Mathematical models for cooperative modeling, identification and NGC of Autonomous Marine Vehicles

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ABSTRACT

Cooperative guidance of autonomous surface and underwater vehicles was demonstrated in the framework of several EC projects, e.g. MORPH: Distributed UUV Systems for Multimodal, 3D Underwater Surveys [1] and CADDY—Cognitive Autonomous Diving Buddy [2].

Demonstrations carried out in these projects, where heterogeneous vehicles developed by different companies and research institutions cooperated together and with divers, are the results of years of combined results on modeling, identification as well as navigation, guidance and control algorithms and architectures.

This paper overviews fundamental models, algorithms and architectures showing their effectiveness through experimental results obtained using prototype autonomous marine vehicles developed by CNR researchers.

In particular, the following key aspects are discussed:

- the combination of simplified uncoupled models of vehicle dynamics with the execution of suitable maneuvers for the identification, based on onboard sensors, of the vehicle's hydrodynamic derivatives [3][4][5]
- the adoption of architectures uncoupling dynamics (control) and kinematics (task-oriented guidance) and its combination with suitable models for straight line and path-following [6] [7]
- the extension of the above-mentioned techniques for cooperative and swarm guidance [8] [9]

Some hints on the modeling of innovative autonomous surface vehicles for very shallow water will be introduced too.

References cited in this Abstract are related only to works where CNR experimental results are presented. A detailed bibliography will be inserted in the paper.

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