

SPECIAL ISSUE

**LEADING INFORMATION AND COMMUNICATION TECHNOLOGIES FOR SMART MANUFACTURING: FACING THE NEW CHALLENGES AND OPPORTUNITIES OF THE 4TH INDUSTRIAL REVOLUTION**

*Edited by S. Di Cataldo, S. Lee, E. Macii, and B. Vogel-Heuser*

**326 Optimizing Quality Inspection and Control in Powder Bed Metal Additive Manufacturing: Challenges and Research Directions**

*By S. Di Cataldo, S. Vinco, G. Urgese, F. Calignano, E. Ficarra, A. Macii, and E. Macii*

| INVITED PAPER | This article provides a wide overview of the latest progress of *in situ* monitoring and control in powder bed metal additive manufacturing, showcasing solutions from both research and industry.

**347 Six-Sigma Quality Management of Additive Manufacturing**

*By H. Yang, P. Rao, T. Simpson, Y. Lu, P. Witherell, A. R. Nassar, E. Reutzel, and S. Kumara*

| INVITED PAPER | This article proposes to design, develop, and implement the new DMAIC (define, measure, analyze, improve, and control) methodology for the six-sigma quality management of additive manufacturing.

**377 Artificial-Intelligence-Driven Customized Manufacturing Factory: Key Technologies, Applications, and Challenges**

*By J. Wan, X. Li, H.-N. Dai, A. Kusiak, M. Martínez-García, and D. Li*

| INVITED PAPER | This article presents the architecture of an AI-driven customized smart factory, showcasing intelligent manufacturing devices, intelligent information interaction, and construction of a flexible manufacturing line.

**399 Manufacturing as a Data-Driven Practice: Methodologies, Technologies, and Tools**

*By T. Cerquitelli, D. J. Pagliari, A. Calimera, L. Bottaccioli, E. Patti, A. Acquaviva, and M. Poncino*

| INVITED PAPER | This article surveys and discusses, with project case studies, the latest software technologies to collect, manage, and elaborate all data generated by Internet of Things (IoT) deployed over a production line.

**423 Learning-Based Automation of Robotic Assembly for Smart Manufacturing**

*By S. Ji, S. Lee, S. Yoo, I. Suh, I. Kwon, F. C. Park, S. Lee, and H. Kim*

| INVITED PAPER | This article proposes an approach to endowing robots with the capability of autoprogramming of assembly tasks with minimal human assistance that is based on “learning from observation” and “robotic embodiment.”

DEPARTMENTS

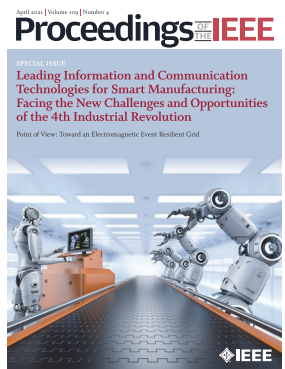
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*By S. Di Cataldo, S. Lee, E. Macii, B. Vogel-Heuser*

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**On the Cover:**

The cover illustration of a smart factory that utilizes robots to perform tasks with little or no human interaction aptly captures the theme of this month's issue.

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By *D. Baumann, F. Mager, U. Wetzker, L. Thiele, M. Zimmerling, and S. Trimpe*

**| INVITED PAPER |** Based on the analysis of literature approaches and real-world use cases, this article identifies and discusses the main challenges that need to be faced for a tight integration of control and wireless communication in smart manufacturing.

## **468 Wireless Networked Multirobot Systems in Smart Factories**

By *K.-C. Chen, S.-C. Lin, J.-H. Hsiao, C.-H. Liu, A. F. Molisch, and G. P. Fettweis*

**| INVITED PAPER |** This article discusses the challenges of smart manufacturing based on artificial intelligence and information communication technology from a wireless networking perspective.

## **495 A Survey of Cybersecurity of Digital Manufacturing**

By *P. Mahesh, A. Tiwari, C. Jin, P. R. Kumar, A. L. N. Reddy, S. T. S. Bukkapatnam, N. Gupta, and R. Karri*

**| INVITED PAPER |** This article presents and discusses the cybersecurity risks in the emerging digital manufacturing (DM) context, assesses the impact on manufacturing, and identifies viable approaches to secure DM.

## **517 A Unified Architectural Approach for Cyberattack-Resilient Industrial Control Systems**

By *C. Zhou, B. Hu, Y. Shi, Y.-C. Tian, X. Li, and Y. Zhao*

**| INVITED PAPER |** This article deals with the cybersecurity issues posed by the Industry 4.0 era, with specific regard to industrial control systems (ICSs), and presents a unified architectural approach to proactively address these issues.

## **542 (Re)deployment of Smart Algorithms in Cyber-Physical Production Systems Using DSL4hDNCS**

By *B. Vogel-Heuser, E. Trunzer, D. Hujo, and M. Sollfrank*

**| INVITED PAPER |** This article addresses the redeployment of intelligent algorithms and learning for evolving smart cyber-physical production systems (CPPSs) with a comprehensive domain-specific language (DSL), DSL4hDNCS.

## **556 A Methodology for Digital Twin Modeling and Deployment for Industry 4.0**

By *G. N. Schroeder, C. Steinmetz, R. N. Rodrigues, R. V. B. Henriques, A. Rettberg, and C. E. Pereira*

**| INVITED PAPER |** This article focuses on the digital twin (DT), one of the key concepts of Industry 4.0, and proposes a methodology for DT design using model-driven engineering (MDE) that strives toward being both flexible and generic.

## **568 A Connective Framework to Support the Lifecycle of Cyber-Physical Production Systems**

By *R. Harrison, D. A. Vera, and B. Ahmad*

**| INVITED PAPER |** This article envisions a connective framework to support the engineering of cyber-physical production systems (CPPSs) in smart manufacturing through the use of a set of digital twins consistent with the real system throughout its lifecycle.

## **582 A Platform Programming Paradigm for Heterogeneous Systems Integration**

By *K.-B. Gemlau, L. Köhler, and R. Ernst*

**| INVITED PAPER |** This article revisits the programming paradigm that is currently used for lock-free multicore programming and explains its extension to the system level, exploring its application to two important developments in industrial design.

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