Assembly for Wearable Force Sensing |
| NAMRC Paper 4 | Timothy No, Michael Gomez and Tony Schmitz | Contributions of Scanning Metrology Uncertainty to Milling Force Prediction |
| NAMRC Paper 16 | Xiao Zhang, Weijun Shen, Vignesh Suresh, Jakob Hamilton, Li- Hsin Yeh, Xuepeng Jiang, Zhan Zhang, Qing Li, Beiwen Li, Iris V. Rivero and Hantang Qin | In-situ Monitoring of Direct Energy Deposition via Structured Light System and its Application in Remanufacturing Industry |
| NAMRC Paper 113 | Md Moinuddin Shuvo and Guha Manogharan | Novel Riser Designs via 3D Sand Printing to Improve Casting Performance |
| NAMRC Paper 92 | Abdullah Al Mamun, Chenang Liu, Chen Kan and Wenmeng Tian | Real-time Process Authentication for Additive Manufacturing Processes based on In-situ Video Analysis |

Wednesday, June

23

NAMRC Track 1 Manufacturing Systems 2

12:00 PM – 1:30

Session Chair: Laine Mears | Session Co-chair: Matthew Krugh

PM

| | | |
|-----------------|---|---|
| NAMRC Paper 103 | Mohammed Shafae, Lee Wells and Jaime Camelio | Modeling in Process Machining Data Using Spatial Point Cloud vs. Time Series Data Structures |
| NAMRC Paper 124 | Miguel Saez and Patrick Spicer | Fixtureless Assembly in the Automotive Industry: A Body Closure Case Study (Presentation Only) |
| NAMRC Paper 88 | Behin Elahi | Manufacturing Plant Layout Improvement: Case Study of a High Temperature Heat Treatment Tooling Manufacturer in Northeast Indiana |
| NAMRC Paper 112 | Farhang Momeni and Jun Ni | Quality Can Improve as Productivity Increases: Machining as Proof |
| NAMRC Paper 24 | Waleed Ahmed, Hussien Hegab, Atef Mohany and Hossam Kishawy | Sustainability Assessment of Difficult-to-Cut Materials Using Rotary Tools: A Step Towards Sustainable Machining Environment |

Wednesday, June

23

NAMRC Track 2 Manufacturing Processes 2

12:00 PM – 1:30

Session Chair: Rohan Shirwaiker | Session Co-chair: Sangkee Min

PM

| | | |
|----------------|--|--|
| NAMRC Paper 13 | Abishek B. Kamaraj, Natalie Reed and Murali Sundaram | Effect of Ultra-High Pulse Frequency on the Resolution in the Electrochemical Deposition of Nickel |
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| | | |
|-----------------|---|--|
| NAMRC Paper 101 | Davide Campanella, Gianluca Buffa and Livan Fratini | A Two Steps Lagrangian-Eulerian Numerical Model for The Simulation of Explosive Welding of Three Dissimilar Materials Joints (Presentation Only) |
| NAMRC Paper 18 | Andreas Hetzel, Marion Merklein and Michael Lechner | Influence of A Local Short-Term Heat Treatment on The Formability of Orbital Formed Functional Components |
| NAMRC Paper 130 | Justin Morrow, Francis Deck, Aditya Nagaraj and Sangkee Min | Evaluating Sub-Surface Stress of Precision Machined Single-Crystal Sapphire with Raman Spectroscopy (Presentation Only) |
| NAMRC Paper 127 | John Agapiou | Filling Friction Stir Welding In-Process Exit Holes in Copper Squirrel Cage Rotors for Electric Motors |

**Wednesday, June 23
12:00 PM – 1:30 PM**
MSEC 01-05 Smart Additive Manufacturing
 Session Chair: Chinedum Okwudire | Session Co-chair: Prahalada Rao

| | | |
|----------------|---|--|
| MSEC2021-68940 | David Rosen | Smart Additive Manufacturing Process Chains for Part Production and Design |
| MSEC2021-63623 | Juan Diego Toscan, Sahand Hajifar, Christian Oswaldo Segura, Luis Javier Segura and Hongyue Sun | Deformation Analysis of 3-D Printed Metacarpophalangeal and Interphalangeal Joints via Transfer Learning, |
| MSEC2021-63870 | Keval Ramani, Ehsan Malekipour and Chinedum Okwudire | Toward Intelligent Online Scan Sequence Optimization for Uniform Temperature Distribution in LPBF Additive Manufacturing |

**Wednesday, June 23
12:00 PM – 1:30 PM**
MSEC 05-02-03 Innovations in the Design and Control of Manufacturing Machines and Equipment (ASME-JSME Joint Symposium) 3
 Session Chair: Atsushi Matsubara | Session Co-chair: Naruhiro Irino

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| MSEC2021-63199 | Daisuke Kono and Tomoyuki Osumi | A Friction Fluctuation Model of Rolling Guideways |
| MSEC2021-63720 | Shotaro Ogawa, Takuhiro Tsukada, Katsuki Koto and Yasuhiro Kakinuma | Enhancement of Force Control Performance of Macro-Micro System Based Polishing Robot with Gravity Compensation |
| MSEC2021-63809 | Nobutoshi Ozaki, Shota Matsui, Toshiki Hirogaki, and Eiichi Aoyama | Cutting State Estimation via Chatter Mark on End Milled Surface and Analysis of Its Formation Mechanism Using Voxel Model Simulation |
| MSEC2021-63721 | Katsuki Koto, Takuhiro Tsukada, Shotaro Ogawa and Yasuhiro Kakinuma | Performance Evaluation of Robot Polishing in Macro-Micro System Based Polishing Robo |
| MSEC2021-65062 | Yoshitaka Morimoto, Akio Hayashi, Yoshiyuki Kaneko, Naohiko Suzuki, Akane Ishizuka and Narimasa Ueda | Study on Non-Axisymmetric 3-D Curved Surface Turning by Driven-Type Rotary Tool Synchronized with Spindle |

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| Wednesday, June 23 | | |
| 12:00 PM – 1:30 PM | | |
| MSEC 06-03 Advances in Finishing Processes: Hard Machining, Grinding, and Abrasive Finishing | | |
| Session Chair: Hitomi Yamaguchi Greenslet Session Co-chair: Changsheng Guo | | |
| MSEC2021-59981 | Xin Li, Xueping Zhang and Rajiv Shivpuri | Microstructure Alteration in the High-Speed Machining of Titanium Alloy Involved with Tool Wear and Cryogenic Condition |
| MSEC2021-63535 | Jin Zhang and Fuzhu Han | High-Speed EDM Milling Using Rotating Short Arcs Under Composite Field |
| MSEC2021-63712 | Yun Huang, Shaochuan Li, Guijian Xiao, Benqiang Chen, Yi He, Wenxi Wang and Kun Zhou | Experimental Study on the Effect of Surface Integrity on Fatigue Performance of Aero-Engine Blade |
| MSEC2021-63805 | Wolfgang Lortz and Radu Pavel | New Perspectives Regarding the Chip Formation Process of Ti-6Al-4V |
| Wednesday, June 23 | | |
| 12:00 PM – 1:30 PM | | |
| MSEC 08-03-01 Advances in Micro- and Nano-scale Additive Manufacturing 1 | | |
| Session Chair: Sourabh Saha Session Co-chair: Brian Giera | | |
| MSEC2021-72956 | Jonathan Hopkins | Manufacturing Micro-Granular Crystals and Other Advanced Microstructures Using Optical Tweezers |
| MSEC2021-63929 | Andriy Sherehiy, Andres Montenegro, Danming Wei and Dan Popa | Adhesive Deposition Process Characterization for Microstructure Assembly |
| MSEC2021-63942 | Olalekan Olowo, Ruoshi Zhang, Zhong Yang, Brian Goulet and Dan Popa | Organic Piezoresistive Robotic Skin Sensor Fabrication, Integration and Characterization |
| Wednesday, June 23 | | |
| 1:30 PM – 3:00 PM | | |
| NAMRC Student Competition 2 | | |
| Session Chair: Dale Lombardo Session Co-chair: Peng Wang | | |
| NAMRC Paper 51 | Karl Schuchard, Abhay Jijode, Vincent Willard, Bruce Anderson, Pierre Grondin, Behnam Pourdeyhimi and Rohan Shirwaiker | Fabrication of Drug-Loaded Ultrafine Polymer Fibers via Solution Blowing and their Drug Release Kinetics |
| NAMRC Paper 19 | Aaron Cornelius, Jaydeep Karandikar, Michael Gomez and Tony Schmitz | A Bayesian Framework for Milling Stability Prediction and Reverse Parameter Identification |
| NAMRC Paper 38 | Christopher Henson, Nathan Decker and Qiang Huang | A Digital Twin Strategy for Major Failure Detection in Fused Deposition Modeling Processes |
| NAMRC Paper 21 | Matthew Russell, Evan King, Chadwick Parrish and Peng Wang | Stochastic Modeling for Tracking and Prediction of Gradual and Transient Battery Performance Degradation |
| NAMRC Paper 54 | Nathan Hertlein, Philip Buskohl, Andrew Gillman, Kumar Vemaganti and Sam Anand | Generative Adversarial Network for Early-Stage Design Flexibility in Topology Optimization for Additive Manufacturing |

