Contents:

Special Issue on Technology Infrastructure for Enabling Smart Manufacturing
Guest Editors: Steven Shooter, Björn Johansson, Yan Lu, Haresh Malkani, and Seung-Jun Shin

Overview

REVIEW PAPERS

1 Defining Near-Term to Long-Term Research Opportunities to Advance Metrics, Models, and Methods for Smart and Sustainable Manufacturing—Arvind Shankar Raman, Karl R. Haapala, Kamyar Raoufi, Barbara S. Linke, William Z. Bernstein, and K. C. Morris


62 Digital Technologies Enabling Data of Production Systems for Decision Support—Maja Bärring, Björn Johansson, and Johan Stahre

80 Methodology for Digitally Logging and Analyzing Manufacturing Issues Encountered on a Factory Floor—Annie Duffy, Ken Bruton, Richard Harrington, Alexander Brem, and Dominic O'Sullivan

99 Privacy-Preserving Data Mining for Smart Manufacturing—Qianyu Hu, Ruimin Chen, Hui Yang, and Soundar Kumara

121 Benchmarking Deep Neural Network Architectures for Machining Tool Anomaly Detection—Tejas Puranik, Aroua Gharbi, Burak Bagdatli, Olivia Prian Fischer, and Demitri N. Mavris


163 Identification of Microstructures in 3-D Printed Ti-6Al-4V Using Acoustic Emission Cepstrum—Tapan Ganatma Nakkina, Ashif Sikandar Iquebal, Rama Krishna Sai S. Gorri, and Satish Bukkapotnam

179 Bidirectional Gated Recurrent Deep Learning Neural Networks for Smart Acoustic Emission Sensing of Natural Fiber–Reinforced Polymer Composite Machining Process—Zimo Wang, Pawan Dixit, Faissal Chegdani, Behrouz Tokati, Bruce L. Tai, Mohamed El Mansori, and Satish Bukkapotnam

199 Smart Machining Process Monitoring Enabled by Contextualized Process Profiles for Synchronization—Zhigang Wang, Timothy C. Wagner, and Changsheng Gao


335 Enabling Advanced Process Control for Manual Grinding Operations—Akhshay Kotapodi Komath, Barbara S. Linke, and Chhi-Huang Chu


Smart and Sustainable Manufacturing Systems: Volume 4, Issue 2

Contents:

Special Issue on Technology Infrastructure for Enabling Smart Manufacturing
Guest Editors: Steven Shooter, Björn Johansson, Yan Lu, Haresh Malkani, and Seung-Jun Shin

iii Overview

REVIEW PAPERS

1 Defining Near-Term to Long-Term Research Opportunities to Advance Metrics, Models, and Methods for Smart and Sustainable Manufacturing—Arvind Shankar Raman, Karl R. Haapala, Kamyar Raoufi, Barbara S. Linke, William Z. Bernstein, and K. C. Morris


62 Digital Technologies Enabling Data of Production Systems for Decision Support—Maja Bärring, Björn Johansson, and Johan Stahre

80 Methodology for Digitally Logging and Analyzing Manufacturing Issues Encountered on a Factory Floor—Annie Duffy, Ken Bruton, Richard Harrington, Alexander Brem, and Dominic O’Sullivan

99 Privacy-Preserving Data Mining for Smart Manufacturing—Qianyu Hu, Ruimin Chen, Hui Yang, and Soundar Kumara

121 Benchmarking Deep Neural Network Architectures for Machining Tool Anomaly Detection—Tejas Puranik, Aroua Gharbi, Burak Bagdatli, Olivia Prian Fischer, and Demiti N. Mounis


163 Identification of Microstructures in 3D–Printed Ti-6Al-4V Using Acoustic Emission Cepstrum—Tapan Ganatma Nakkina, Ashif Sikandar Iquebal, Rama Krishna Sai S. Gothi, and Satish Bukkapatnam
CO-EDITORS
Dr. Yinlun Huang
Department of Chemical Engineering and Materials Science
Wayne State University
Detroit, MI, USA

Dr. Sudarsan Rachuri
Advanced Manufacturing Office
Office of Energy Efficiency and Renewable Energy
Department of Energy
Washington, DC, USA

EDITORIAL SERVICES
Sara Welliver
Supervisor, Peer Review Services
J&J Editorial Services
201 Shannon Oaks Cir #124
Cary, NC 27511, USA
tel +1.919.650.1459, ext. 210
astm@jjeditorial.com

EDITORIAL OBJECTIVES
Smart and Sustainable Manufacturing Systems (SSMS) is published online by ASTM International, a nonprofit technical organization that develops and publishes voluntary consensus standards and related information for materials, products, systems, and services. Contributions are peer reviewed prior to publication.

