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Optimal three-dimensional trajectory to generate maneuvering forces with a caudal fin of large aspect ratio CECILIA HUERTAS-CERDEIRA, MORTEZA GHARIB, California Institute of Technology — The flapping motion of a caudal fin is an efficient method of generating thrust forces in an unmanned underwater vehicle. Simple pitching and heaving motions of this appendix, however, are not sufficient to achieve agile maneuvering of the vehicle. To address this deficiency, the use of a caudal fin that can perform large rotations around all three axes is explored. Due to the large number of possible trajectories attainable by such a mechanism, this study employs an experimental optimization procedure to obtain the most efficient three-dimensional trajectory that can generate a specified side-force value, equivalent to a turning moment. The optimal trajectory followed by a fin of large aspect ratio is presented and shown to be highly efficient. The trajectory is then experimentally analyzed in detail, and the use of fins of varying flexibility is considered, with increased flexibility being shown to be detrimental to the maneuvering performance of the fin.

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