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| Wednesday, June 23 | | |
| 1:30 PM – 3:00 PM | | |
| NAMRC Track 3 Material Removal 2 | | |
| Session Chair: N Arunachalam Session Co-chair: Zhaoyan Fan | | |
| NAMRC Paper 45 | R Vignesh and N Arunachalam | Design and Development of Spiral Grooved Grinding Wheel and their Influence on the Performance of Vertical Surface Grinding Process |
| NAMRC Paper 60 | Leonardo Rosa Ribeiro Da Silva, Felipe dos Anjos Rodrigues Campos, Wisley Falco Sales and Alisson Rocha Machado | Evaluation of the Tool Wear in the Turning Process of INCONEL 718 Using PCD Tools |
| NAMRC Paper 46 | J Rajaguru and N Arunachalam | Effect of Ultrasonic Vibration on the Performance of the Deep Hole Drilling Process |
| NAMRC Paper 94 | Eddie Taewan Lee, Zhaoyan Fan and Burak Sencer | Estimation of CBN Grinding Wheel Condition Using Image Sensor |
| NAMRC Paper 48 | Deep Singh, N Arunachalam and D S Srinivasu | A Novel Iterative- Based Field Search Technique for Roundness Evaluation |
| Wednesday, June 23 | | |
| 1:30 PM – 3:00 PM | | |
| NAMRC Track 4 Additive Manufacturing 2 | | |
| Session Chair: Frank Pfefferkorn Session Co-chair: Mathew Kuttolamadom | | |
| NAMRC Paper 34 | Stefan Ball, Milad Ghayoor, Somayeh Pasebani and Ali Tabei | Statistical Analysis of Porosity and Process Parameter Relationships in Metal Additive Manufacturing |
| NAMRC Paper 33 | James Bevis, Shane Dunlavy and Rodrigo Martinez-Duarte | Development and Preliminary Validation of a Robocasting Platform for the Additive Manufacturing of a Composite Paste Towards the Fabrication of Complex Geometries of Porous Tungsten Carbide |
| NAMRC Paper 121 | Michael Liu, Abhishek Kumar, Satish Bukkapatnam and Mathew Kuttolamadom | A Review of the Anomalies in Directed Energy Deposition (DED) Processes & Potential Solutions - Part Quality & Defects |
| NAMRC Paper 40 | Kandice S. B. Ribeiro, Fábio E. Mariani, Henrique T. Idogava, Gustavo C. da Silva, Zilda C. Silveira, Milton S. F. de Lima and Reginaldo T. Coelho | Evaluation of Laser Polishing as Post-Processing of Inconel 625 Produced by Directed Energy Deposition |
| NAMRC Paper 125 | Marcus Jackson, Aishwarya Deshpande, Aaron Kim and Frank Pfefferkorn | A Study of Particle Size Metrics Using Non-Spherical Feedstock for Metal Additive Manufacturing |
| Wednesday, June 23 | | |
| 1:30 PM – 3:00 PM | | |
| NAMRC Track 5 Smart Manufacturing – Processes, Systems and Integration 2 | | |
| Session Chair: Ahmed El-Ghannam Session Co-chair: Hantang Qin | | |
| NAMRC Paper 11 | Ahmed El-Ghannam, Sujithra Chandrasekaran and Farjana Sultana | Mechanism of Epitaxial Growth of Silica Nanowires Reinforcing Agent on Porous Sic Scaffold |
| NAMRC Paper 12 | Li Chen, Jing Huang and Qing Chang | Data-Enabled Real-Time Molding for Production Systems with Variable Cycle Time |

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| NAMRC Paper 128 | Russell Waddell and Taylor Fry | The Cheaply Connected Factory: A Brief Evaluation of Consumer Sensors and Hardware Deployed in Industrial Applications |
| NAMRC Paper 17 | Weijun Shen, Xiao Zhang, Xuepeng Jiang, Li-Hsin Yeh, Zhan Zhang, Qing Li, Beiwen Li and Hantang Qin | Surface Extraction from Micro-Computed Tomography Data for Additive Manufacturing |
| NAMRC Paper 118 | Yanglong Lu and Yan Wang | Machine Fault Diagnosis of Fused Filament Fabrication Process with Physics-Constrained Dictionary Learning |

Wednesday, June 23

1:30 PM – 3:00 PM

MSEC 01-02 Advances in Bioinspired Additive Manufacturing

Session Chair: Xiangjia (Cindy) Li | Session Co-chair: Yang Yang

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| MSEC2021-60675 | Benjamin Perelman and Vishal Sharma | Assessing the Mechanical Properties of 3d Printed Bio-Inspired Structures and Integrating the Structures into a Product |
| MSEC2021-60894 | Brandon Bethers and Yang Yang | Computational Study of Reinforcement Mechanisms of Cuttlefish Bone Inspired Structure for 3d Printing |
| MSEC2021-61050 | Dylan Joralmon, Evangeline Amonoo, Yizhen Zhu and Xiangjia Li | Magnetic Field Assisted 3d Printing of Limpet Teeth Inspired Polymer Matrix Composite With Compression Reinforcement |
| MSEC2021-63493 | Zipeng Guo, Lu An, Sushil Lakshmanan, Jason Armstrong, Shenqiang Ren and Chi Zhou | Additive Manufacturing of Porous Ceramics With Foaming Agent |

Wednesday, June 23

1:30 PM – 3:00 PM

MSEC 06-04 Advances in Processing of Polymers and Polymer Composites

Session Chair: Felicia Stan | Session Co-chair: Anasuya Sahoo

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|----------------|---|---|
| MSEC2021-62311 | Carlos Javier Rodriguez Mondejar, Alvaro Rodriguez-Prieto and Ana Maria Camacho | Estimation of Maximum Flow Length for Cf-Peek Overmolded Grid Structures Using the Finite Element Method |
| MSEC2021-63499 | Felicia Stan, Ionut-Laurentiu Sandu, Adriana-Madalina Turcanu, Nicoleta-Violeta Stanciu and Catalin Fetecau | The Influence of Carbon Nanotubes and Reprocessing on Morphology and Properties of High-Density Polyethylene/carbon Nanotube Composites |
| MSEC2021-63821 | Fabrizio Quadrini, Daniele Santoro, Leandro Iorio and Loredana Santo | Conical Thermoplastic Composite Anisogrid Lattice Structure by Innovative Out-of-Autoclave Molding Process |
| MSEC2021-64002 | Asma Ul Hosna Meem, Kyle Rudolph, Allyson Cox, Austin Andwan, Timothy Osborn and Robert Lowe | Impact of Process Parameters on the Tensile Properties of Dlp Additively Manufactured Elast-Blk 10 Uv-Curable Elastomer |
| MSEC2021-64039 | Weiheng Xu, Dharnedar Ravichandran, Sayli Jambhulkar, Yuxiang Zhu and Kenan Song | Fabrication of Multilayered Polymer Composite Fibers for Enhanced Functionalities |

| Wednesday, June 23 1:30 PM – 3:00 PM | | |
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| MSEC 07-05 Robotic Manufacturing and Assembly in Smart Factories Session Chair: Azadeh Haghighi Session Co-chair: Bitao Yao | | |
| MSEC2021-62468 | Yunbo Zhang, Wenhao Yang and Qin Qin Xiao | An Augmented-Reality Based Human-Robot Interface for Robotics Programming in the Complex Environment |
| MSEC2021-63670 | Jared Flowers and Gloria Wiens | Collaborative Robot Risk of Passage Among Dynamic Obstacles |
| MSEC2021-63687 | Danming Wei, Andriy Sherehiy, Alireza Tofangchi, Mohammad Hossein Saadatze, Dan Popa, Keng Hsu and Moath Alqatamin | Precision Evaluation of Nexus, a Custom Multi-Robot System for Microsystem Integration |
| MSEC2021-63787 | Azadeh Haghighi, Abdullah Mohammed and Lihui Wang | Energy Efficient Multi-Robotic 3d Printing for Large-Scale Construction – Framework, Challenges, and a Systematic Approach |
| MSEC2021-64512 | Yang Hu, Yalin Wang, Feng Xu, Bitao Yao, Wenjun Xu and Hao Feng | Two-Dimensional Image Based Product Connector Recognition for Robotic Disassembly in Remanufacturing |
| Wednesday, June 23 1:30 PM – 3:00 PM | | |
| MSEC 08-03-02 Advances in Micro- and Nano-scale Additive Manufacturing 2 Session Chair: Brian Giera Session Co-chair: Nilabh Roy | | |
| MSEC2021-60255 | Rushil Pingali and Sourabh Saha | Reaction-Diffusion Modeling of Photopolymerization During Femtosecond Projection Two-Photon Lithography |
| MSEC2021-63803 | Dilan Ratnayake, Alexander Curry, Chuang Qu, John Usher and Kevin Walsh | Characterizing the Conductivity of Aerosol Jet Printed Silver Features on Glass |
| MSEC2021-63985 | Obehi Dibua, Chee Foong and Michael Cullinan | Advances in Nanoparticle Sintering Simulation: Multiple Layer Sintering and Sintering Subject to a Heat Gradient |
| MSEC2021-64058 | Byoungdo Lee, Weishen Chu and Wei Li | The Cooling Rate Effect on Graphene Synthesis in Low Pressure Chemical Vapor Deposition |
| MSEC2021-64048 | Joshua Grose, Obehi Dibua, Dipankar Behera, Chee Foong and Michael Cullinan | Simulation and Characterization of Nanoparticle Thermal Conductivity for a Microscale Selective Laser Sintering System |

[Back to Conference Schedule](#)

Thursday, June 24, 2021

| Time* | Event | Organizer |
|-------------------------|--|---------------|
| 10:50 AM to 11:20 AM | Keynote Session 5 (Pre-Recorded Event) by Dr.-Ing. Christian Brecher, Ordinary Professor for Machine Tools at the Laboratory for Machine Tools and Production Engineering (WZL) of the RWTH Aachen & Director of the Department for Production Machines at the Fraunhofer Institute for Production Technology IPT | Dr. Sam Anand |
| 11:25 AM to 11:55 AM | Keynote Session 6 (Live Event) by Dr. Robert Ivester, Acting MEP Director and the Deputy Director of the Hollings Manufacturing Extension Partnership (MEP) Program at the National Institute of Standards & Technology (NIST) | Dr. Sam Anand |
| 12:00 PM to 1:00 PM | <p>Pre-recorded Technical Presentations</p> <ul style="list-style-type: none"> ▪ NAMRC Track 4- Additive Manufacturing Session 3 ▪ NAMRC Track 5- Smart Manufacturing and Cyber Physical Systems Session 3 ▪ MSEC 01-03 Additive Manufacturing with Functional Polymers, Multi-material Structures and Composites ▪ MSEC 02-01 Advanced Materials Manufacturing ▪ MSEC 03-01-01 Advances in Biomanufacturing of Tissue-Engineered Scaffolds and Organs 1 ▪ MSEC 05-03-01 Advanced Machining and Metrology for Smart Manufacturing Technologies (ASME-JSME Joint Symposium) 1 ▪ MSEC 06-06-01 Advances in Lightweight and Dissimilar Materials Joining 1 ▪ MSEC 07-07-01 Changeable, Transformable Manufacturing & Distributed Green Supply Chains in Pandemic Recovery Efforts 1 | |

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|--------------------------------|---|-----------------|
| 12:00 PM to 1:30 PM | Federal Agencies Perspective on Advanced Manufacturing (Live Event) | Dr. Pfefferkorn |
| 1:00 PM to 1:30 PM | Live discussion for Technical Presentations | |
| 1:30 PM to 2:30 PM | Pre-recorded Technical Presentations <ul style="list-style-type: none"> ▪ NAMRC Track 2- Manufacturing Processes Session 3 ▪ NAMRC Track 4- Additive Manufacturing Session 4 ▪ NAMRC Track 5- Smart Manufacturing and Cyber Physical Systems Session 4 ▪ MSEC 01-04-01 Computational Methods and Process Planning for Additive Manufacturing 1 ▪ MSEC 03-01-02 Advances in Biomanufacturing of Tissue-Engineered Scaffolds and Organs 2 ▪ MSEC 04-02 Advances in Sustainable Manufacturing Processes and Systems ▪ MSEC 06-08 Advances in Assisted and Augmented Manufacturing Processes ▪ MSEC 07-07-02 Changeable, Transformable Manufacturing & Distributed Green Supply Chains in Pandemic Recovery Efforts 2 | |
| 1:30 PM to 3:00 PM | NSF's Advanced Manufacturing Program: Overview, Update and Q&A (Live Event) | Dr. ZJ Pei |
| 2:30 PM to 3:00 PM | Live discussion for Technical Presentations | |
| 3:10 PM to 4:40 PM | SME Awards Ceremony (Live Event) | Suzy Marzano |

