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Optimal Path Planning for Autonomous Underwater Glider in the Ocean Current

Erick Fredj (1,2), David Kidron (1), Chip Haldeman (2), and Josh Kohut (2)

(1) Lev Academic Center, Lev Academic Center, Computer, Jerusalem, Israel , (2) (b) Department of Marine and Coastal Sciences Rutgers, The State University of New Jersey 71 Dudley Road New Brunswick, NJ 08901.

An autonomous underwater glider is designed for high endurance, over long-range distance, however, their reduced velocity (less than 0.5 m/s) makes them sensitive to ocean currents (around 0.3 m/s and reach a maximum of 1.7 m/s in average) during their deployment. Consequently, a feasible path must be generated through the ocean current field. This study opens the opportunity for optimal path planning of autonomous underwater vehicles by studying the global flow geometry via dynamical systems methods. Optimal glider paths were computed for a 2-dimensional kinematic model of an end-point glider problem. The numerical solutions to the optimal control problem solution will be compared to corresponding results on Lagrangian Coherent Structure (LCS) obtained using the Direct Lyapunov Exponent (DLE) method. The field velocity data used for these computations is obtained from measurements taken in the MARACOOS domain, by HF-Radar stations, or General Circulation Model (GCM) e.g. ROMS model, or Altimetry sensor scanning the Mid-Atlantic Bight.