PURPOSE AND SCOPE
This journal fosters transdisciplinary research that crosses the boundaries of information science, systems engineering and engineering design, manufacturing, and product life cycle with a focus on how to make manufacturing systems smarter and sustainable.

ASSOCIATE EDITORS
Dr. Darek Ceglarek
University of Warwick
Coventry, UK

Prof. Matthew Doolan
Australian National University
Canberra, Australia

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

Dr. Sagar V. Kamarthi
Northeastern University
Boston, MA, USA

Prof. Sami Kara
University of New South Wales
Sydney, Australia

Dr. Soundar Kumara
Pennsylvania State University
University Park, PA, USA

Dr. Sankaran Mahadevan
Vanderbilt University
Nashville, TN, USA

Dr. Raju Mattikalli
The Boeing Company
Seattle, WA, USA

Dr. Laura Pullum
Oak Ridge National Laboratory
Oak Ridge, TN, USA

Prof. Lihong Qiao
Beijing University
Beijing, China

Prof. K. Senthil Kumar
Indian Institute of Information Technology
Chennai, India

Prof. Roberto Teti
University of Naples Federico II
Napoli, Italy

Dr. Manoj Kumar Tiwari
National Institute of Industrial Engineering,
Mumbai, India

Prof. Thorsten Wuest
West Virginia University
Morgantown, WV, USA

Dr. Li Zheng
Tsinghua University
Beijing, China

EDITORIAL BOARD
Dr. Fazleena Badurdeen
University of Kentucky
Lexington, KY, USA

Dr. Yashwanth Kumar Bandari
Oak Ridge National Lab
Knoxville, TN, USA

Dr. Abdelaziz Bouras
Qatar University
Doha, Qatar

Prof. Alexander Brodsky
George Mason University
Fairfax, VA, USA

Dr. Bryony DuPont
Oregon State University
Corvallis, OR, USA

Prof. Sebti Foufou
Qatar University
Doha, Qatar

Prof. Pasquale Franciosa
University of Warwick
Coventry, UK

Dr. Robert Gao
The University of Connecticut
Storrs, CT, USA

Dr. Moneer Helu
NIST
Gaithersburg, MD, USA

Prof. Sanjay Jain
George Washington University
Washington, DC, USA

Prof. I. S. Jawahir
University of Kentucky
Lexington, KY, USA

Dr. Minna Lanz
Tampere University of Technology
Tampere, Finland

Dr. Kincho H. Law
Stanford University
Stanford, CA, USA

Dr. Mahesh Mani
Allegheny Science and Technology
Washington, DC, USA

Dr. Michael W. McKittrick
U.S. Department of Energy
Washington, DC, USA

Dr. Shreyes N. Meikote
Georgia Institute of Technology
Atlanta, GA, USA

Prof. P. V. M. Rao
Indian Institute of Technology Delhi
New Delhi, India

Dr. Utpal Roy
Syracuse University
Syracuse, NY, USA

Dr. Christopher J. Saldana
Georgia Institute of Technology
Atlanta, GA, USA

Prof. Esvaran Subrahmanian
Carnegie Mellon University
Pittsburgh, PA, USA

Dr. Dawn Tilbury
University of Michigan
Ann Arbor, MI, USA

Dr. Conrad S. Tucker
Carnegie Mellon University
Pittsburgh, PA, USA

Dr. Li Zheng
Tsinghua University
Beijing, China

Dr. Bicheng Zhu
H.A. Automotive Systems Inc.
Troy, MI, USA

Dr. Mahesh Mani
Allegheny Science and Technology
Washington, DC, USA

Dr. Michael W. McKittrick
U.S. Department of Energy
Washington, DC, USA

Dr. Shreyes N. Meikote
Georgia Institute of Technology
Atlanta, GA, USA

Prof. P. V. M. Rao
Indian Institute of Technology Delhi
New Delhi, India

Dr. Utpal Roy
Syracuse University
Syracuse, NY, USA

Dr. Christopher J. Saldana
Georgia Institute of Technology
Atlanta, GA, USA

Prof. Esvaran Subrahmanian
Carnegie Mellon University
Pittsburgh, PA, USA

Dr. Dawn Tilbury
University of Michigan
Ann Arbor, MI, USA

Dr. Conrad S. Tucker
Carnegie Mellon University
Pittsburgh, PA, USA

Dr. Anahita Williamson
NJ, USA

Dr. Paul William Witherell
NIST
Gaithersburg, MD, USA

Dr. Lang Yuan
University of South Carolina
Columbia, SC, USA

Dr. Jing Zhang
Indiana University—Purdue
University Indianapolis
Indianapolis, IN, USA