Keynote Speaker

Dr.-Ing. Christian Brecher

Ordinary Professor for Machine Tools at the Laboratory for Machine Tools and Production Engineering (WZL) of the RWTH Aachen & Director of the Department for Production Machines at the Fraunhofer Institute for Production Technology IPT



Since January 1, 2004, Prof. Dr.-Ing. Christian Brecher is the Ordinary Professor for Machine Tools at the Laboratory for Machine Tools and Production Engineering (WZL) of the RWTH Aachen as well as the Director of the Department for Production Machines at the Fraunhofer Institute for Production Technology IPT. Further, he is CEO of the Cluster of Excellence “Integrative Production Technology for High-Wage Countries” that is funded by the German Research Foundation (DFG). Together with his colleague Prof. Hopmann he is also responsible for the Aachen Center for Integrative Lightweight Production (AZL) since 2012. After finishing his academic studies in mechanical engineering, he started his professional career first as a research assistant and later as a team leader in the department for machine investigation and evaluation at the WZL. From 1999 to April 2001, he was responsible for the department of machine tools in his capacity as a Senior Engineer. After a short spell as a consultant in the aviation industry, Professor Brecher was appointed in August 2001 as the Director for Development at the DS Technologie Werkzeugmaschinenbau GmbH, Mönchengladbach, where he was responsible for construction and development until December 2003. Prof. Brecher has received numerous honours and awards including the Springorum Commemorative Coin, the Borchers Medal of the RWTH Aachen, the Scholarship Award of the Association of German Tool Manufacturers (Verein Deutscher Werkzeugmaschinenfabriken VDW) and the Otto Kienzle Memorial Coin of the Scientific Society for Production Technology (Wissenschaftliche Gesellschaft für Produktionstechnik WGP). From 2015 to 2017 he was for a period of three years chairman of the scientific group for machines of CIRP, the International Academy for Production Engineering. From 2015 to 2017 Professor Brecher became the acting Head of Institute at the Fraunhofer Institute for Production Technology IPT and in January 2018 he accepted the permanent position of Head of Institute.

Title: Turning data into value

Abstract: Reliable access to any kind of data, information and knowledge – at any time and any place – is considered to be one of the most important visions of the Internet of Production. However, what benefits do manufacturing companies draw from the diversity of the recorded data? Which analysis tools and algorithms offer accurate predictions and thus enable a continuous control of production? These and other questions will be presented in the talk with practical use cases from a metal cutting process on a machine tool. The Internet of Production describes the vision of the Cluster of Excellence, which is a unique long term and interdisciplinary research structure of Germany's Excellence Strategy.

Keynote Speaker

Dr. Robert Ivester

Acting MEP Director and the Deputy Director of the Hollings Manufacturing Extension Partnership (MEP) Program at the National Institute of Standards & Technology (NIST)

Dr. Robert W. Ivester serves as the Acting MEP Director and the Deputy Director of the Hollings Manufacturing Extension Partnership (MEP) Program at the National Institute of Standards and Technology. The MEP National Network™ focuses its expertise and knowledge as well as that of its partners (industry, educational institutions, state governments, NIST and other federal research laboratories and agencies) on providing U.S. manufacturers with information and tools they need to improve productivity, assure consistent quality, accelerate the transfer of manufacturing technology and infuse innovation into production processes and new products.



Dr. Ivester served at the Department of Energy for seven years, most recently as Director of the Federal Energy Management Program (FEMP) in the Office of Energy Efficiency and Renewable Energy. FEMP oversees the implementation of policy and actions that result in energy efficiency implementation, renewable energy adoption, and reduction in energy and water use in federal government operations. Dr. Ivester also served in the Advanced Manufacturing Office (AMO) for six years. During that time, AMO launched five Manufacturing USA Institutes, the Critical Materials Hub, and hundreds of small R&D and technical assistance projects across the Nation. He also worked at the National Institute of Standards and Technology for over 16 years, leading and performing research in advanced manufacturing.

He has been an instructor for the Johns Hopkins University Engineering for Professionals program for graduate-level studies in manufacturing engineering since 2001. He is a SME Fellow and a Fellow of the American Society of Mechanical Engineers. He received his doctorate in engineering and a Bachelor of Science in Mechanical Engineering and Master of Science in Manufacturing Engineering from the University of Massachusetts at Amherst.

Title: Manufacturing Extension Partnership: Strengthening U.S. Manufacturers and Empowering the U.S. Manufacturing Ecosystem

Abstract: The Hollings Manufacturing Extension Partnership (MEP) is based at the National Institute of Standards and Technology (NIST). The MEP program was created in 1988 by the Omnibus Trade and Competitiveness Act to improve the competitiveness of U.S.-based manufacturing by making manufacturing technologies, processes, and services more accessible to small and medium-sized manufacturers (SMMs) with MEP Centers in every state and Puerto Rico. These SMMs are critical to our nation's economy, as they constitute 62% of U.S. manufacturing gross domestic product (GDP), 67% of U.S. manufacturing wages and 73% of U.S. manufacturing jobs. These SMMs are also critical to the U.S. innovation ecosystem and helping to achieve the full impact of technology deployment in our nation. Join Rob Ivester, NIST MEP Deputy Director, to learn how MEP works to strengthen U.S. manufacturers by providing technology assistance, workforce, and supply chain services, and in doing so, is empowering the U.S. manufacturing ecosystem.

NSF's Advanced Manufacturing Program: Overview, Update and Q&A

Wednesday, June 24, 2021, 1:30 - 3:00 pm

Organizer: Zhijian (ZJ) Pei

In this special session, three NSF program directors from the NSF Advanced Manufacturing Cluster will update the audience what is new at NSF, especially regarding advanced manufacturing. They will also answer questions from the audience.

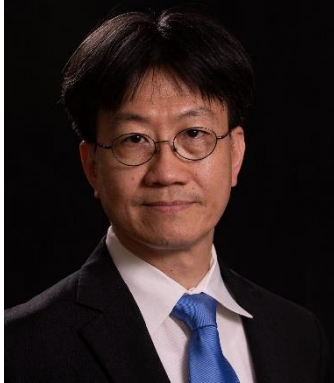
The panelists at this special session are:

- Kevin Chou, Program Director – Responsible for Advanced Manufacturing (AM).
- Khershed Cooper, Program Director – Responsible for Advanced Manufacturing (AM), Engineering Research Centers (ERCs), and Network for Computational Nanotechnology (NCN).
- Andy Wells, Program Director – Responsible for Advanced Manufacturing (AM).

Kevin Chou

Program Director

National Science Foundation (NSF)



Currently serving as a Program Director, Kevin Chou joined the NSF (as IPA) in April 2020 from University of Louisville (UofL), where he is the Edward R. Clark Chair of Advanced Manufacturing. Affiliated with Industrial Engineering Department, Dr. Chou also directed UofL's Additive Manufacturing Institute of Science and Technology (AMIST) from Jan. 2019 – Apr. 2020. He received his Ph.D. from Purdue University and post-doc training from National Institute of Standards and Technology. His research interest includes a broad range of manufacturing processes with recent focus on metal additive manufacturing. He is the recipient of 2016 SME RAPID Dick Aubin Distinguished Paper from SME's Rapid Technologies & Additive Manufacturing Community. Dr. Chou is a Fellow of American Society of Mechanical Engineers (ASME), for which he led the Technical Program of its International Manufacturing Science and Engineering Conference in 2011 and served as the Chair of its Manufacturing Engineering Division (MED) (Jan. 2018 – Jun. 2019). From Aug. 2014 – Aug. 2015, Dr. Chou was the Assistant Director for Technology in the Advanced Manufacturing National Program Office in the U.S. Department of Commerce, supporting the Manufacturing USA initiative.

Khershed P Cooper

Program Director

National Science Foundation (NSF)



Dr. Khershed P. Cooper is a Program Director (PD) for the Advanced Manufacturing (AM) program in the Civil, Mechanical and Manufacturing Innovation (CMMI) Division of the Engineering Directorate at National Science Foundation (NSF). He directs basic research activities in advanced manufacturing, and associated Manufacturing USA and NSF-DFG (Deutsche Forschungsgemeinschaft) collaborations. He is a disciplinary program officer for the Engineering Research Centers (ERC) and a co-PD for cross-cutting programs, such as, Critical Aspects of Sustainability (CAS), Emerging Frontiers in Research and Innovation (EFRI), Network for Computational Nanotechnology (NCN) and National Nanotechnology Coordinated Infrastructure (NNCI). He is an NSF representative for NSTC's Nano Science Engineering and Technology (NSET) Sub-committee, which frames the NNI Strategic Plan. He represents NSF for NextFlex (flexible electronics) and REMADE (circular economy) manufacturing innovation institutes. Prior to joining NSF, Dr. Cooper was a Program Officer for Manufacturing Science at the Office of Naval Research (ONR) and, concurrently, a Senior Research Metallurgist at the Naval Research Laboratory (NRL). His earlier appointments were to serve as a Supervisor of the Materials Research Group at Geo-Centers, Inc and a Scientist II at Olin Metals Research Laboratory. He received his MS and PhD from University of Wisconsin–Madison and his BTech from IIT—Bombay. He has presented at national and international conferences, meetings and workshops. He has over 200 invited talks, 70 contributed presentations, nearly 150 publications, edited one book and holds one patent. He has sponsored and participated in international studies in various emerging areas of advanced manufacturing. He is a Fellow of SME and ASM International and a recipient of ASM International's Burgess Memorial Award.

Andy Wells

Program Director

National Science Foundation (NSF)



Dr. Andy Wells has been a Program Director in the National Science Foundation's Advanced Manufacturing program since 2019, where he supports fundamental research to advance American manufacturing technologies. He is the co-leader of the Future Manufacturing solicitation, which supports research and education that will enable new, potentially transformative, manufacturing approaches to eliminate scientific, technological, educational, economic and social barriers that limit current manufacturing. He is an NSF representative to the National Science and Technology Council's (NSTC) Subcommittee on Advanced Manufacturing, and to the Manufacturing USA Interagency Working Group. Andy brings to the program over 25 years of experience developing and building precision equipment that enables manufacturers and researchers to visualize and transform materials at the micro- and nano-scale. Most recently, he was a technical program manager at Thermo Fisher Scientific and FEI Company, where he led development of scanning electron microscopes and ion-beam machining tools for semiconductor, materials science, and life science customers. Previously, he developed equipment for laser and mechanical micromachining at Electro Scientific Industries and was an adjunct professor at Portland State University. Andy received his PhD and MS degrees in mechanical engineering from Caltech, and his bachelor's degree from Dartmouth.

