The Department of Electrical and Computer Engineering presents:

A DISTINGUISHED SEMINAR

PROFESSOR ANTONIO PASCOAL

EXPLORING THE FRONTIER OF COOPERATIVE MARINE ROBOTICS: NAVIGATION AND CONTROL OF NETWORK AUTONOMOUS VEHICLES

ABSTRACT

The last decade has witnessed tremendous progress in the development of marine technologies that are steadily affording scientists advanced equipment and methods for ocean exploration and exploitation. Recent advances in marine robotics, sensors, computers, communications, and information systems are being applied to the development of sophisticated technologies that will lead to safer, faster, and far more efficient ways of exploring the ocean frontier, especially in hazardous conditions. As part of this trend, there has been a surge of interest worldwide in the development of autonomous marine robots capable of roaming the oceans freely and collecting data at the surface of the ocean and underwater on an unprecedented scale. Representative examples are autonomous surface craft (ASC) and autonomous underwater vehicles (AUVs). The mission scenarios envisioned call for the control of single or multiple AUVs acting in cooperation to execute challenging tasks without close supervision of human operators.

This talk addresses the general topic of cooperative motion navigation and control of marine vehicles, both from a theoretical and a practical perspective. The presentation builds upon practical developments and experiments. Examples of scientific missions with ASCs and AUVs, acting alone or in cooperation, set the stage for the main contents of the presentation. Especial emphasis is placed on the problem of operating groups of vehicles for scientific ocean studies, habitat mapping in complex 3D scenarios, geotechnical surveying, and sustained presence at sea in hazardous environments. From a theoretical standpoint, a number of challenging problems are addressed in the area of cooperative motion control and navigation of groups of autonomous vehicles. The connections with advanced methods for navigation, including geophysical-based navigation, are also briefly discussed. The results obtained are illustrated with videos from actual field tests with multiple marine robots exchanging information over acoustic networks.

* The core material presented in the talk was obtained in the scope of the following EC-funded projects:
- CO3AUVs (http://www.co3-auvs.org),
- MORPH (http://cordis.europa.eu/project/rcn/101726_en.html),
- CADDY (http://www.caddy-fp7.eu/), and
- WiMUST (http://www.wimust.eu/)projects of the EC.

April 23, 2018

WCH 205/206

11:10 a.m. - 12:00 p.m.

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BIOGRAPHY

Antonio Pascoal has a PhD in Control Science from the University of Minnesota, Minneapolis, MN, USA, 1987. He is a Professor of Control and Robotics at IST, University of Lisbon, Portugal; a Member, Scientific Council of the Institute for Systems and Robotics (ISR); Founder, Dynamical Systems and Ocean Robotics Lab (DSORLab) of ISR; Coordinator, Thematic Area “Technologies for Ocean Exploration and Exploitation” of the Associate Laboratory of Robotics and Engineering Systems (LARSyS); Adjunct Scientist, National Institute of Oceanography (NIO), Goa India. Expertise in Dynamical Systems Theory, Marine Robotics, Navigation, Guidance, and Control of Autonomous Vehicles, and Networked Control and Estimation with applications to air and underwater robots. His long-term goal is to contribute to the development of advanced robotic systems for ocean resources exploration and exploitation.

He has coordinated and participated in a large number of international projects that have led to the design, development, and field-testing of single and multiple autonomous marine and air vehicles and systems in cooperation with partners in India (National Institute of Oceanography, Goa), USA (Naval Postgraduate School, Monterey, CA), Korea (KAIST, Daejeon), and Europe. Selected EC funded projects for which he was IST´s Principal Investigator include: i) H2020-ICT-2014-1/ GA 645141 WIMUST: Widely Scalable Mobile Underwater Sonar Technology, 2015-2018; ii) FP7-ICT-2013-2 GA 611373 CADDY: Cognitive Autonomous Diving Buddy, 2014-2016; iii) FP7-ICT-2011-7 GA 288704 MORPH: Marine Robotic System of Self-Organizing, Logically Linked Physical Nodes, 2012-2016: iv) FP7-ICT-2007-3 GA 231378 CO3-AUVs: Cooperative Cognitive Control for Autonomous Underwater Vehicles, 2009-2012; v) EU-FP6-IST-035223 GREX: Coordination and Control of Cooperating Heterogeneous Unmanned Systems in Uncertain Environments, 2006-2009.

Director, FCT PhD program on Networked Interactive Cyber Physical Systems (NETSyS). Associate Editor of IEEE Access, Member of the Editorial Board of the Springer Intelligent Systems, Control and Automation Book Series, and Elected Chair, IFAC Technical Committee Marine Systems, from 2008-2014. Member, International Program Committee of numerous conferences on dynamical systems and control as well as marine and aerial robotics. He has published a total of 70 book chapters and peer reviewed journal papers and 250 conference papers (h-index 40, i10-index 125).

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