Guest Editorial Special Section—Papers From the 2019 MASM/WSC Conference

THE 2019 International Conference on Modeling and Analysis of Semiconductor Manufacturing (MASM 2019) was part of the 2019 Winter Simulation Conference (WSC) that was held December 8–11 in National Harbor, MD, USA. The MASM conferences provide a forum for the exchange of ideas and industrial innovations between researchers and practitioners from around the world involved in modeling and analysis of complex high-tech manufacturing systems. While the papers from MASM conferences are of high quality and are often cited in journal papers, they are limited in size. As a premier journal for topics covered in the MASM conferences, IEEE TRANSACTIONS ON SEMICONDUCTOR MANUFACTURING, agreed to consider extended article submissions based on the 21 papers accepted and presented at the MASM 2019 conference for a Special Section of an upcoming issue of the journal. There were sessions on Scheduling and Dispatching, Fab Scheduling, Maintenance and Engineering, Capacity and Production Planning, Qualification and Wafer-to-Order Allocation, Semiconductor Manufacturing Models, and Semiconductor Modeling Representations. Dr. Sabine Herlitschka, Chief Executive Officer and Chief Technology Officer of Infineon Technologies Austria AG, gave an excellent keynote talk titled "A European View on Future Semiconductor Industry Needs for MASM." An archive of the MASM 2019 papers can be found at https://informs-sim.org/wsc19papers/by_area.html.

The guest editors of this Special Section were the Co-chairs of the 2019 MASM conference and they invited the authors of 9 papers to submit a full paper for consideration. Six papers were submitted and four appear herein. Each paper in this special section contains at least 40% new content with significant new content in the results portion of the paper. Each of the papers will be briefly described below.

The first paper is titled "A Sequential Search Method of Dispatching Rules for Scheduling of LCD Manufacturing Systems" and is an extension of Lee *et al.* (2019). In this paper, the authors propose a sequential search method for finding a proper set of weights for combining dispatching rules to improve an objective value of the fab, such as increasing throughput or decreasing setup times. They use a decision tree approach and a hierarchical clustering method to efficiently search for weights in a short period of time by eliminating some sub-spaces that are less likely to have good objective values. The proposed method finds better weight sets than a random search method and a response optimization method in experiments.

The second paper is titled "Which Spare Parts Service Measure to Choose for a Front-End Wafer Fab?" and is an extension of Lamghari-Idrissi *et al.* (2019). In this paper, the authors study the influence of spare part service measures on the performance of front-end wafer fabrication process with an emphasis on the bottleneck resource. First, they simulate the spare part supply chain to show the impact of the spare part service measures on the time to repair distribution. Second, they use this empirical distribution to assess the performance of the front-end wafer fabrication process. They conclude that the choice of the spare parts service measure has a high impact on the front-end wafer fabrication process performance. The proposed methodology could help practitioners make improved decisions regarding spare parts service measures.

The third paper considers a qualification management problem arising in the photolithography area of wafer fabs. This is an extension of Kopp and Mönch (2019) and is titled "Matheuristics for Qualification Management Decisions in Wafer Fabs." The stepper machines, a common bottleneck in many wafer fabs, must be qualified to process lots of different families. A qualification time window is associated with each stepper and family. It can be reinitialized as needed and can be extended by on-time processing of lots from qualified families. Fast heuristic approaches, among them a Greedy Randomized Adaptive Search Procedure (GRASP), are proposed to solve large-sized problem instances using a small amount of computing time. The qualification decisions modeled by binary decision variables are made by heuristic procedures that exploit the problem structure while the real-valued quantities for each family and stepper are computed using linear programming. Computational experiments based on randomly generated problem instances are conducted. The results show that the proposed matheuristics are able to quickly provide high-quality solutions.

The final paper is titled "SMT2020—A Semiconductor Manufacturing Testbed" and is an extension of Kopp *et al.* (2019). In this paper, the authors present a new set of simulation models, organized in a testbed. The aim of the testbed consists in providing researchers with a platform able to credibly represent the complexity of modern semiconductor manufacturing. The testbed is open for public use, and so far includes four models. A high-volume/low-mix model and a low-volume/high-mix model are the foundation of the

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testbed. Two additional models incorporate the complexity of engineering lots. The paper includes a case study that demonstrates that the third and fourth model can be used to assess the performance of integrated dispatching strategies for production and engineering lots.

In closing, we encourage the readers of this Special Section to participate in a future MASM conference which is annually included as conference within the Winter Simulation Conference.

