## **Contents**

Pa	art I Resilient Control and Estimation Under Cyber-Attacks	
1	Secured Filters Based on Saturated Innovations  Xingkang He, Xiaoqiang Ren, Henrik Sandberg, and Karl H. Johansson	3
2	Zero-Dynamics Attack, Variations, and Countermeasures	31
3	Secure Networked Control Under Jamming Attacks: An SINR-Based Approach Ahmet Cetinkaya, Hideaki Ishii, and Tomohisa Hayakawa	63
Pa	art II Secure Communication and Privacy in Control	
4	Resilient Hierarchical Networked Control Systems: Secure Controls for Critical Locations and at Edge	95
5	A Tutorial on Security and Privacy Challenges in CPS	121
Pa	art III Cyber-Physical Security for Applications	
6	A Low-Cost Approach to Securing Commercial GPS Receivers Against Spoofing Attacks Muaz Ahmad and Yongqiang Wang	149

viii Contents

7	A System-of-Systems Approach to Strategic Cyber-Defense and Robust Switching Control Design for Cyber-Physical Wind Energy Systems  Juntao Chen and Quanyan Zhu	177
8	Machine Learning-Based and Physics-Based Attack Resilient Wide-Area Monitoring, Protection and Control Systems Gelli Ravikumar and Manimaran Govindarasu	203
In	dex	225