The Center for Control, Dynamical Systems, and Computation
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Presents

Mission and Vehicle Control of Aerial and Marine Vehicles

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Abstract:
The last decade has witnessed tremendous progress in the development of aerial and marine technologies that can provide scientists with advanced equipment and methods for autonomous exploration and exploitation of different earth environments. Recent advances in marine and aerial robotics, sensors, computers, communications, and information systems are being applied to develop sophisticated technologies that will lead to safer, faster, and far more efficient ways of exploring the environment frontier, especially in hazardous conditions. As part of this trend in aerial robotics Uninhabited Air Vehicles (UAVs) present nowadays high degree of robustness and reliability and are able to operate in challenging and uncertain mission scenarios.
Unlike fixed-wing aircraft, helicopters are designed to execute vertical flight maneuvers, including hovering, and vertical take-off and landing (VTOL). Moreover, their ability to perform agile maneuvers both at high and low speeds does not undermine the good flying qualities displayed in fast forward flight. The trade-off for such maneuverability is an inherent complexity that translates into a highly nonlinear and unstable dynamical system with wide parameter variations over the vehicle's flight envelope. In this context, the development of mission and vehicle control systems constitutes both a challenge and a fundamental requirement for the accomplishment of high performance autonomous flight.
In terms of marine robotics, there has been a surge of interest worldwide in the development of autonomous marine robots capable of roaming the environment freely, collecting data at the surface of the ocean and underwater at an unprecedented scale. Representative examples include autonomous surface craft (ASC) and autonomous underwater vehicles (AUVs). The mission scenarios envisioned call for the control of single or multiple ASCs and AUVs acting in cooperation to execute challenging tasks without close supervision of human operators.
The present talk will address the topics of aerial and marine vehicle control and mission control from both a practical and a theoretical perspective. The presentation is rooted in the practical developments and experiments carried out with the Delfim ASC, the Autonomous Helicopter, and the Infante AUV developed at ISR/IST.

About the Speaker:
Carlos Silvestre received the Licenciatura degree in Electrical Engineering from the Instituto Superior Tecnico (IST) of Lisbon, Portugal, in 1987 and the M.Sc. degree in Electrical Engineering and the Ph.D. degree in Control Science from the same school in 1991 and 2000, respectively. Since 2000, he is with the Department of Electrical Engineering of Instituto Superior Tecnico, where he is currently an Assistant Professor of Control and Embedded Architectures for Real Time Control Applications. Over the past years, he has conducting research at the Institute for Systems and Robotics on the subjects of vehicle and mission control of air and underwater robots. His research interests include linear and nonlinear control theory, coordinated control of multiple vehicles, gain scheduled control, integrated design of guidance and control systems, inertial navigation systems, and mission control and real time embedded architectures for complex autonomous systems with applications to uninhabited air and underwater vehicles.