

Trajectory planning for AUVs in the presence of obstacles and a nonlinear flow field using mixed integer nonlinear programming

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This presentation addresses the optimal trajectory planning for autonomous underwater vehicles. We start with an introduction to autonomous vehicles with a particular emphasis on marine vehicles. The introduction covers relevant concepts, subsystems, and applications of autonomous vehicles. We discuss the importance of trajectory planning and review the main techniques for path/trajectory planning.

A mixed integer nonlinear programming (MINLP) model is then presented for 2D trajectory planning, considering vehicle kinematic constraints, obstacle avoidance, and a nonlinear flow field to represent the ocean current. The flow field is based on a set of data that is integrated into the MINLP problem.

A tailored solution approach will be presented to address the difficulties posed by the MINLP problem. The performance of the resulting methodology is illustrated in four case studies, and the results are used to gain insight into trajectory planning in the presence of flow fields. Finally, we outline our current work on 3D trajectory planning and show an application of planning in the Red Sea.