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Increased swimming efficiency using thickness-varying flexible fins PETER YEH, YUANDA LI, ALEXANDER ALEXEEV, Georgia Institute of Technology — We use three dimensional computer simulations to probe the hydrodynamics and deformation of oscillating flexible fins with varying thickness. We model the fin as an elastic rectangular plate undergoing a plunging motion at its leading edge. Since we assume that the thickest part of the fin is very small compared to its other length scales, the plate is modeled as infinitely thin. We simulate the thickness gradient by introducing an appropriate mass gradient and stiffness gradient in the plate. We characterize the steady state swimming velocity, input power, and swimming economy as a function of driving frequency and thickness ratio (between the thickest and thinnest parts). Our simulations show that the swimming economy, the ratio between the velocity and input power, is increased when the trailing edge is thinner. These findings help to identify the physical mechanisms that allow fish to have high swimming efficiency.

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