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Títol de la tesi	Contribution to the model and navigation control of an autonomous underwater vehicle
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(Mínim 1 i màxim 4, podeu veure els codis a http://doctorat.upc.edu/gestio-academica/impresos/tesi-matricula-i-diposit/codis-unesco)

Resum de la tesi de 4000 caràcters màxim (si supera els 4000 es tallarà automàticament)

This thesis deals with the further development of an existing underwater vehicle for autonomous navigation. The vehicle was conceived to navigate over the sea surface and, at certain fixed points, to dive vertically in order to obtain a profile of a water column. The main objectives of the thesis are the improvement of the hardware and software of the vehicle in order to make it fully operational, and the design and implementation of control techniques for autonomous navigation.

The problem of autonomous navigation is addressed first with the calculation of an hydrodynamic model in 3DoF. An extensive study about the selection of the coefficients is performed, using a linearized model. The calculation of the coefficients is done using two approaches: a geometric one and another one based on least squares techniques applied to experimental data obtained during sea trials. The least squares method gives satisfactory results and the simulations fits the experimental data. The resulting hydrodynamic model is completed with the physical constraints of the actuators of the vehicle.
Solving the autonomous navigation problem requires the design of controllers for both the inner loop (dynamic) and the outer loop (kinematic). Several solutions based on type-1 TSK fuzzy control are presented for velocity control, yaw control, pure pursuit navigation, and path following. The fuzzy controller is used to manage different linear controllers designed for specific conditions. The hydrodynamic model plays an important role in the design of the controller for the inner loop. In addition, a gain scheduled controller is designed to validate a particular case of the fuzzy controller in the inner loop.

Regarding the finishing of the vehicle to be fully operational, the improvements begin with a new driver for the lateral thrusters because they lacked backwards movement capability. Additionally, upgrades in the handling of the vehicle had to devised. In this respect, a wireless on/off system is presented to power the vehicle, and a WiFi connection is adapted to manipulate the software of the vehicle remotely. Furthermore, a study of the currents and power of the immersion system in order to reduce the power consumption is performed, and the hardware is improved with the inclusion of some commercial devices, like an IMU, CTD, and acoustic localization system.
The software is improved in several aspects. First, some problems derived from previous works are debugged. The system is then restructured with a multithread development, which provides robustness and modularity. As the system needed an extension of the protocol communication for easy handling, a robust protocol communication is implemented with the possibility to execute scripts. Finally, the existing graphical user interface is simplified in order to provide only the information required by the operator.
In order to improve the buoyancy of the vehicle, several foams are designed, adjusted to the geometry of the vehicle, and a ballast system is also included for fine adjustment.

Finally, several tests in the laboratory, a swimming pool, a channel, and at sea are performed in order to check the performance of the vehicle. Results show a correct behavior of hardware and software, and also validate the performance of the controllers designed for autonomous navigation.

Keywords: Autonomous underwater vehicle, hydrodynamic model, autonomous navigation and control, TSK fuzzy control, PID control, gain scheduling control, vehicle hardware, vehicle software.

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