Trajectory planning algorithm for the recovery of an AUV from a moving submerged station.

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The technology of autonomous underwater vehicles (AUV) has seen very strong growth over the last decade. Small hydrodynamic forces and associated resistance acting on these vehicles require a low power propulsion unit, which, together with the high performance of their navigation systems and information acquisition devices, enables them to develop long-range invaluable missions. Due to their high performance AUV's applications grows constantly in many different sectors: commercial, performing risky and expensive maritime maintenance tasks as in oil platforms; institutional, with maritime investigation and oceanography tasks for a better protection and use of natural resources; and national defense, in security operations relative to surveillance, intelligence and inspection.

Despite the AUV's broad field of applications and the benefits generated in economic and security scopes, launch and recovery systems of these vehicles have not seen a parallel development. For this reason, there is great interest in the scientific community in the development and implementation of effective methods and algorithms to assist in this complex manoeuever.

In this paper an algorithm that plans the trajectory of an AUV for the underwater recovery in a mobile platform is presented. The planning module is in charge of determinig a path from a starting zone to the target, considering the navigation capabilities of the AUV. For that purpose, the algorithm defines the path and the speed of the AUV in three stages (Fig. 1): Homing, from an arbitrary starting position for the AUV to another one in which the vehicle reaches the same course as the target, Approach, which directs the AUV to a preset position in the same plane as the target and closed to it and Docking, which allows the AUV to reach the mobile platform at the predefined speed. During the Docking phase, the trajectory of the AUV must avoid certain restricted navigation areas whose positions are known and fixed with respect to a reference system attached to the target.

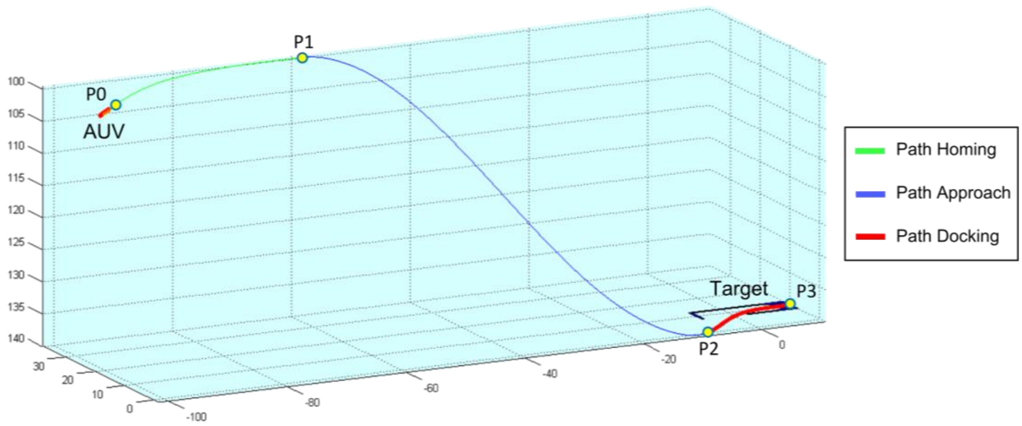

Figure 1. ·3D view of the planned trajectory for the underwater recovery of AUV in a mobile platform with restricted navigation areas.

In order to evaluate the effectiveness of the algorithms defined in this work, a series of dynamic simulations have been implemented under the Matlab programming environment. In this study, different starting positions and orientations, as well as different conditions in the last stage (docking), have been considered.

From the results, it can be inferred that the developed algorithm for planning of AUV trajectory for underwater recovery in a mobile platform is able to guide the vehicle from its initial position to the target point independently of the starting position or bearing of AUV, whenever the vehicle starts the recovery manoeuver from the starting zone (Fig. 2). Besides, the planned trajectory does no encroach on the restricted areas on any of the simulated cases.

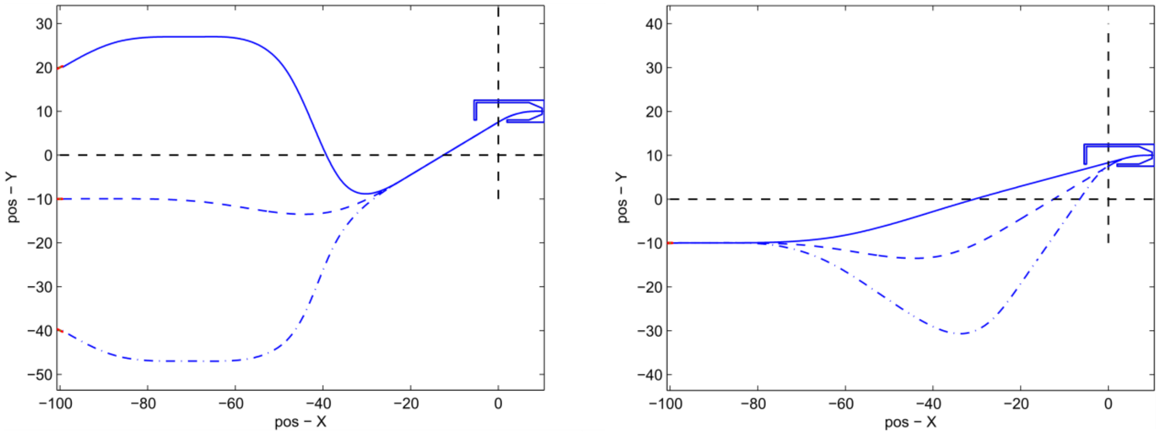

Fig. 2. Path taken by the AUV by modifying different parameters of the trajectory.

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