From Feedback Control to Intelligent Resilience

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Abstract

The development of cyber-physical systems with multiple sensor/actuator components and feedback loops has given rise to advanced automation applications, including energy and power, intelligent transportation, water systems, manufacturing, etc. Traditionally, feedback control has focused on enhancing the tracking and robustness performance of the closed-loop system; however, as cyber-physical systems become more complex and interconnected and more interdependent, there is a need to refocus our attention not only on performance but also on the resilience of cyber-physical systems. In situations of unexpected events and faults, artificial intelligence and machine learning can play a key role in improving the fault tolerance of cyber-physical systems and preventing serious degradation or a catastrophic system failure. The goal of this presentation is to provide insight into the design and analysis of intelligent monitoring methods for cyber-physical systems, which will ultimately lead to more resilient societies.

Marios M. Polycarpou is a Professor of Electrical and Computer Engineering and the Chair of the Board of the KIOS Research and Innovation Center of Excellence at the University of Cyprus. He is also a Founding Member of the Cyprus Academy of Sciences, Letters, and Arts, an Honorary Professor of Imperial College London, and a Member of Academia Europaea (The Academy of Europe). He served as Founding Chair of the Department of Electrical and Computer Engineering and Founding Director of the KIOS Center of Excellence at the University of Cyprus. Prof. Polycarpou is the recipient of the 2023 IEEE Frank Rosenblatt Technical Field Award and the 2016 IEEE Neural Networks Pioneer Award for contributions to the theory and application of neural networks and learning systems in monitoring and control. He is a Fellow of IEEE and IFAC. He served as the President of the IEEE Computational Intelligence Society (2012-2013), as the President of the European Control Association (2017-2019), and as the Editor-in-Chief of the IEEE Transactions on Neural Networks and Learning Systems (2004-2010). Prof. Polycarpou currently serves on the Editorial Boards of the Proceedings of the IEEE and the Annual Reviews in Control. His research work has been funded by several agencies and industry in Europe and the United States, including the prestigious European Research Council (ERC) Advanced Grant, the ERC Synergy Grant and the EU-Widening Teaming program.