

Abstract Submitted
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Bistability and the transition to chaos in a flapping flag model

SILAS ALBEN, Georgia Tech, MICHAEL SHELLEY, New York University — We study the nonlinear dynamics of a heavy elastic sheet moving in a 2D inviscid fluid and which sheds a vortex sheet from its trailing edge. Many previous flag models are approximations, with varying degrees of accuracy, to this model. We use the model to characterize the behavior of flapping flags at large amplitudes and over many flapping periods. As bending rigidity is decreased, we find a transition from periodic to chaotic flapping. This transition is characterized by the appearance of higher-wavelength bending modes and smaller flapping frequencies. We also determine the stability boundary of the flow-aligned state for the flag, in the two-dimensional parameter space of dimensionless flag inertia and bending rigidity. We find bistability of flapping and stretched-straight states over a range of dimensionless rigidity, in agreement with experiments.

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