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Flying, swimming, falling...: fluid-solid interactions with vortex shedding SEBASTIEN MICHELIN, STEFAN LLEWELLYN SMITH, University of California, San Diego — The interaction between the motion of slender bodies and the fluid around them is at the center of several natural phenomenas. To move in fluids, insects and fishes need to deform their bodies in such a way that the resulting flow around them applies the required force on their body. Unsteady pressure effects are essential here to understand the coupling between the fluid and solid motions. We consider slender solid bodies with sharp edges. At intermediate Re, the boundary layers separate because of the presence of the edge and strong vortices are shed. A simplified 2D potential flow model is proposed here. Point vortices with monotonically increasing intensity are shed from the edges of the body to enforce the regularity of the flow on its boundary. The Brown-Michael equation describes the motion of these vortices and enforces the conservation of momentum for the fluid around the vortex. The potential flow is computed using conformal mapping or bounded vortex sheet representation for the solid body. Simple representations of locomotion mechanisms such as flapping flight are proposed using this model. The forces resulting from prescribed flapping motions of rigid airfoils and deformable thin bodies are computed. The question of the free motion of an elastic 1D body will also be discussed.

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