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Bistable property of a flexible ring in a uniform flow[1] BO YOUNG KIM, SOO JAI SHIN, HYUNG JIN SUNG, KAIST — An improved version of the immersed boundary (IB) method is developed for simulating a flexible ring clamped at one point in a uniform flow. The boundary of the ring consists of a flexible filament with tension and bending stiffness, which can be modeled as a linear spring with spring constant k and initially unstretched length. In our simulation, we observe bistable states, one stationary stable and the other self-sustained periodically flapping, that coexist over a range of flow velocities depending on the initial inclination angle. The bistable property of the initially elliptic flexible ring is observed in the simulations. The Reynolds number range of the bistability region and the flapping amplitude are specified for various aspect ratios (a/b). It is found that for a/b=0.5, the bistability region is most postponed and the flapping amplitude at the self-sustained flapping state is minimized. A new bistability phenomenon is observed that with certain aspect ratio two periodically flapping states coexist with different amplitudes in a Reynolds number range, instead of the stationary stable and periodically flapping states.

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