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Underwater propulsion of an internally actuated elastic plate PETER YEH, LEJUN CEN, ALPER ERTURK, ALEXANDER ALEXEEV, Georgia Institute of Technology — Combining experiments and numerical simulations we examine underwater locomotion of an active (internally powered) flexible bimorph composite. We use Macro-Fiber Composite (MFC) piezoelectric laminates that are actuated by a sinusoidally varying voltage generating thrust similar to that of a flapping fin in carangiform motion. In our fully-coupled three dimensional simulations, we model this MFC bimorph fin as a thin, elastic plate that is actuated by a time-varying internal moment producing periodic fin bending and oscillations. The steady state swim velocity and thrust are experimentally measured and compared to the theoretical predictions. Our simulations provide detailed information about the flow structures around the swimming fin and show how they affect the forward motion. The results are useful for designing self-propelling fish-like robots driven by internally powered fins.

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