Abstract Submitted
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Flow transport of an instability-driven cilium[1] CHENGLEI WANG, SIMON GSELL, UMBERTO D'ORTONA, JULIEN FAVIER, Aix-Marseille Univ., CNRS, Centrale Marseille, M2P2, France — Cilia are hair-like micro-scale organelles. They usually exhibit self-oscillations which are crucial for flow transport in biological contexts. Some recent studies demonstrate that such motions could result from dynamic instabilities caused by dynein activities inside cilia. However, the capability of such instability-driven cilia in flow transport still remains unclear and this study aims at bridging this gap. Specifically, the cilium is represented by a flexible arc filament. The internal actuation is modelled as a constant follower force imposed at the cilium tip without or with a sinusoidally time-varying perturbation. With a well-established numerical solver based on the immersed boundary lattice Boltzmann method and the nonlinear finite element method, effects of some key parameters, including the follower-force strength and the perturbation magnitude and frequency on flow transport, are systematically explored. Preliminary results show that the flow transport is enhanced with the increasing follower force and that under some conditions the perturbation can trigger a lock-on of the beating frequency on the perturbation frequency. When this occurs, the flow transport can be increased if the perturbed beating frequency is larger than the unperturbed one.

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