POSTMASTER send address change to:
ASTM International—SSMS, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959

www.astm.org Printed in the USA.
Overview

Smart and sustainable manufacturing systems are rapidly evolving in response to global competitiveness and demands from industry. In order to address rapid developments in the state of the art, this special issue addresses specific technology infrastructures for enabling smart manufacturing and brings various stakeholders to address call for action in research and technology issues, viewpoint on gaps, challenges, opportunities, and disruptive technologies in transitioning research to technology, to product, and to market place. The traditional IT brings together all needed technologies for information processing. Operational Technologies (OT), alternatively, support physical value creation through the use of sensors and software necessary to predict, control and monitor plant and equipment.

This special issue includes thirteen peer-reviewed papers addressing the state of the art in technology infrastructure for smart manufacturing. The first paper by Raman et al. presents the outcomes from a workshop at the National Institute of Standards and Technology that brought together thought leaders in academia, industry, and government with the aim to define advanced manufacturing research and educational needs for improving manufacturing process performance through improved sustainability metrics, modeling approaches, and decision support methods. The results are recommendations for future research responding to the short-, mid-, and long-term needs of the advanced manufacturing community for enabling smart and sustainable manufacturing. This is followed by three papers providing an overview of domains critical to smart and sustainable manufacturing: Lynn et al. provide the state of integrated CAM/CNC control systems with a path towards smarter CNC; Morris, Lu, and Frechette establish foundations for information governance for smart manufacturing; and Bärring, Johansson, and Stahre provide a state of digital technologies enabling data of production systems for decision support.

The next series of papers describe methodologies and approaches to enable transformation in smart and sustainable manufacturing. Duffy et al. describe a methodology for digitally logging and analyzing manufacturing issues encountered on a factory floor. The approach sets the stage for a more complete digital transformation. Hu et al. describe approaches for privacy preserving data mining in smart manufacturing and highlights a technique for enhancing cyber-security while managing the digital transformation in manufacturing. The theme continues in the paper by Puranik et al. by benchmarking deep neural network architectures for machining tool anomaly detection. This is capped by the paper by Adrita et al. that describes the development of a decision support system to enable adaptive manufacturing. These operational technologies are critical for the transition to smart and sustainable manufacturing.

The remaining papers describe applications where technologies for smart manufacturing are employed. Additive manufacturing will undoubtedly become more integrated in future manufacturing. Nakkina et al. describe how smart manufacturing technologies are applied to the identification of microstructures in 3D printed Ti-6Al-4V using acoustic emission cepstrum. Wang et al. demonstrate the use of neural networks in smart acoustic emission sensing in composite machining. Smart machining is further developed by Wang, Wagner, and Guo, with process monitoring enabled by contextualized process profiles for synchronization. Smart finishing of parts is described by Kamath,
Linke, and Chu by enabling advanced process control for manual grinding operations. The special issue ties these processes together with the final paper by Nåfors et al. and an application of a hybrid digital twin concept for factory layout planning.

The resulting special issue on technology infrastructure for smart and sustainable manufacturing contains some of the most recent and state of the art advances in the field by experts from around the world. We are certain that the range of papers will prove beneficial to researchers as they examine the state of the art and build upon the foundations. We have also endeavored to provide applications to demonstrate these technologies on applicable advanced manufacturing systems and operations.

Guest Editors

Dr. Steven Shooter
George Washington University and Advanced Manufacturing Office,
US Department of Energy

Dr. Björn Johansson
Chalmers University of Technology

Dr. Yan Lu
Systems Integration Division, US National Institute of Standards and Technology

Dr. Haresh Malkani
Clean Energy Smart Manufacturing Innovation Institute

Dr. Seung-Jun Shin
Hanyang University