Preface

The international conference on "Robust Manufacturing Control—Innovative and Interdisciplinary Approaches for Global Networks" (RoMaC 2012) was held on the campus of Jacobs University in Bremen, Germany. As expressed by the title, one major intention of the conference is to focus on transdisciplinary approaches toward robustness in manufacturing. The conference was sponsored by the International Production Engineering Academy (CIRP) and the Alfried Krupp von Bohlen und Halbach-Foundation, to both of which I am very thankful.

Today, Global Production Networks (i.e., the nexus of interconnected material and information flows through which products and services are manufactured, assembled, and distributed) are confronted with and expected to adapt to:

- sudden and unexpectable large-scale changes of important parameters which occur more frequently.
- event propagation in networks with high degree of interconnectivity which leads to unforeseen fluctuations.
- non-equilibrium states which increasingly characterize daily business.

These multi-scale changes deeply influence logistic target achievement and call for robust planning and control strategies. Therefore, understanding the cause and effects of multi-scale changes in production networks is of major interest in order to achieve robustness in respect of stabilizing and sustaining systems performance. New methodological approaches from different science disciplines are promising to contribute to a new level of comprehension of network processes. Unconventional methods from biology, perturbation ecology, or auditory display are gaining increasing importance as they are confronted with similar challenges. Advancements from the classical disciplines such as mathematics, physics, and engineering are of continuing importance.

This Lecture Notes Volume starts out with Part I "Interdisciplinary Approaches for Robustness in Manufacturing". The contributions presented in Part I cover interdisciplinary work between manufacturing research and a wide range of disciplines, such as systems biology, auditory display, network sciences, or nonlinear dynamics. Especially for today's global manufacturing systems, interdisciplinary

research offers a possibility to tackle research questions that arise due to the interplay between a need for robustness and a growing system complexity in manufacturing. As for instance shown in the first paper of Part I by Beber et al., strong parallels exist between manufacturing and metabolic systems. This justifies the application of methods from systems biology, which are designed to cope with the complexity of natural systems (i.e., cells) and offer possibilities to analyze and describe system robustness. Further, it is shown in Part I by Iber et al. that the analysis of manufacturing feedback data with methods from auditory display can identify causes and impacts of certain parameters in complex manufacturing networks which graphical analysis is not able to. This can support and contribute to an increasing robustness of manufacturing processes.

Part II "Robust Manufacturing Control Methods" addresses the issue of how important it is to have novel tools and approaches, which enable manufacturers to keep their high performance in today's unpredictable market conditions. Techniques from three different areas are presented. First, several scheduling methods are described. Scheduling is a well-known problem, which has been extensively studied in the literature. However, manufacturing systems nowadays are highly complex and also often highly automated and therefore further advancements are necessary. Moreover, as production systems have to face sudden changes and fluctuations, innovative robust scheduling procedures are needed. Second, this part also presents methods related to the concept of autonomous control. Granting various logistic objects decision-making abilities could lead to increased robustness of the systems. Third, the part finishes with data mining techniques, which can be used in order to discover knowledge from databases. Such tools are commonly applied in many fields and their use is also growing in manufacturing and logistics. Data mining algorithms can be very beneficial in a complex manufacturing environment, where numerous parameters are involved. For example, they can be utilized to form different product families or to generate production planning rules.

The central topic of the contributions summarized in Part III is "Robustness in Manufacturing Networks and Adaptable Logistics Chains". All contributions focus on the fact that the majority of nowadays manufacturing companies organize their production in a production network: suppliers, manufacturing sites, distribution hubs, and customers are spread around the whole world. Challenges that companies are faced with and solutions to problems that they encounter if they want to keep their production network robust and adaptable are presented here. Within this overarching range, contributions in Part III address several different problems: first, methods to design, configure, or plan robust production networks are presented. This is followed by contributions that deal with the issue of quality management as a means to achieve robustness in global production networks. Part III further includes contributions on collaboration, coordination, and adaptability within global production networks. It concludes with contributions that address questions of decentralized manufacturing, putting also a focus on environmental impacts and issues.

Part IV "Process Optimization and Strategic Approaches toward Robustness" presents a selection of papers, which elaborate on diverse aspects of robust manufacturing control. First, companies should establish adaptable production processes, which are able to operate under changing market conditions. Manufacturers need to ensure that their logistics performance matches the requirements of the customers in terms of delivery reliability, for example. Therefore, concepts such as productivity of the production processes, the level of decentralization of production control, and optimization of the decision-making procedures in production planning and control are of high importance and are addressed in some of the papers in this part. In addition to looking into their processes, manufacturers should also carefully select their strategies. They need to develop manufacturing and strategic flexibilities, which enable them to have strategies of higher robustness. Finally, it is argued that enterprises should also consider the trade-off between robustness and efficiency when making their strategic decisions.

I would like to express my gratitude to all authors contributing to the conference as well as to all participants of the conference making this event successful. Moreover, I would like to thank the members of the program committee for their valuable comments in the respective reviews. In particular, I cordially thank Professor Neil A. Duffie and Professor Hans-Peter Wiendahl acting as editorial committee members for their highly appreciated recommendations and advice on how to prepare and run an international conference as RoMaC 2012 was the first conference ever organized by the Global Production Logistics workgroup at Jacobs University. I am explicitly grateful to Stanislav Chankov and Mirja Meyer who are research associates in my workgroup for their valued assistance in organizing and double checking all paper-relevant processes including the conference preparation. And finally, I thank Silke Tilgner for her high engagement in the conference planning and organization.

I very much hope that with this conference Robust Manufacturing Control was started as a topic on its own and will get further consideration in the future.

Katja Windt
Professor of Global Production Logistics
School of Engineering and Science
Jacobs University
Chair of CIRP sponsored Conference on Robust Manufacturing Control 2012

http://www.springer.com/978-3-642-30748-5

Robust Manufacturing Control
Proceedings of the CIRP Sponsored Conference RoMaC 2012, Bremen, Germany, 18th-20th June 2012
Windt, K. (Ed.)
2013, XXX, 554 p., Hardcover
ISBN: 978-3-642-30748-5