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FACULTY OF SCIENCE AND TECHNOLOGY
DEPARTMENT of ELECTROMECHANICAL ENGINEERING

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"Aerial and Marine Vehicles for Critical Infrastructures Inspection"

by

Prof. Carlos Silvestre
Department of Electrical Engineering of
Instituto Superior Tecnico, Lisboa Portugal

Date : 20/4/2011(Wednesday)
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Venue : N204

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. In this talk I'm going to focus on the developments of my group in Marine and Aerial Robotics in particular I'm going to briefly present the MEDIRES and AIRTICI projects aimed at develop advanced robotic tools for the inspection critical infrastructures in different operation

scenarios.

The MEDIRES Project: The cost of a rubble-mound breakwater, its expected behaviour, as well as the consequences of its failure, do justify the existence of a monitoring programme which helps in the decision making process relative to the timing of the maintenance, or even repair, works. However, the continuous monitoring of the status of any given breakwater stretch is not yet feasible. That is why the most common procedure consists of the periodic inspection of these structures. The goals of the MEDIRES project were to use the latest technological breakthroughs in positioning, navigation, and control of surface autonomous vehicles to develop new techniques for accurate and efficient inspection of the geometry of semisubmerged structures with application to rubble mound breakwaters. This activity ended up with the development of a tool, named IRIS, for high accuracy surveying of both the above water and submerged parts of the armour layer of rubble-mound breakwaters (or semisubmerged structures, in general). This tool that can be used in autonomous mode or equip an Autonomous Surface Craft to produce tri-dimensional surveys with the spatial regularity required for this kind of structures.

The AIRTICI Project: This project aims at the development of advanced robotic tools and techniques for the inspection of critical infrastructures. The cost involved in the construction and maintenance of critical infrastructures (CIs) like bridges, dams, overhead power lines, and industrial chimneys, the consequences of their failure or malfunction, do completely justify the existence of a periodic monitoring programme which helps in the risk evaluation and decision making process relative to the timing of the maintenance, or even repair, works. A Helicopter for the inspection of CIs will be developed and its capabilities fully demonstrated in three realistic operational scenarios. The project brings together a multidisciplinary team with well proven expertise in a wide range of key areas that range from the inspection of bridges and dams, using classical tools, aerial inspection of overhead power lines using video surveillance and laser based techniques onboard manned helicopters, industrial chimney inspection resorting to infrared cameras, computer vision, robotics, advanced systems for navigation, guidance, and control (NGC), and payload data acquisition and processing.

Biography

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 Associate Professor of Control and Robotics. 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 ocean 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.
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