Presentation Details for Thursday, June 24, 2021-

Thursday, June

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NAMRC Track 4 Additive Manufacturing Processes 3

12:00 PM – 1:30 PM

Session Chair: Tarik Dickens | Session Co-chair: Wayne Hung

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| NAMRC Paper 50 | Vysakh Venugopal, Omkar Ghalsasi, Matthew McConaha, Alice Xu, Jonathan Forbes and Sam Anand | Image Processing-based Method for Automatic Design of Patient-Specific Cranial Implant for Additive Manufacturing |
| NAMRC Paper 56 | Vinay Varghese and Soham Mujumdar | Micromilling-induced Surface Integrity of Porous Additive Manufactured Ti6Al4V Alloy |
| NAMRC Paper 131 | Shyam-Sundar Balasubramanian, Chris Philpott, James Hyder, Mike Corliss, Bruce Tai and Wayne Hung | Novel Fatigue Tester for Additively Manufactured Metals |
| NAMRC Paper 68 | Chaitanya Vundru, Ramesh Singh, Wenyi Yan and Shyamprasad Karagadde | Effect of Spreading of the Melt Pool on the Deposition Characteristics in Laser Directed Energy Deposition |
| NAMRC Paper 69 | Helen Parker, Sean Psulkowski, Phong Tran and Tarik Dickens | In-Situ Defect Analysis of 3D Printing via Conductive Filament and Ohm's Law |

Thursday, June

24

NAMRC Track 5 Smart Manufacturing: Processes, Systems and Integration 3

12:00 PM – 1:30 PM

Session Chair: Matthew Krugh | Session Co-chair: Binil Starly

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| NAMRC Paper 126 | John Karigiannis, Shaopeng Liu, Stephane Harel, Xiao Bian, Peihong Zhu, Feng Xue, Steeves Bouchard, David Cantin, Maxime Beaudoin-Pouliot, Bernard Bewlay and Marie-Christine Caron | Multi-Robot System for Automated Fluorescent Penetrant Indication Inspection with Deep Neural Nets |
| NAMRC Paper 52 | Mahmud Hasan, Kemafor Anyanwu and Binil Starly | Hybrid Blockchain Architecture for Cloud Manufacturing-as-a-service (CMaaS) Platforms with Improved Data Storage and Transaction Efficiency |
| NAMRC Paper 44 | Jinwoo Song and Young Moon | A Layer Image Auditing System Secured by Blockchain |
| NAMRC Paper 55 | Jonathan Rosales Vizueté, Sourabh Deshpande and Sam Anand | IIoT based Augmented Reality for Factory Data Collection and Visualization |
| NAMRC Paper 62 | Ethan Wescoat, Matthew Krugh and Laine Mears | Random Forest Regression for Predicting an Anomalous Condition on a UR10 Cobot End-Effector from Purposeful Failure Data |

| Thursday, June 24 12:00 PM – 1:30 PM MSEC 01-03 Additive Manufacturing with Functional Polymers, Multi-material Structures and Composites Session Chair: Bulent Arda Gozen Session Co-chair: Kun (Kelvin) Fu | | |
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| MSEC2021-62317 | Jordan Garcia, Robert Harper and Charles Lu | Y. Anisotropic Material Behaviors of 3D Printed Carbon-Fiber Polymer Composites with Open-Source Printers |
| MSEC2021-63208 | Nor Aiman Sukindar, Azib Azhari Awang Dahan, Sharifah Imihezri Syed Shaharuddin and Farah Huda Abd Halim | Performance of Low-Cost 3D Printer in Medical Application |
| MSEC2021-63412 | Roosbeh (Ross) Salary, Mohan Yu, Logan Lawrence, James Day and Pier Paolo Claudio | Pneumatic Microextrusion-Based Additive Biofabrication of Polycaprolactone Bone Scaffolds – Part II: Investigation of the Influence of Polymer Flow Parameters |
| MSEC2021-63635 | Jing Zhao, Muyue Han and Lin Li | Impacts of Process Parameters on Shape Memory Properties of Stereolithography Manufactured Parts: An Experimental Analysis |
| MSEC2021-64133 | Murali Sundaram, Zane Decker, Mason Makulinski and Suprita Vispute | Effects of Size-Reduction on the Failure Mechanism of 3D Printed PLA + Parts |

| Thursday, June 24 12:00 PM – 1:30 PM MSEC 02-01 Advanced Materials Manufacturing Session Chair: Saeed Farahani Session Co-chair: Mihaela Banu | | |
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| MSEC2021-58537 | Aspen Glaspell, Jaejoong Ryu and Kyosung Choo | Thermo-Mechanical Simulation of Ti6Al4V-NiTi Dissimilar Laser Welding Process |
| MSEC2021-64052 | Sahil Dhoka, Himanshu Abhi, Nicholas Hendrickson, William Embloom and Scott Wagner | Integrating Friction-Stir Back Extrusion to Powder Metallurgy |
| MSEC2021-64916 | Mihaela Banu, Tae Hwa Lee, S. Jack Hu and Pei-Chung Wang | Investigation of the Dynamic Response of a Multispot System at Joining Using Ultrasonic Welding |

| Thursday, June 24 12:00 PM – 1:30 PM MSEC 03-01-01 Advances in Biomanufacturing of Tissue-Engineered Scaffolds and Organs 1 Session Chair: Yifei Jin Session Co-chair: Jun Yin | | |
|---|--|---|
| MSEC2021-71264 (Invited Symposium Speaker) | Michael McAlpine | 3D Printing Bionic Devices |
| MSEC2021-63658 | MD Ahasan Habib, Slesha Tuladhar and Cartwright Nelson | Rheological Analysis of Low-Viscous Hydrogels for 3D Bio-Printing Processes |
| MSEC2021-63996 | Bashir Khoda and Md Ahasan Habib | A Rheological Study of Bio-Ink: Shear Stress and Cell Viability |

Thursday, June 24
12:00 PM – 1:30 PM
MSEC 05-03-01 Advanced Machining and Metrology for Smart Manufacturing Technologies (ASME-JSME Joint Symposium) 1
 Session Chair: Takashi Matsumura | Session Co-chair: Norikazu Suzuki

| | | |
|----------------|---|---|
| MSEC2021-60045 | Tsutomu Uenohara, Reza Aulia Rahman, Yasuhiro Mizutani and Yasuhiro Takaya | Laser Micro Machining Using a Photonic Nanojet in Water Medium |
| MSEC2021-60409 | Yizhao Guan, Hiromasa Kume, Shotaro Kadoya, Masaki Michihata and Satoru Takahashi | The FDTD Analysis of Near-Field Response for Microgroove Structure with Standing Wave Illumination for the Realization of Coherent Structured Illumination Microscopy |
| MSEC2021-60417 | Yushen Liu, Shotaro Kadoya, Masaki Michihata and Satoru Takahashi | Numerical Study on Tip Shape of Near-Field Optical Fiber Probe for Detecting Electric Field Intensity of Whispering Gallery Mode Resonance |
| MSEC2021-64688 | John Henry Navarro-Devia, Dzung Viet Dao, Yun Chen and Huaizhong Li | Analysis of Vibration Signals in Monitoring Titanium End Milling Process Using Triaxial Accelerometer |

Thursday, June 24
12:00 PM – 1:30 PM
MSEC 06-06-01 Advances in Lightweight and Dissimilar Materials Joining 1
 Session Chair: Wayne Cai | Session Co-chair: Xun Liu

| | | |
|----------------|---|--|
| MSEC2021-69636 | Jingjing Li (Invited Symposium Speaker) | Creation of Dissimilar Materials Structures |
| MSEC2021-61180 | Tyler Grimm, Amit Deshpande and Laine Mears | Chipping Reduction Using Thermally-Assisted Friction Element Welding |
| MSEC2021-63650 | Gowtham Parvathy, Tyler Grimm and Laine Mears | Conduction Heat Assisted Friction Element Welding |

Thursday, June 24
1:30 PM – 3:00 PM
NAMRC Track 2 Manufacturing Processes 3
 Session Chair: Laine Mears | Session Co-chair: Arif Malik

| | | |
|----------------|--|---|
| NAMRC Paper 27 | Andreas Rohrmoser, Hinnerk Hagenah and Marion Merklein | Influence of the Forming Induced Hardening on the Wear Behavior of Aluminum Gears within a Metal-Plastic Material Pairing and Targeted Adaption |
| NAMRC Paper 28 | Tyler Grimm, Gowtham Parvathy and Laine Mears | Friction Element Riveting: A Novel Aluminum to Aluminum Joining Process |
| NAMRC Paper 31 | Tyler Grimm, Ankit Varma, Amit Deshpande, Laine Mears and Xin Zhao | Characterization of Aluminum Flow During Friction Element Welding |
| NAMRC Paper 39 | Rachele Bertolini, Enrico Savio, Andrea Ghiotti and Stefania Bruschi | The Effect of Cryogenic Cooling and Drill Bit on the Hole Quality when Drilling Magnesium-based Fiber Metal Laminates |

| | | |
|----------------|--|--|
| NAMRC Paper 20 | Sumair Sunny, Glenn Gleason, Karuna Sitaula and Arif Malik | Predictive Modeling of Laser Shock Peening Induced Near-Surface Residual Stress in Alumina |
|----------------|--|--|

Thursday, June 24
1:30 PM – 3:00 PM
NAMRC Track 4 Additive Manufacturing 4
 Session Chair: Yong Chen | Session Co-chair: Maxwell Pranievicz

| | | |
|-----------------|---|---|
| NAMRC Paper 91 | Pu Han, Sihan Zhang, Alireza Tofangchi and Keng Hsu | Relaxation of Residual Stress in FFF Part with In-Process Laser Heating |
| NAMRC Paper 98 | Yang Xu, Fangjie Qi, Xiangyun Gao, Yujie Shan, Yun Zhou and Yong Chen | Direct Droplet Writing – A Novel Droplet-punching Capillary-splitting 3D Printing Method for Highly Viscous Materials |
| NAMRC Paper 85 | Chao Liu and Junjun Ding | Material Extrusion 3D Printing of Carbon Material Reinforced PDMS Matrix Composites and their Mechanical Properties |
| NAMRC Paper 109 | Jie Sun | An Overview of Scaffolds for Retinal Pigment Epithelium Research |
| NAMRC Paper 59 | Jaime Berez, Maxwell Pranievicz and Christopher Saldana | Assessing Laser Powder Bed Fusion System Geometric Errors through Artifact-Based Methods |

