Swimming performance of biomimetic trapezoidal elastic fins
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of Mechanical Engineering, Georgia Institute of Technology — Using three-
dimensional computer simulations, we probe the biomimetic free-swimming of trape-
zoidal elastic plates plunging sinusoidally in a viscous fluid, varying the frequency
of oscillations and plate geometry. We choose the elastic trapezoidal plate geometry
because it more closely approximates the shape of real caudal fish fins. Indeed, cau-
dal fins are found in nature in a variety of trapezoidal shapes with different aspect
ratios. Because of this, we perform our simulations using plates with aspect ratios
varying from the cases where the plate has a longer leading edge and to plates with
a longer trailing edge. We find that the trapezoidal fins with the longer trailing edge
are less efficient than the rectangular fins at the equivalent oscillation frequencies.
This is surprising because many fish found in nature have a widening tail. We relate
this to the fact that our model considers fins with uniform thickness whereas fish
uses tapered fins. Our results will be useful for the design of biomimetic swimming
devices as well as understanding more closely the physics of fish swimming.

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