

# Preface

My activity in the field of data-driven process monitoring and diagnosis began with the visit of Prof. B. Huang from the University of Alberta as an AvH-fellow (fellow of Alexander von Humboldt Foundation) in our institute in 2003. I have learnt some data-driven methods and was so impressed by the first successful application of a simple data-driven detection algorithm on a test bed in our laboratory. Motivated by this success, a research group working on data-driven methods was established in our institute in 2004. This working group has been active in European research projects NeCST (2004–2007) and PAPYRUS (2010–2013), in national research grant ZIM-EVA (2010–2012) and in a number of industrial collaborative projects.

For about three decades, model-based fault diagnosis in dynamic automatic control systems has been a research focus of our institute. This tradition has a strong influence on our research activities in the field of data-driven process monitoring and diagnosis. Much attention has been paid to the development of data-driven fault diagnostic methods for dynamic processes and to the establishment of a link between data-driven and model-based methods. Driven by our collaboration with the automotive and process industry, our recent research is dedicated to the data-driven design of fault-tolerant and lifetime management of automatic control systems.

This book is a summary of our work of the past 10 years. Since the summer semester of 2013, the draft version of this book also serves as lecture notes for the Master's course on *Fault Diagnosis and Fault Tolerant Systems*, offered in the Department of Electrical Engineering and Information Technology (EIT) at the University of Duisburg-Essen. It is worth mentioning that the main results and methods described in this book are presented in the form of algorithms, and detailed case studies are included in most chapters. In fact, this book is so structured that it can also be used as a self-study book for engineers in the application fields of automatic control.

This book would not be possible without the valuable support of many people. I would like to thank Prof. Huang for his help in the starting period of our work, Prof. P. Zhang for her remarkable contributions in these 10 years, Dr. Naik and Dr. Yin for their excellent work as the first member of our working group,

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