Thursday, June 24
1:30 PM – 3:00 PM
NAMRC Track 5 Smart Manufacturing – Processes, Systems and Integration 4
 Session Chair: Weihong Guo | Session Co-chair: N Arunachalam

| | | |
|----------------|---|--|
| NAMRC Paper 57 | Dongdong Liu, Weidong Cheng, Jianjing Zhang, Robert Gao and Weigang Wen | Integrated Method of Generalized Demodulation and Artificial Neural Network for Robust Bearing Fault Recognition |
| NAMRC Paper 79 | Nesar Ahmed Titu, Matthew Baucum, Timothy No, Mitchell Trotsky, Jaydeep Karandikar, Tony Schmitz and Anahita Khojandi | Estimating Johnson-Cook Material Parameters using Neural Networks |
| NAMRC Paper 25 | Kandice S. B. Ribeiro, Henrique H. L. Núñez, Jason Jones, Peter Coates and Reginaldo Coelho | A Novel Melt Pool Mapping Technique Towards the Online Monitoring of Directed Energy Deposition Operations |
| NAMRC Paper 73 | Matthew Behnke, Shenghan Guo and Weihong Guo | Comparison of Early Stopping Neural Network and Random Forest for In-Situ Quality Prediction in Laser Based Additive Manufacturing |
| NAMRC Paper 77 | Rishikesan V, Bhagyesh Chaturvedi and Arunachalam N | Characterisation of drilling-induced damage in GFRP Honeycomb Sandwich Composites using Acoustic Emission |

**Thursday, June
24
1:30 PM – 3:00
PM**

MSEC 01-04-01 Computational Methods and Process Planning for Additive Manufacturing 1

Session Chair: Tsz-Ho Kwok | Session Co-chair: Yunbo 'Will' Zhang

| | | |
|----------------|---|--|
| MSEC2021-63351 | Ana Paula Clares and Guha Manogharan | Discrete-Element Simulation of Powder Spreading Process in Binder Jetting, and the Effects of Powder Size Distribution. |
| MSEC2021-63375 | Liangkui Jiang, Pavithra Premaratne, Yanhua Huang, Zhan Zhang and Hantang Qin | Modeling and Experimental Validation of Droplet Generation in Electrohydrodynamic Inkjet Printing for Prediction of Printing Quality |
| MSEC2021-63719 | Xiaoqing Tian, Yaling Li, Dingyifei Ma, Jiang Han and Lian Xia | Closed-Loop Control of Silicone Extrusion-Based Additive Manufacturing Based on Machine Vision |
| MSEC2021-63642 | Zhicheng Rong, Chang Liu and Yingbin Hu | 4D Printing of Complex Ceramic Structures via Controlling Zirconia Contents and Patterns |
| MSEC2021-63717 | Wenxuan Jia, Yuen-Shan Leung, Huachao Mao, Han Xu, Chi Zhou and Yong Chen | Hybrid-Light-Source Stereolithography for Fabricating Macro-Objects with Micro-Textures |

**Thursday, June
24
1:30 PM – 3:00
PM**

MSEC 03-01-02 Advances in Biomanufacturing of Tissue-Engineered Scaffolds and Organs 2

Session Chair: Yifei Jin | Session Co-chair: Kyle Christensen

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|----------------|---|--|
| MSEC2021-63242 | Youping gong, Jinlai Qi, Rougang Z hou, Honghao Chen, Junling He, Zizhou Qiao, Zhikai Bi, Huipeng Chen, Furjan M. S. H. Al, Guojin Chen, Xiang Zhang and Huifeng Shao | Three-Dimensional Cell Culture with Alginate Hetero Gel Microspheres |
| MSEC2021-63411 | Logan Lawrence, James Day, Pier Paolo Claudio and Roozbeh (Ross) Salary | Investigation of the Regenerative Potential of Human Bone Marrow Stem Cell-Seeded Polycaprolactone Bone Scaffolds, Fabricated Using Pneumatic Microextrusion Process |
| MSEC2021-63413 | Roozbeh (Ross) Salary, Abigail Chaffins, Mohan Yu, James Day and Pier Paolo Claudio | Investigation of the Functional Properties of Additively-Fabricated Triply Periodic Minimal Surface-Based Bone Scaffolds for the Treatment of Osseous Fractures. |
| MSEC2021-63471 | Cartwright Nelson, Slesha Tuladhar and MD Ahasan Habib | Designing an Interchangeable Multi-Material Nozzle System for 3D Bioprinting Process |
| MSEC2021-63654 | Huifeng Shao, Zhuoluo Jing, Rougang Zhou, Zhiheng Nian, Haiqiang Liu, Youping Gong and Yong He | Manufacturing of Biodegradable Intramedullary Nail with High Strength |

Thursday, June 24
1:30 PM – 3:00 PM
MSEC 04-02 Advances in Sustainable Manufacturing Process and Systems
 Session Chair: Daniel Cooper | Session Co-chair: William Bernstein

| | | |
|----------------|---|---|
| MSEC2021-63507 | Xiange Wang, Philip Kent Velbis and Barbara Linke | Framework for User-Friendly Modeling of Energy Use in Fused Deposition Modeling |
| MSEC2021-63645 | Abigail Clarke-Sather, Asad Bashir Tyler Poggiogalle and Christopher Meehan | Material Properties of Discarded Textiles for Manufacturing Feedstocks |
| MSEC2021-63739 | Reginald Elvis Peter Francis and Senthilkumaran Kumaraguru | Material Efficiency and Economics of Hybrid Additive Manufacturing |

Thursday, June 24
1:30 PM – 3:00 PM
MSEC 06-08 Advances in Assisted and Augmented Manufacturing Processes
 Session Chair: Weilong Cong | Session Co-chair: Meng Zhang

| | | |
|----------------|--|---|
| MSEC2021-60388 | Yunze Li, Dongzhe Zhang and Weilong Cong | Ultrasonic Vibration Assisted-Laser Directed Energy Deposition of B4C-Ti Composite: Effects of Laser Power and Ultrasonic Vibration |
| MSEC2021-60520 | Rui Dai, Beomjin Kwon and Qiong Nian | A Novel Packing Hollow Dodecahedron Model to Study the Mechanical and Thermal Properties of Stochastic Metallic Foams |
| MSEC2021-63281 | Tom Zhang, Yubin Liu and Lawrence Yao | Effect of Laser Forming on the Energy Absorbing Behavior of Metal Foams |
| MSEC2021-63404 | Tyler Grimm and Laine Mears | Electrically Assisted Wire Drawing Polarity Effects |

Thursday, June 24
1:30 PM – 3:00 PM
MSEC 07-07 Changeable, Transformable Manufacturing & Distributed Green Supply Chain in Pandemic Recovery Efforts
 Session Chair: Ahmed Azab | Session Co-chair: Mohamed Gadalla

| | | |
|----------------|---|--|
| MSEC2021-65490 | Sardar Asif Khan | Single Minute Exchange of Die: A Case Study to Improve System Changeability |
| MSEC2021-60408 | Saeideh Salimpour and Ahmed Azab | A Dynamic Programming Approach to Solve the Facility Layout Problem for Reconfigurable Manufacturing |
| MSEC2021-63766 | Yunqing Li, Shivakumar Raman, Binil Starly and Paul Cohen | Design of Knowledge Graph in Manufacturing Services Discovery |

[Back to Conference Schedule](#)

Friday, June 25, 2021

| Time* | Event | Facilitator |
|-------------------------|---|--------------------------|
| 11:25 AM to 11:55 AM | Keynote Session 7 (Live Event) by Dr. Gen Satoh, Associate Director at the Raytheon Technologies Additive Manufacturing Process Capability Center | Dr. Sam Anand |
| 12:00 PM to 1:00 PM | Pre-recorded Technical Presentations <ul style="list-style-type: none"> ▪ NAMRC Track 2- Manufacturing Processes Session 4 ▪ NAMRC Track 4- Additive Manufacturing Session 5 ▪ MSEC 06-06-02 Advances in Lightweight and Dissimilar Materials Joining 2 ▪ MSEC 07-06-03 Industrial Internet, Cloud and Digital Twins in the Wake of COVID-19 (3) ▪ MSEC 08-02-01 Advances in Micro and Nano Manufacturing 1 ▪ MSEC 09-02 Data-Enabled Modeling, Detection, Optimization, and Prognostics for Quality and Reliability Improvement of Advanced Manufacturing Systems ▪ MSEC 12-01-01 MED 100-Year Issue of JSME State-of- the-Art Papers 1 | |
| | Pre-recorded Doctoral Symposium-I Presentations (Process planning and modeling) | Dr. Chen, Dr. Haapala |
| 1:00 PM to 1:30 PM | Live discussion for Technical Presentations and Doctoral Symposium-I | Dr. Chen, Dr. Haapala |
| 1:30 PM to 2:30 PM | Pre-recorded Technical Presentations <ul style="list-style-type: none"> ▪ NAMRC Track 5- Smart Manufacturing and Cyber Physical Systems Session 5 ▪ MSEC 01-04-02 Computational Methods and Process Planning for Additive Manufacturing 2 ▪ MSEC 03-02 Advances in Manufacturing, Development, and Analysis of Biomedical Devices | |

| | | |
|--------------------|--|-----------------------|
| | <ul style="list-style-type: none"> ▪ MSEC 05-03-02 Advanced Machining and Metrology for Smart Manufacturing Technologies (ASME-JSME Joint Symposium) 2 ▪ MSEC 06-06-03 Advances in Lightweight and Dissimilar Materials Joining 3 ▪ MSEC 07-02 Cyber-Physical Systems and Cybersecurity in Industry 4.0 ▪ MSEC 08-02-02 Advances in Micro and Nano Manufacturing 2 ▪ MSEC 12-01-02 MED 100-Year Issue of JSME State-of-the-Art Papers 2 | |
| | Pre-recorded Doctoral Symposium-II Presentations (Processes and materials) | Dr. Chen, Dr. Haapala |
| 2:30 PM to 3:00 PM | Live discussion for Technical Presentations and Doctoral Symposium-II | Dr. Chen, Dr. Haapala |
| 3:10 PM to 4:10 PM | Pre-recorded Doctoral Symposium-III Presentations (Design, simulation and optimization) | Dr. Chen, Dr. Haapala |
| 3:10 PM to 4:30 PM | Poster Session (Live Event) | Dr. Chen, Dr. Haapala |
| 4:10 PM to 4:40 PM | Live discussion for Doctoral Symposium-III | Dr. Chen, Dr. Haapala |

Keynote Speaker

Gen Satoh

Associate Director at the Raytheon Technologies Additive Manufacturing Process Capability Center

Gen Satoh is an Associate Director at the Raytheon Technologies Additive Manufacturing Process Capability Center and leads technology development activities in the areas of design, materials, and process simulation. Prior to joining Raytheon, Gen led the development of large-format wire-fed additive manufacturing at the Alcoa Technical Center targeting aerospace structural applications produced via near-net-shape deposition or the patented Ampliforge™



process. Gen received his M.S. and Ph.D. in Mechanical Engineering from Columbia University with a focus on laser materials processing and a B.S. in Engineering from Harvey Mudd College.

