

# Part III

## Variable-Structure Methods and Models in Control and Estimation

The focus of the first two parts of this book was set on the use of sliding mode techniques, both in the frame of control synthesis and observer design. In addition to these tasks, sliding mode and related variable-structure approaches are also relevant for modeling and design of decentralized control systems, predictive control, and further (stochastic) fault diagnosis techniques. In Chap. 9, Zheng Huang, Ron J. Patton, and Jianglin Lan present sliding mode state and fault estimation for decentralized systems, including a detailed case study highlighting the most important methodological aspects. Hybrid estimation tasks, due to transitions between various dynamic system models, are discussed by Dirk Weidemann and Ilja Alkov in Chap. 10 for the fault diagnosis of nonlinear differential-algebraic equation systems. Here, Kalman filtering techniques are adapted in such a way that they become applicable for systems of differential-algebraic equations with a variable structure. In order to make a control design insensitive against faults, Piotr Witczak and Marcin Witczak deal with fault-tolerant model predictive control techniques under consideration of constraints for Takagi–Sugeno systems in Chap. 11. This book is concluded by a contribution of Jens Tonne and Olaf Stursberg who focus on a constrained model predictive control of processes with an uncertain structure. This structural uncertainty is described suitably by jump Markov linear systems.