

1. Record Nr.	UNINA9910506405603321
Autore	Wu Chengwei
Titolo	Security of Cyber-Physical Systems
Pubbl/distr/stampa	Cham : , : Springer International Publishing AG, , 2021 ©2022
ISBN	3-030-88350-7
Descrizione fisica	1 online resource (293 pages)
Collana	Studies in Systems, Decision and Control Ser. ; ; v.396
Altri autori (Persone)	YaoWeiran SunGuanghui WuLigang
Soggetti	Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Preface -- Acknowledgements -- Contents -- Notations and Acronyms -- List of Figures -- List of Tables -- 1 Introduction -- 1.1 Current Research on Securing CPSs -- 1.1.1 Advances in Detecting Attacks -- 1.1.2 Advances in Securing CPSs Under DoS Attacks -- 1.1.3 Advances in Securing CPSs Under Deception Attacks -- 1.2 Publication Contribution -- 1.3 Publication Outline -- Part I Secure Estimation and Control for CPSs Under DoS Attacks -- 2 Optimal DoS Attack Scheduling for CPSs -- 2.1 Introduction -- 2.2 System Formulation and Preliminaries -- 2.2.1 Physical Process Description -- 2.2.2 SINR-Based Communication Model -- 2.3 Remote Estimator Design -- 2.4 Attack Sequence Design and Energy Allocation -- 2.5 Simulation Results -- 2.6 Conclusion -- 3 Active Defense Control of CPSs via Sliding Mode -- 3.1 Introduction -- 3.2 System Formulation and Preliminaries -- 3.2.1 Physical Process Description -- 3.2.2 DoS Attack -- 3.3 Resilient Sliding Mode Control Design -- 3.3.1 Estimator Design -- 3.3.2 Sliding Mode Approach -- 3.3.3 Stability Analysis -- 3.3.4 Resilient Sliding Mode Controller Design -- 3.4 Active Defense-Based Resilient Control -- 3.4.1 Optimal Defense Strategy -- 3.4.2 Defense Scheme-Based Estimator -- 3.4.3 Sliding Dynamics Analysis -- 3.4.4 Resilient Sliding Mode Control Design with Defense Strategy -- 3.5 Conclusion -- 4 Learning Tracking Control for CPSs -- 4.1 Introduction -- 4.2 System

Formulation and Preliminaries -- 4.2.1 Physical Process and Reference Model Descriptions -- 4.2.2 SINR-Based Communication Model -- 4.2.3 Control Objective -- 4.3 Optimal Tracking Controller Design and Stability Analysis -- 4.3.1 Analysis of the Value Function -- 4.3.2 Optimal Tracking Controller Design -- 4.3.3 Analysis of the Solution to the Riccati Equation -- 4.4 Q-Learning Optimal Tracking Scheme Design.

4.4.1 Convergence Analysis of Algorithm -- 4.5 Off-Policy Learning Control Algorithm -- 4.5.1 Model-Based Off-Policy Learning Control Scheme -- 4.5.2 Model-Free Off-Policy Learning Control Scheme -- 4.6 Conclusion -- 5 Intelligent Control for Nonlinear Networked Control Systems -- 5.1 Introduction -- 5.2 Problem Formulation -- 5.2.1 System Description -- 5.2.2 Fuzzy Logic Systems -- 5.3 Adaptive Control Design -- 5.4 Simulation Results -- 5.5 Conclusion -- 6 Reliable Filtering of Sensor Networks -- 6.1 Introduction -- 6.2 Problem Formulation -- 6.2.1 IT-2T-S Fuzzy Model -- 6.2.2 Failure Model -- 6.2.3 IT2 Fuzzy Reliable Distributed Filter Design -- 6.2.4 Filtering Error System -- 6.3 Main Results -- 6.4 Simulation Results -- 6.5 Conclusion -- Part II Secure Estimation and Control for CPSs Under False Data Injection Attacks -- 7 Secure Estimation for CPSs via Sliding Mode -- 7.1 Introduction -- 7.2 Problem Formulation -- 7.2.1 CPSs Model -- 7.2.2 CPSs Model in Descriptor Form -- 7.2.3 Minimization Optimal Problem -- 7.2.4 Sliding Mode Observer -- 7.3 Secure Estimation Algorithm Design -- 7.3.1 Projection Operator -- 7.3.2 Sliding Mode Observer Secure Estimation Algorithm -- 7.4 Convergence Analysis of Algorithm 1 -- 7.4.1 Analysis for Time Update -- 7.4.2 Analysis for Projection Operator -- 7.4.3 Analysis for Estimation Update -- 7.4.4 Analysis for Terminated Conditions of Inner Loop -- 7.4.5 Analysis of Sliding Mode Error Rejection Term Design -- 7.5 Simulation Results -- 7.6 Conclusion -- 8 Zero-Sum Game Based Optimal Secure Control -- 8.1 Introduction -- 8.2 Problem Formulation -- 8.2.1 Physical Process Description -- 8.2.2 Actuator Attack -- 8.3 Main Results -- 8.3.1 Optimal Estimator Design -- 8.3.2 Zero-Sum Game Based Optimal Policies Design -- 8.3.3 Convergence of the Scheme -- 8.4 Extended Work -- 8.5 Simulation Results -- 8.6 Conclusion.

9 Proactive Secure Control for CPSs -- 9.1 Introduction -- 9.2 System Formulation and Preliminaries -- 9.2.1 Physical Process: A Switching System Representation -- 9.2.2 The Closed-Loop System Under Attacks -- 9.3 Moving Target Defense Control Scheme -- 9.3.1 Controller and Moving Target Defense Design -- 9.3.2 Stability Analysis -- 9.4 Attack Detection and Isolation -- 9.4.1 Attack Detection Observer Design -- 9.4.2 Attack Isolation Scheme -- 9.5 Moving Target Defense Control Design -- 9.5.1 Reinforcement Learning Based Reactive Control Scheme -- 9.5.2 Moving Target Defense Design -- 9.6 Simulation Results -- 9.7 Conclusion -- 10 Fault-Tolerant Tracking Control for Nonstrict-Feedback Systems -- 10.1 Introduction -- 10.2 System Description and Preliminaries -- 10.2.1 Nonstrict-Feedback System -- 10.2.2 Fault Model -- 10.2.3 Control Objective -- 10.2.4 Neural Networks -- 10.2.5 Observer Design -- 10.3 Observer-Based Adaptive Fault-Tolerant Control Design -- 10.4 Simulation Results -- 10.5 Conclusion -- 11 Deep Reinforcement Learning Control Approach to Mitigating Attacks -- 11.1 Introduction -- 11.2 System Formulation and Preliminaries -- 11.2.1 Physical System Description -- 11.2.2 CPSs Under Cyber Attacks -- 11.3 Deep Reinforcement Learning Based Secure Controller Design and Implementation -- 11.3.1 Markov Decision Process -- 11.3.2 Reinforcement Learning Algorithm -- 11.3.3 Deep Neural Networks Approximation -- 11.3.4 Implementation of Lyapunov-Based Soft Actor-Critic Deep Reinforcement Learning Control Algorithm -- 11.4

Convergence and Stability Analysis -- 11.4.1 Algorithm Convergence
Analysis -- 11.4.2 Data-Based Stability Analysis -- 11.5 Simulation
Results -- 11.6 Conclusion -- 12 Conclusion and Further Work -- 12.1
Conclusion -- 12.2 Further Work -- Appendix References.