Title: Additive Manufacturing Capability and Tool Development

Additive manufacturing (AM) continues to impact the way we view the components and systems that drive aerospace and defense solutions across Raytheon Technologies. The capabilities offered by AM open opportunities for improvements in performance, cost, and lead time across the corporation. The development and deployment of additive manufacturing technologies across the product portfolio, however, requires a holistic understanding of the manufacturing process, including considerations from design to materials, deposition and in-situ monitoring, as well as post-processing and NDE. Addressing all of these interrelated areas when developing additive-enabled parts is critical to maximizing the business impact the technologies offer. This presentation will highlight approaches being employed within Raytheon Technologies to develop the capabilities and tools to address gaps in these areas as well as key aerospace and defense applications where AM is being adopted.

Doctoral Symposium

Welcome to the Doctoral Symposium of MSEC 2021!

The Doctoral Symposium will be an opportunity for doctoral students who will graduate soon (within a year) or a recently graduated doctoral student to showcase their doctoral dissertation research in various advanced manufacturing research areas. The symposium will also provide universities and industrial companies an opportunity to identify excellent candidates for job openings targeting Ph.D. graduates in advanced manufacturing.

In the first Doctoral Symposium of ASME Manufacturing Science and Engineering Conference, 16 students will present their work on Friday (June 25). They are assigned to three sessions, and each session will be 90 minutes. Each presentation will be 12 minutes with 3 minutes of Q&A.

The students' email addresses are given in this booklet. Please feel free to follow up with the students on their work before/after the Doctoral Symposium.

Organizers

Dr. Yong Chen, *University of Southern California, Los Angeles, CA, USA*

Dr. Karl Haapala, *Oregon State University, Corvallis, OR, USA*

Doctoral Symposium

13-01 Process Planning and Modeling (Friday, June 25 – 12 – 1:30 pm)

| | | | |
|--------------|-----------|----------------------------|---|
| Karl | Schuchard | kgschuch@ncsu.edu | North Carolina State University |
| Rishi | Malhan | rmalhan@usc.edu | University of Southern California |
| Donghua | Zhao | dongdong5212a@163.com | Shanghai Jiao Tong University |
| Joseph | Kubalak | josephk7@vt.edu | Virginia Tech |
| Ankit | Agarwal | agarwal.3@iitj.ac.in | Indian Institute of Technology Jodhpur |
| Muhammad-Ali | Ablat | amaimaitiaili@ucmerced.edu | University of California Merced |

13-02 Processes and Materials (Friday, June 25 – 1:30 – 3:00 pm)

| | | | |
|------------|----------|------------------------------|-----------------------------------|
| Yizhou | Jiang | yizhouj@usc.edu | University of Southern California |
| Daniel | Franke | dfranke2@wisc.edu | University of Wisconsin- Madison |
| Padmalatha | Kakanuru | padmalathakakanuru@gmail.com | Stevens Institute of Technology |
| Yang | Xu | yxu195@usc.edu | University of Southern California |
| Hemant | Agiwal | agiwal@wisc.edu | University of Wisconsin- Madison |

13-03 Design, Simulation, and Optimization (Friday, June 25 – 3:00 – 4:30 pm)

| | | | |
|---------|-----------|----------------------|---------------------------------|
| Nathan | Hertlein | hertlenj@mail.uc.edu | University of Cincinnati |
| Zhuo | Wang | zwg@umich.edu | University of Michigan-Dearborn |
| Vysakh | Venugopal | venugovh@mail.uc.edu | University of Cincinnati |
| Matthew | Krugh | mkrugh@gmail.com | Clemson University |
| Lun | Li | li2l6@mail.uc.edu | University of Cincinnati |

Presentation Details for Friday, June 25, 2021-

**Friday, June 25
12:00 PM – 1:30
PM**

NAMRC Track 2 Manufacturing Processes 4

Session Chair: N Arunachalam | Session Co-chair: Sarah J. Wolff

| | | |
|-----------------|---|--|
| NAMRC Paper 66 | Przemysław Podulka | Application of Image Processing Methods for the Characterization of Selected Features and Wear Analysis in Surface Topography Measurements |
| NAMRC Paper 75 | Hui Wang, Benjamin Gould, Niranjana Parab, Cang Zhao, Aaron Greco, Tao Sun and Sarah J. Wolff | High-Speed Synchrotron X-Ray Imaging of Directed Energy Deposition of Titanium: Effects of Processing Parameters on the Formation of Entrapped-Gas Pores |
| NAMRC Paper 120 | T Aravind, S Boominathasellarajan and N Arunachalam | Fabrication of Micro-Channels on Polymethyl Methacrylate (PMMA) Plates by Thermal Softening Process Using Nichrome Wire: Tool Design and Surface Property Evaluation |
| NAMRC Paper 96 | Ching-Tun Peng and Iqbal Shareef | Dry Machining Parameter Optimization for γ -TiAl With a Rhombic Insert |
| NAMRC Paper 108 | Kelsey Lalka, Aaron Dunn, Hannah Skrbis, Noelle Langmack, Joseph Budzinski and Steven Schmid | Hydroforming of Ti-6Al-4V Acetabular Cups |

**Friday, June 25
12:00 PM – 1:30
PM**

NAMRC Track 4 Additive Manufacturing 5

Session Chair: Jing Shi | Session Co-chair: Sam Anand

| | | |
|-----------------|---|--|
| NAMRC Paper 70 | Michael Ogunsanya, Joan Isichei, Santosh Kumar Parupelli, Salil Desai and Yi Cai | In-situ Droplet Monitoring of Inkjet 3D Printing Process using Image Analysis and Machine Learning Models |
| NAMRC Paper 72 | Roman Savinov, Yachao Wang, Jin Wang and Jing Shi | Comparison of Microstructure and Properties of CoCrFeMnNi High-Entropy Alloy from Selective Laser Melting and Directed Energy Deposition Processes |
| NAMRC Paper 76 | Edisson Andres Naula Duchi, Biali Fernando Lima Rodriguez, Luis Eduardo Garza Castañon and José Israel Martínez López | Manufacturing of Stereolithography Enabled Soft Tools for Point of Care Micromixing and Sensing Chambers for Underwater Vehicles |
| NAMRC Paper 100 | Yujie Shan, Dongming Gan and Huachao Mao | Curved Layer Slicing based on Isothermal Surface |
| NAMRC Paper 89 | Lun Li and Sam Anand | Hatch Pattern Optimization of Powder Bed Fusion Additive Manufacturing Process for Minimizing Part GD&T Errors |

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|---|---|--|
| Friday, June 25 12:00 PM – 1:30 PM | | |
| MSEC 06-06-02 Advances in Lightweight and Dissimilar Materials Joining 2 | | |
| Session Chair: Yongbing Lee Session Co-chair: Wayne Cai | | |
| MSEC2021-60179 | Fadi Al-Badour, Abdulrahman Al-Ghamdi, Akeem Adesina, Rami Suleiman and Nesar Merah | Friction Stir Diffusion Bonding of Magnesium Alloy ZK 60 to Steel |
| MSEC2021-61036 | Jiangchao Wang, Bin Yi and Xiaoli Zhou | Influence of Clamping for Out-of-Plane Welding Distortion Mitigation During Thin Steel Plates Welding |
| MSEC2021-61250 | Koen Faes, Jens Vermeersch and Rafael Gomes Nunes Silva | Joining of Metal-Plastic Composites with Advanced Welding Processes |
| MSEC2021-63321 | Giovanni Chianese, Pasquale Franciosa, Jonas Nolte, Darek Ceglarek and Stanislao Patalano | Photodiode-Based In-Process Monitoring of Part-to-Part Gap and Weld Penetration Depth in Remote Laser Welding of Automotive Battery Tab Connectors |
| MSEC2021-64320 | Daniel Franke, Shiva Rudraraju, Michael Zinn and Frank Pfefferkorn | Effect of Tool Eccentricity on the Development of Force Based Defect Detection During Friction Stir Welding of Aluminum Alloy 6061-T6 |
| Friday, June 25 12:00 PM – 1:30 PM | | |
| MSEC 07-06-03 Industrial Internet, Cloud and Digital Twins in the Wake of COVID-19 (3) | | |
| Session Chair: Yujie Chen Session Co-chair: Xi (Vincent) Wang | | |
| MSEC2021-61672 | Dong Han, Wangming Li, Xinyu Li, Liang Gao and Yang Li | A Data-driven Proactive Scheduling Approach for Hybrid Flow Shop Scheduling Problem |
| MSEC2021-63407 | David Stock, Aditi Mukhopadhyay, Rob Potter and Andy Henderson | Tool Wear Analysis of MTConnect Production Data |
| MSEC2021-63522 | Yilin Fang and Kai Mei | Multi-Robotic Disassembly Line Balancing Using Deep Reinforcement Learning |
| MSEC2021-64407 | Yang Hu, Zitong Liu, Feng Xu, Jiayi Liu, Wenjun Xu and Hao Feng | Human Motion Position Prediction for Human-Robot Collaboration in Manufacturing Considering Human Joint Repair |
| MSEC2021-64642 | Yang Hu, Yiwen Ding, Feng Xu, Jiayi Liu, Wenjun Xu and Hao Feng | Knowledge Recommendation System for Human-Robot Collaborative Disassembly Using Knowledge Graph |
| Friday, June 25 12:00 PM – 1:30 PM | | |
| MSEC 08-02-01 Advances in Micro and Nano Manufacturing 1 | | |
| Session Chair: Ping Guo Session Co-chair: Bashir Khoda | | |
| MSEC2021-59847 | Chuang Qu, Bruce Alphenaar, Shamus Mcnamara and Kevin Walsh | Optimization of Ultra-High Aspect Ratio Nanostructures Fabricated Using Glancing Angle Deposition |
| MSEC2021-59982 | Peiqiang Yang, Xueping Zhang, Zhenqiang Yao and Rajiv Shivpuri | Molecular Dynamics Modeling the Nano-Indentation of Titanium |
| MSEC2021-60390 | Stanislau Niauzorau, Aliaksandr Sharstniou, Natalya Kublik, | Synthesis of Nanoporous Gold by Chemical Dealloying of Co-Sputtered |

