

Abstract Submitted
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Dynamics of a single flexible filament in a flowing soap film.

CHAONAN CHEN, SHUNSHAN FENG, TONG ZHOU¹, School of Mechatronical Engineering, Beijing Institute of Technology — The interactions between flexible plates and surrounding fluids like two-dimensional flag-in-wind problems are important physical phenomena. Here we use a spandex filament with one end fixed flapping in gravity-driven soap film device which can be regarded as a quasi-two-dimensional flow tunnel. A silk filament had been used previously to demonstrate three stable dynamical states: stretched-straight, flapping, and bistable states. The similar phenomena occurred for a spandex filament while the bifurcation conditions seem to be different compared with a silk filament, as the critical filament length is longer and critical inflow velocity is higher than that for a silk filament. In the experiment, we considered some representative parameters (filament length, inflow velocity, and bending stiffness of the filament) to study their effects on the stability of the filament and its bifurcation conditions. An interface-tracking ALE finite element method was then conducted to reproduce the experiment and investigate more details about effects of these parameters. which are significant to reveal the underlying mechanism of flag-in-wind problem.

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