

Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

A Mechanical Fish to Emulate the Fast-Start Performance of Pike CHENGCHENG FENG, YAHYA MODARRES-SADEGHI, University of Massachusetts, Amherst — A northern pike is capable of achieving an instantaneous acceleration of 25g, far greater than that achieved by any manmade vehicle. In order to understand the secrets behind achieving such high accelerations, we have built a mechanical fish to emulate the motion of a pike, a fast-start specialist. A live pike bends its body into a C-shaped curve and then uncoils it very quickly to send a traveling wave along its body in order to achieve high acceleration. We have designed a mechanical fish whose motion is accurately controlled by servo motors, to emulate the fast-start by bending its body to a C-shape from its original straight position, and then back to its straight position. An earlier design of a mechanical fish, which could start from an initial C-shaped curve, shed two vortex rings downstream, resulting in a transfer of energy from the fish to water, and therefore, a reaction force from the fluid to the fish. A maximum acceleration of around 4g was achieved in that design. Our new design adds an additional motion to the sequence by first bending the fish from its straight position into a C-shaped curve. Furthermore, this new mechanical fish is designed to be adjustable in swimming pattern, tail shape, tail rigidity, and body rigidity, making it possible to study the influence of all of these parameters on the fast-start performance.

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Date submitted: 09 Aug 2010

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