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Understanding the Effects and Limits of a Passive Tail on Escape Performance in a Robotic Fast-Start Fish Capable of Rapid Underwater Locomotion TODD CURRIER, SAMUEL LHERON, YAHYA MODARRESSADEGHI, University of Massachusetts Amherst — An experimental study is conducted on a robotic fish designed to emulate the fast-start response. The fish body is constructed of 3D materials and a light spring steel spine. The body is actuated using pressurized pistons. A total of two pistons are supplied with pressure through lightweight high-pressure service lines. The source of pressure is carbon dioxide with a 4.82 MPa peak operating pressure resulting in a body response that can cycle a C-start maneuver in milliseconds. The motion of the fish is controlled using large bandwidth solenoids with a control signal produced by a programmable microprocessor. The buckling modes of a slender column in compression are used to produce organic movements in the body with only two sources of actuation. The interaction of the fluid with the underactuated structure results in a travelling wave in the body of the robotic fish that is kinematically comparable to the live fish. The classical question of which tail stiffness is optimal in the fast-start is explored in a complete free floating model of the fish.

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