UCI Samueli School of Engineering | Department of Mechanical and Aerospace Engineering

Seminar Series

Measuring and enhancing network resilience; performance metrics and defense strategies

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Friday, April 14, 2023 – 10:30 am
McDonnell Douglas Engineering Auditorium (MDEA)

Abstract: Resilience, understood as the ability of a network to carry out its goals under adversarial attacks and unexpected failures, is critical for autonomy. Despite important advances in the design of distributed coordination and decision-making algorithms, multi-agent networks have proven fragile to targeted attacks. Novel theories and tools are therefore needed to guarantee resiliency of these systems, being the development of notions and techniques that characterize network resilience. However, obtaining such characterizations is difficult as resilience and performance are a complex function of the network's and adversary's capabilities, knowledge, resources, and the network interconnection structure. At the same time, we also need novel design methodologies that can protect multi-agent networks and adaptively manage their interconnection over time to achieve performance guarantees. In this talk, we present our recent progress in these directions.

Bio: Sonia Martínez is a Full Professor at the Department of Mechanical and Aerospace Engineering at the University of California, San Diego and a Jacobs Faculty Scholar. Prof. Martínez received her B.S. degree from the Universidad de Zaragoza, Spain in 1997, and her Ph.D. degree in Engineering Mathematics from the Universidad Carlos III de Madrid, Spain, in May 2002. Following a year as a Visiting Assistant Professor of Applied Mathematics at the Technical University of Catalonia, Spain, she obtained a Postdoctoral Fulbright Fellowship and held appointments at the Coordinated Science Laboratory of the University of Illinois, Urbana-Champaign during 2004, and at the Center for Control, Dynamical systems and Computation (CCDC) of the University of California, Santa Barbara during 2005. From January 2006 to June 2010, she was an Assistant Professor with the department of Mechanical and Aerospace Engineering at the University of California, San Diego. From July 2010 to June 2014, she was an Associate Professor with the department of Mechanical and Aerospace Engineering at the University of California, San Diego.

Dr Martínez' research interests include networked control systems, multi-agent systems, and nonlinear control theory with applications to robotics, cyber-physical systems, and natural/social networks. In particular, she has focused on the modeling and control of robotic sensor networks, the development of distributed coordination algorithms for groups of autonomous vehicles, and the geometric control of mechanical systems. For her work on the control of underactuated mechanical systems she received the Best Student Paper award at the 2002 IEEE Conference on Decision and Control. She was the recipient of a NSF CAREER Award in 2007. For the co-authored papers "Motion coordination with Distributed Information," and "Tutorial on dynamic average consensus: The problem, its applications, and the algorithms", she received respectively the 2008 and 2021 Control Systems Magazine Outstanding Paper Award. She is a Senior Editor of Automatica and an IEEE Fellow. Recently, she was named the inaugural Editor in Chief of a new Control System Society publication, the IEEE Open Journal of Control Systems (IEEE OJCS).