Preface

The emergence of large-scale and networked physical systems such as smart grids, multi-robot systems and transportation systems calls for new theory, methodology, and frameworks for synthesizing and analyzing such systems from a control engineering perspective. In such networked and large-scale systems, the grand challenges for control include the network-induced communication constraints (such as communication delays, and data losses), scalability issue, nonlinearity, and uncertainty.

The receding horizon control (RHC) strategy is regaining popularity in recent years, and it is particularly efficient and promising to handle communication constraints, provide satisfactory control performance, as well as deal with other issues such as nonlinearity and disturbances. Specifically speaking, the RHC strategy is able to offer ahead information to compensate for network-induced communication constraints; it can achieve suboptimal performance for large-scale systems in a distributed fashion; it is efficient in handling nonlinear control problem online and iteratively. This book makes full use of these features of RHC and brings RHC-based methodologies and frameworks for the control of nonlinear networked systems and large-scale systems.

The technical contents of the book contain eight self-contained chapters, which may be divided into four parts. The first part is Chap. 1. In this chapter, a relatively comprehensive overview on the RHC for networked control systems (NCSs) and distributed RHC for large-scale agent systems is offered, which would give readers a clear research background. The second part includes Chaps. 2–4. Chapters 2 and 3 provide novel approaches to solve the RHC-based control problem for nonlinear NCSs with two-channel data losses and two-channel data loss and information latency, respectively. Chapter 4 solves the output feedback RHC problem for NCSs with measurement dropouts. The third part includes Chaps. 5–7, which focuses on the distributed RHC problems for large-scale nonlinear systems. The methods on dealing with external disturbances, transmission delays, and simultaneous occurrence of delays and disturbances are reported in Chaps. 5–7. Finally, the fourth part contains Chap. 8, which provides a novel approach on the event-triggered RHC problem for nonlinear systems, to save computational load and communication

resources. The event-triggered RHC is a very new topic and Chap. 8 provides a basic but useful result.

For each control problem, this book not only provides practical solutions with effective control algorithms and/or strategies, but also offers rigorous theoretical analysis with provably correct design conditions. In addition, simulation examples are provided in each chapter to show how to implement the developed algorithms and/or strategies. This book would be useful for graduate students, control engineers, and university instructors; however they need the backgrounds on basic RHC before fully understanding this book. In particular, it is believed that the book would be very helpful for those who are doing research in RHC for large-scale systems and networked systems.

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