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|---|--|---|
| | Venkata Sampath and Bruno Azeredo | Gold-Silver Thin Films and Study of Its Variability |
| MSEC2021-60460 | Madhu Vadali and Utsavkumar Mistry | Influence of Surface Geometry on Melt Pool Flows and Shape in Pulsed Laser Surface Melting |
| MSEC2021-63347 | Michael Grzenda, Arielle Gamboa, James Mercado, Lin Lei, Jennifer Guzman, Lisa Klein, Andrei Jitianu and Jonathan Singer | Parametric Control of Melting Gel Morphology and Chemistry via Electrospray Deposition |
| Friday, June 25 12:00 PM – 1:30 PM | MSEC 09-02 Data-Enabled Modeling, Detection, Optimization, and Prognostics for Quality and Reliability Improvement of Advanced Manufacturing Systems Session Chair: Xiaowei Yue Session Co-chair: Xiaolei Fang | |
| MSEC2021-58639 | Shenglei Du, Jingmei Guo, Lin Yi, Chen Zhang and Shi Liu | Real-Time Reliability Assessment of Wind Turbine Components Using a Back-Propagation Neural Network and SCADA Data |
| MSEC2021-62056 | Rajshekhkar Singhania, Chinmay Sawkar and Manoj Tiwari | Optimal Sensor Deployment to Diagnose Large-Scale Manufacturing Systems Using a Convergence-Trajectory Controlled Ant Colony System Algorithm |
| MSEC2021-62348 | Xiaolei Fang and Xin Li | Multistream Sensor Fusion-Based Prognostics Model for Systems Under Multiple Operational Conditions |
| MSEC2021-63465 | Joseph Cohen and Jun Ni | A Semi-Supervised Multiclass Anomaly Detection Approach for Partially Labeled In-Process Measurement Data |
| MSEC2021-63661 | Hao Wang, Yassine Qamsane, James Moyne and Kira Barton | Merging Subject Matter Expertise and Deep Convolutional Neural Network for State-Based Online Machine-Part Interaction Classification |
| Friday, June 25 12:00 PM – 1:30 PM | MSEC 12-01-01 MED 100-Year Issue of JSME State-of-the-Art Papers 1 Session Chair: Laine Mears Session Co-chair: Albert Shih | |
| MSEC2021-72735 | Yuming Zhang | Advanced Welding Manufacturing - A Brief Analysis and Review of Challenges and Solutions |
| MSEC2021-73103 | Jay Lee | Intelligent Maintenance Systems and Predictive Manufacturing |
| MSEC2021-73166 | Yung C. Shin, Benxin Wu, Shuting Lei, Gary J. Cheng and Y. Lawrence Yao | Overview of Laser Applications in Manufacturing and Materials Processing in Recent Years |

**Friday, June 25
12:00 PM – 1:30
PM**

Doctoral Symposium- Session 1 Process planning and modeling

Session Chair: Yong Chen | Session Co-chair: Karl Haapala

| | | |
|----------------|---|---|
| MSEC2021-68367 | Donghua Zhao and Weizhong Guo | Research on Design Methodology and Key Technology of Rotary 3d Printer for Curved Layer Slicing |
| MSEC2021-68804 | Ankit Agarwal | Modeling and Control of Geometric Tolerances in End Milling of Thin-Walled Component |
| MSEC2021-68865 | Karl Schuchard | Computational and Experimental Characterization of 3d-Melt Blowing Process-Structure-Function Interrelationships for Tissue Engineering |
| MSEC2021-68992 | Rishi Malhan | Manipulator Trajectory Planning Under Motion Constraints |
| MSEC2021-68998 | Joseph Kubalak, Alfred Wicks and Christopher Williams | Topology and Toolpath Optimization via Layer-Less Multi-Axis Material Extrusion |
| MSEC2021-69071 | Muhammad-Ali Ablat | Mechanics of Origami-Based Sheet Metal Bending |

**Friday, June 25
1:30 PM – 3:00 PM**

NAMRC Track 5 Smart Manufacturing - Processes, Systems and Integration 5

Session Chair: Zhaoyan Fan | Session Co-chair: Ali Tabei

| | | |
|----------------|---|---|
| NAMRC Paper 78 | Cheng Zhu, Tian Yu and Qing Chang | Applying Task-Oriented Safety Field Calibration in Human Robot Collaborative Systems |
| NAMRC Paper 61 | Shohanuzzaman Shohan, Jordan Harm, Mahmud Hasan, Binil Starly and Rohan Shirwaiker | Non-Destructive Quality Monitoring of 3D Printed Tissue Scaffolds via Dielectric Impedance Spectroscopy and Supervised Machine Learning |
| NAMRC Paper 87 | Niechen Chen | An Evolutionary Neural Network Approach to Machining Process Planning: A Proof of Concept |
| NAMRC Paper 53 | Asmaa Harfoush, Karl Haapala and Ali Tabei | Application of Artificial Intelligence in Incremental Sheet Metal Forming: A Review |
| NAMRC Paper 97 | Mitch Woodside, Joseph Fischer, Patrick Bazzoli, Douglas Bristow and Robert Landers | A Kinematic Error Controller for Real-Time Kinematic Error Correction of Industrial Robots |

**Friday, June 25
1:30 PM – 3:00 PM**

MSEC 01-04-02 Computational Methods and Process Planning for Additive Manufacturing 2

Session Chair: Chi Zhou | Session Co-chair: Tsz Ho Kwok

| | | |
|----------------|---|---|
| MSEC2021-63540 | Muyue Han, Jing Zhao and Lin Li | Emissions of Volatile Organic Compounds From 4D Printing and Associated Control Strategies Towards Workplace Safety |
| MSEC2021-63751 | Shubhra Kamal Nandi, Rakesh Kumar, Anubhav Anubhav and Anupam Agrawal | Prediction of Melt-Pool Characteristics in SLM Process for Ti6Al4V Using a Semi-Analytical Model |

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| MSEC2021-63823 | Ryan Stebbins, Philip King and Guha Manogharan | A Computational Study on Novel Runner Extension Designs via 3D Sand-Printing to improve Casting Performance |
| MSEC2021-63965 | Irfan Mustafa and Tsz Ho Kwok | Development of Intertwined Infills to Improve Multi-Material Interfacial Bond Strength |
| Friday, June 25 1:30 PM – 3:00 PM | MSEC 03-02 Advances in Manufacturing, Development, and Analysis of Biomedical Devices Session Chair: Yihao Zheng Session Co-chair: Yancheng Wang | |
| MSEC2021-63406 | Prasannavenkadesan Varatharajan and Pandithevan Ponnusamy | Prediction of Cutting Force in Bone Cutting Using Finite Element Analysis |
| MSEC2021-63715 | Yong Lei, Yingda Hu and Murong Li | Friction Analysis in Needle Insertion into Soft Tissue |
| MSEC2021-63952 | Yuan-Shin Lee, Yi Wang and Yen Yu Ian Shih | Vibration-Assisted Insertion of Flexible Cortical Neural Micro-Electrodes with Bio-Dissolvable Guides for Medical Implantation |
| MSEC2021-64056 | Xinxiao Li, Patrick Chernjavsky, Katerina Angjeli, Sola Hoffman, Sara Frunzi and Yihao Zheng | Experimental Investigation of the Material Removal Rate in Grinding of Calcified Plaque by Rotational Atherectomy |
| Friday, June 25 1:30 PM – 3:00 PM | MSEC 05-03-02 Advanced Machining and Metrology for Smart Manufacturing Technologies (ASME-JSME Joint Symposium) 2 Session Chair: Yasuhiro Takaya Session Co-chair: Satoru Maruyama | |
| MSEC2021-60651 | Norikazu Suzuki, Hiroki Hayashi, Eiji Shamoto, Naruhiro Irino and Yasuhiro Imabeppu | Time Domain Simulation of Dynamic Corner Milling Process Considering Chatter Vibration with Finite Amplitude |
| MSEC2021-63373 | Mitsuru Hasegawa and Tatsuya Sugihara | Development of Cutting Tools with Micro-Textured Surface for High-Speed Machining of Ti-6Al-4V |
| MSEC2021-63704 | Shoichi Tamura, Takashi Matsumura, Atsushi Ezura and Kazuo Mori | Anisotropic Cutting Force Characteristics in Milling of Maraging Steel Processed through Selective Laser Melting |
| MSEC2021-63727 | Isamu Nishida and Keiichi Shirase | Automated Tool Path Generation for End-Milling Operation using CAD Model in STL Format |
| Friday, June 25 1:30 PM – 3:00 PM | MSEC 06-06-03 Advances in Lightweight and Dissimilar Materials Joining 3 Session Chair: Xun Liu Session Co-chair: Wayne Cai | |
| MSEC2021-60412 | Jan-Tore Jakobsen, R. M Chandima Ratnayake, Arnfinn Neverdal and Sølve Sætre Sem | Investigating Optimal Parameter combination for Friction Stir Spot Welding on Al7075-T6: Engineering Robust Design Approach |
| MSEC2021-60759 | Nannan Chen, Hongliang Wang, Jingjing Li, Vic Liu and James Schroth | Evolution of Interfacial Microstructure during Resistance Spot Welding of Cu and Al with Ni-P Coating |
| MSEC2021-61775 | Shenghan Guo, Dali Wang, Jian Chen, Zhili Feng and Weihong Guo | Predicting Nugget Size of Resistance Spot Welds using Infrared Thermal videos with |

