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A vortex shedding model of a flapping membrane SEBASTIEN MICHELIN, STEFAN G. LLEWELLYN SMITH, University of California, San Diego — The behavior of a two-dimensional flexible membrane in an imposed axial high-Re flow is investigated. The coupling of the internal solid dynamics and the fluid dynamics makes the direct numerical simulation of this situation a computationally expensive and challenging problem. A reduced-order representation of the flow around the solid is used here to study the coupled dynamics. The vortical wake is accounted for by the shedding of point vortices with monotonically-varying intensity (Brown–Michael vortices) from the trailing edge. This model is used to investigate the flapping flag instability that arises from the competition of the destabilizing pressure difference created by the flag deflection, its bending rigidity and its inertia. The stability of the flag state of rest and the structure of the flapping modes are studied and compared to the results of the linear stability analysis. Finally, a study of the kinematic and dynamic waves traveling along the flag in the flapping regime is presented.

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