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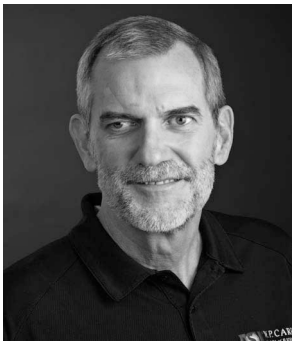
APPENDIX
RELATED WORK

1) M. Hassoun, D. Kopp, L. Mönch and A. Kalir, "A new high-volume/low-mix simulation testbed for semiconductor manufacturing," in *Proc. Winter Simulat. Conf. (WSC)*, National Harbor, MD, USA, 2019, pp. 2419–2428, doi: 10.1109/WSC40007.2019.9004654.
2) D. Kopp and L. Mönch, "Fast heuristics for making qualification management decisions in wafer fabs," in *Proc. Winter Simulat. Conf. (WSC)*, National Harbor, MD, USA, 2019, pp. 2348–2359, doi: 10.1109/WSC40007.2019.9004941.
3) D. Lamghari-Idrissi, D. Soellaart, R. Basten and N. Dellaert, "Influence of spare parts service measures on the performance of front-end wafer production process," in *Proc. Winter Simulat. Conf. (WSC)*, National Harbor, MD, USA, 2019, pp. 2269–2280, doi: 10.1109/WSC40007.2019.9004919.
4) J. Lee, Y. Kim, Y. B. Kim, H. Kim, B. Kim, and G. Chung, "A sequential search framework for selecting weights of dispatching rules in manufacturing systems," in *Proc.Winter Simulat. Conf. (WSC)*, National Harbor, MD, USA, 2019, pp. 2201–2211, doi: 10.1109/WSC40007.2019.9004693.



John W. Fowler is the Motorola Professor of International Business with the W. P. Carey School of Business, Arizona State University (ASU). He has published over 125 journal articles and over 100 conference papers. His research interests include discrete-event simulation, deterministic scheduling, multicriteria decision making, and applied operations research with applications in semiconductor manufacturing and healthcare. He was the Program Chair for the 2002 and 2008 Industrial Engineering Research Conferences and the 2008 Winter Simulation Conference (WSC) and the Program Co-Chair for the 2012 INFORMS National Meeting. He was the Founding Editor-in-Chief of *IIE Transactions on Healthcare Systems Engineering* and currently serves as a Healthcare Operations Management Departmental Editor. He is also an Editor of the *Journal of Simulation* and an Associate Editor of IEEE TRANSACTIONS ON SEMICONDUCTOR MANUFACTURING and the *Journal of Scheduling*. He is a Fellow of the Institute of Industrial and Systems Engineers (IISE), served as the IISE Vice President for Continuing Education, is a former INFORMS Vice President, and served on the WSC Board of Directors.

Lars Mönch received the master's and Ph.D. degrees in applied mathematics from the University of Göttingen, Germany, and the Habilitation degree in information systems from the Technical University of Ilmenau. He is a Full Professor with the Department of Mathematics and Computer Science, University of Hagen, Germany. He has authored over 80 refereed journal papers and book chapters, two monographs, and one edited book. His current research and teaching interests are in production planning and control of semiconductor wafer fabrication facilities, and applied optimization and artificial intelligence applications in manufacturing, logistics, and service operations. He serves as an Associate Editor for the IEEE TRANSACTIONS ON SEMICONDUCTOR MANUFACTURING, the IEEE TRANSACTIONS ON AUTOMATION SCIENCE AND ENGINEERING, the *European Journal of Industrial Engineering*, *Business & Information Systems Engineering*, *RAIRO—Operations Research*, and the *Journal of Simulation*.

Tae-Eog Lee received the Doctoral degree from The Ohio State University. He has been a Professor with the Department of Industrial and Systems Engineering, KAIST, since 1991. He has worked on modeling, simulation, scheduling, and control of robotized process tools for semiconductor manufacturing and discrete-event systems like Petri nets, and modeling and simulation for combat training. He received "The Month's Scientist Award" from Korean Research Foundation and Ministry of Science and Technology, South Korea, in December 2015. He was the President of KIIE from 2017 to 2018 and an Associate Editor of IEEE TRANSACTIONS ON AUTOMATION SCIENCE AND ENGINEERING from 2004 to 2008. He has also served for Modeling and Analysis of Semiconductor Manufacturing and several other international conferences.