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| MSEC2021-63892 | Helen Guixiu Qiao and Guangkun Li | Auto-Calibration for Vision-Based 6-D sensing system to support Monitoring and Health Management for Industrial Robots |
| MSEC2021-63960 | David Gamero, Andrew Dugenske, Thomas Kurfess, Christopher Saldana and Katherine Fu | SQL and NoSQL Databases for Cyber Physical Production Systems in Internet of Things for Manufacturing |
| MSEC2021-63990 | Zhaojun Qin and Yuqian Lu | Multi-Agent-Based Self-Organising Manufacturing Network Towards Mass Personalisation |
| MSEC2021-63974 | Junying Yao, Yongkui Liu, Tingyu Lin, Xubin Ping, He Xu, Wenxiao Wang, Yingying Xiao, Lin Zhang and Lihui Wang | Robotic Grasping Training Using Deep Reinforcement Learning with Policy Guidance Mechanism |
| MSEC2021-64065 | Yongzhi Qu, Gregory Vogl and Zechao Wang | A Deep Neural Network Model for Learning Generalized Frequency Response Function Using Sensor Measurements |
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| MSEC2021-63864 | Sri Sukanta Chowdhury, Zhong Yang, Patrick W. Clapacs and Dan O. Popa | Untethered Microrobots with Serpentine Actuators: The Role of Elastic Point Contact & Laser Beam Shape on Their Locomotion |
| MSEC2021-63887 | Sushmita Challa, M. Shafquatul Islam, Danming Wei, Cindy Kathleen Harnett, Jasmin Beharic and Dan Popa | Functional Fiber Junctions for Circuit Routing in E-Textiles: Deterministic Alignment of MEMS Layout with Fabric Structure |
| MSEC2021-63902 | Sayli Jambhulkar, Weiheng Xu, Yuxiang Zhu, Dharnedar Ravichandran and Kenan Song | Microscale 3D Printed Patterns for Nanoscale Particle Assembly |
| MSEC2021-63916 | Andrea Grisell and Murali Sundaram | Creation of Functionally Graded Glass Channels by Electrochemical Discharge Machining Process: A Feasibility Study |
| MSEC2021-64079 | Bashir Khoda, S M Naser Shovon and AMM Nazmul Ahsan | Solid Transfer of Large Particles by Dipping in a Heterogeneous Mixture |
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| MSEC2021-72613 | Yusuf Altintas, Gabor Stepan, | Chatter Stability of Machining Operations |

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| | Erhan Budak, Tony Schmitz and Zekai Murat Kilic | |
| MSEC2021-73443 | I. Jawahir | Modeling and Optimization of Sustainable Machining Processes: Recent Advances and Outlook |
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| MSEC2021-68705 | Padmalatha Kakanuru and Kishore Pochiraju | Additively Manufactured High-Performance Silicon Carbide Composite |
| MSEC2021-68869 | Daniel Franke | Sub-Surface Void Formation and Detection During Friction Stir Welding of Aluminum Alloys |
| MSEC2021-68873 | Yang Xu | Direct Droplet Writing – a Novel Droplet-Punching Capillary-Splitting 3D Printing Method for Highly Viscous Materials |
| MSEC2021-68999 | Hemant Agiwal, Frank Pfefferkorn, Kumar Sridharan and Hwasung Yeom | Low Force Friction Surfacing for Crack Repair in 304L Austenitic Stainless Steels |
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| MSEC2021-68811 | Nathan Hertlein | Optimal Design and Processing for Additive Manufacturing Using Machine Learning |
| MSEC2021-68991 | Vysakh Venugopal | Numerical Optimization and Machine Learning Techniques for Part Design and Process Parameters for Additive Manufacturing |
| MSEC2021-69048 | Lun Li | Fast Additive Manufacturing Simulation and Optimization |
| MSEC2021-69068 | Matthew Krugh | Evaluation of Product Quality Through Technologically Augmented Workers in Industry 4.0 Assembly |
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| Session Chair: Ahmed Azab Session Co-chair: Chi Zhou | | |
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| MSEC2021-73030 | Philipp Sembdner, Bernhard Bust, Lars Dornheim, Stefan Holtzhausen and Ralph Stelzer | Parametrically Adjustable Surgical Template Models to Support the Insertion of Individual Knee Joint Implants |
| MSEC2021-70118 | Scott Kerner, Shamali Laxman Nevase, Matthew Krugh and Laine Mears | Wearable Force Sensing Glove for Manual Work in Automotive Assembly |

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| MSEC2021-72796 | Yinan Wang and Xiaowei Yue | NP-ODE: Neural Process Aided Ordinary Differential Equations for Uncertainty Quantification of Finite Element Analysis |
| MSEC2021-68691 | David Merayo, Alvaro Rodriguez-Prieto and Ana Maria Camacho | Prediction of Material Properties by Using the Finite Element Method and Artificial Intelligence |
| MSEC2021-73167 | Ethan Wescoat, Matthew Krugh and Laine Mears | Purposeful Failure Methodology: Generating Training Data for Predicting Equipment Failure |
| MSEC2021-69077 | Purvee Bhatia and Nancy Diaz-Elsayed | A Framework to Aid Decision-Making for Investing in Smart Manufacturing Technologies |
| MSEC2021-68958 | Chenang Liu and Zhangyue Shi | A Blockchain-Enabled Approach for Cyber-Physical Security in Advanced Manufacturing |
| MSEC2021-68971 | Aniruddha Gaikwad, Brian Giera, Gabriel Guss, Jean-Baptiste Forien, Manyalibo Matthews and Prahalada Rao | Sensing and Physics-based Machine Learning for Quality Assurance in L-PBF |
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| MSEC2021-68848 | Kolbe Kirlin and James Garofalo | Design and Testing of Wire Arc Additive Manufacturing (WAAM) End Effector |
| MSEC2021-68965 | Benjamin Bevans, Ziyad Smoqi, James Craig, Alan Abul-Haj, Brent Roeder, Bill Macy, Jeffery E. Shield and Prahalada Rao | Closed-Loop Control of Meltpool Temperature in Directed Energy Deposition |
| MSEC2021-69049 | Reza Yavari, Ziyad Smoqi, Alex Rienschie, Ben Bevans, Humaun Kobir, Heimdall Mendoza, Hyeyun Song, Kevin Cole and Prahalada Rao | Part-Scale Thermal Simulation of Laser Powder Bed Fusion Using Graph Theory: Effect of Thermal History on Porosity, Microstructure Evolution, and Recoater Crash |
| MSEC2021-69073 | Xiaoqing Wang, Yi Yao, Shanshan Zhang, Lin Li, Wenjun Cai, Natalia Esparragoza, Matthew Rosser, Dana Ingalsbe and Kaiwen Wang | Microstructure and Mechanical Properties of 18Ni-300 Maraging Steel Fabricated by Selective Laser Melting |
| MSEC2021-69078 | Ziyad Smoqi, Benjamin Bevans, Harold (Scott) Halliday, Joshua Toddy, Jeffery Shield and Prahalada Rao | Directed Energy Deposition of Cobalt-Chromium Stellite Wear Coating |
| MSEC2021-67397 | Rana Dabaja, Robert Buechler, Sun-Yung Bak, Gustavo | Intelligent Dental Implant Design |

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| MSEC2021-68643 | India Dykes, Mahmoud Amr, Arda Gozen, Michelle Counts, Joshua Kernan, Alia Mallah, Juana Mendenhall, Nehal Abu-Lail and Bernard Vanwie | 3D Printed Sa-Gel-Ga Scaffolds with Tunable Mechanical Properties |
| MSEC2021-68863 | Karl Schuchard, Bruce Anderson, Behnam Pourdeyhimi and Rohan Shirwaiker | Characterization of 3d-Melt Blowing for Tissue Engineering Applications |
| MSEC2021-72866 | Moataz Abdulhafez and Mostafa Bedewy | Direct Laser-Induced Nanocarbon Formation on Flexible Polymers: Tailoring Porous and Fibrous Morphologies |
| MSEC2021-73147 | Chao Sui and Wenchao Zhou | Effects of Driving Signal on Piezo Inkjet Printing |
| MSEC2021-68771 | Mingman Sun and Meng Zhang | Physics-Based Modeling for Two Photon Polymerization Additive Manufacturing |
| MSEC2021-68949 | Liangkui Jiang, Pavithra Premaratne, Yanhua Huang, Zhan Zhang and Hantang Qin | Modeling of Droplet Generation in Electro Hydrodynamic Inkjet Printing |
| MSEC2021-68608 | Ala Qattawi, Ala'aldin Alafaghani, Muhammad Ali Ablat Nuryar, Hossein Abedi and Jian-Qiao Sun | Data-Driven Modeling and Optimization of FDM Processing Parameters |
| MSEC2021-68726 | Christopher Indrarto and Burak Sencer | Machine Tool Vibration Mitigation by Optimal Trajectory Pre-Filter Design |
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| MSEC2021-68798 | Marija Glisic, Badrinath Veluri and Devarajan Ramanujan | Reusable Life Cycle Inventory Models for Centerless Grinding |
| MSEC2021-68852 | Tyler Grimm and Laine Mears | Electrically Assisted Milling |
| MSEC2021-68968 | Julianne Jonsson, Christopher Chighizola, Christopher D'elia, Michael Hill, Barbara Linke, Daniel Weber, Benjamin Kirsch and Jan Aurich | Wafer Experiments to Assess Machining Distortion in Aluminum |
| MSEC2021-71239 | Nilesh Ashok Kharat, Tyler Grimm and Laine Mears | 3D Stochastic Milling for Freeform Surfaces |
| MSEC2021-69521 | Felicia Fashanu and Barbara Linke | Analysis of Force Controlled Grinding with a Multi-Grit Scratch Test on a Polishing Machine |

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| MSEC2021-73165 | Sohan Nagaraj and Nancy Diaz-Elsayed | Correlation Between the Tool Temperature and Workpiece Surface Characteristics in CNC Milling |
| MSEC2021-68966 | Masafumi Endo, Burak Sencer | Machining Cycle-Time Prediction by Machine Learning of CNC Interpolator Dynamics |
| MSEC2021-68994 | Nishant Ojal, Harish Cherukuri, Ryan Copenhaver, Tony Schmitz, Adam W. Jaycox and Kyle Devlugt | SPH Simulations of Modulated Tool Path Machining |
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| MSEC2021-69005 | Ru Yang and Ping Guo | Deep-learning based Point-light Photometric Stereo for 3D Reconstruction of Metal Surface |
| MSEC2021-69021 | Mohammad Ali Ansari, Frank Pfefferkorn and Shiva Rudraraju | Predictive Modeling of Defect Formation in Friction Stir Welding |
| MSEC2021-73041 | Amit B. Deshpande, Tyler J. Grimm and Laine Mears | Abrasive Element Use in Friction Element Welding |
| MSEC2021-73042 | Gowtham V. Parvathy, Tyler Grimm and Laine Mears | Heat Assisted Friction Element Welding |
| MSEC2021-73058 | Golnaz Tomraei, Jaegeun Lee, Moataz Abdulhafez and Mostafa Bedewy | Decoupling Gas-Phase Decomposition, Catalyst Nanoparticle Formation, and Catalytic Growth in CVD of Carbon Nanotube Forests |
| MSEC2021-68963 | Hossein Abedi, Keyvan Safaei Baghbaderani, Ala'aldin Alafaghani, Ala Qattawi, Moataz M. Attallah and Mohammad Elahinia | Neural Network Modeling of NiTiHf Transformation Temperatures |
| MSEC2021-68941 | Ala Qattawi, Muhammad Ali Ablat and Jian-Qiao Sun | Investigating Fracture Failure in Origami-Based Sheet Metal Bending |

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