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Dynamic boundaries in flowing fluids, from erosion sculptures to flapping wing flight

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ABSTRACT

Textbook fluid mechanics addresses steady flows past fixed, rigid objects. However, Nature rarely obeys such restrictions and instead offers many fascinating situations involving the mutual influence of dynamic structures and unsteady flows. Such problems are complex because changes in shape affect flow, which in turn alters shape, and so on. Drawing inspiration from biological and geophysical flows, our Applied Math Lab attacks such fluid–structure interaction problems through tabletop experiments, math modeling, and computational simulations. I will present several case studies from the slow but persistent sculpting of erodible boundaries by flowing fluids to the fast flapping wing motions of insects and their robotic cousins.