A Intelligent Montoring, Fault Diagnosis and Security of Critical Infrastructure Systems

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Abstract
Modern societies have reached a point where everyday life relies heavily on the reliable operation and intelligent management of critical infrastructures, such as electric power systems, telecommunication networks, water distribution networks, transportation systems, etc. Designing, monitoring and controlling such systems is becoming increasingly more challenging as their size, complexity and interactions are steadily growing. Moreover, these critical infrastructures are susceptible to natural disasters, frequent failures, as well as malicious attacks. There is an urgent need to develop a common system-theoretic framework for modeling the behavior of critical infrastructure systems and for designing algorithms for intelligent monitoring, control and security of such systems. The goal of this presentation is to motivate the need for fault diagnosis and security of critical infrastructure systems and to provide a methodology for detecting, isolating and accommodating both abrupt and incipient faults in a class of complex nonlinear dynamic systems. A detection and approximation estimator based on computational intelligence techniques is used for onlinehealth monitoring. Once a fault is detected, a bank of isolation estimators is activated for the purpose of fault isolation. A key design issue is the adaptive residual threshold associated with each isolation estimator. Various adaptive approximation techniques and learning algorithms will be presented and illustrated, and directions for future research will be discussed.

Biography
Marios M. Polycarpou received the B.A. degree in Computer Science and the B.Sc. degree in Electrical Engineering both from Rice University, Houston, TX, USA in 1987, and the M.S. and Ph.D. degrees in Electrical Engineering from the University of Southern California, Los Angeles, CA, in 1989 and 1992 respectively. In 1992, he joined the University of Cincinnati, Ohio, USA, where he reached the rank of Professor of Electrical and Computer Engineering and Computer Science. In 2001, he was the first faculty to join the newly established Department of Electrical and Computer Engineering at the University of Cyprus, where he is currently Professor. His teaching and research interests are in intelligent systems and control, adaptive and cooperative control systems, computational intelligence, fault diagnosis and distributed agents. Dr. Polycarpou has published more than 185 articles in refereed journals, edited books and refereed conference proceedings, and co-authored the book *Adaptive Approximation Based Control*, published by Wiley in 2006. He is also the holder of 3 patents.

Prof. Polycarpou is currently the Editor-in-Chief of the *IEEE Transactions on Neural Networks.* He serves as an Associate Editor of two international journals and past Associate Editor of the *IEEE Transactions on Neural Networks* (1998-2003) and of the *IEEE Transactions on Automatic Control* (1999-2002). He served as the Chair of the Technical Committee on Intelligent Control, IEEE Control Systems Society (2003-05) and as Vice

President, Conferences, of the IEEE Computational Intelligence Society (2002-03). He is currently an elected member of the Board of Governors of the IEEE Control Systems Society and an elected AdCom member of the IEEE Computational Intelligence Society. Dr. Polycarpou was the recipient of the William H. Middendorf Research Excellence Award at the University of Cincinnati (1997) and was nominated by students for the Professor of the Year award (1996). He has been invited as Keynote Plenary Speaker at several international conferences and served as General Chair of the joint 2005 IEEE International Symposium on Intelligent Control and 2005 Mediterranean Conference on Control and Automation. Dr. Polycarpou is a Fellow of the IEEE and his research has been funded by several agencies in the United States, the European Commission and the Research Promotion Foundation of Cyprus.