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Long flexible cylinders subject to vortex-induced vibrations in shear flow exhibit preferentially counter-clockwise figure-eight trajectories at lock-in REMI BOURGUET, Massachusetts Institute of Technology, YAHYA MODARRES-SADEGHI, University of Massachusetts Amherst, MICHAEL TRIANTAFYLLOU, Massachusetts Institute of Technology — Long flexible cylindrical structures placed in cross-flow current exhibit large amplitude, self-excited, vortex-induced vibrations. The flow excites structure when the vortex shedding frequency is synchronized with the frequency of cross-flow vibration, a condition referred to as lock-in. When the in-line and cross-flow vibrations occur with a frequency ratio of two, as is generally observed in this context, the cylinder exhibits figure-eight trajectories. We investigate the existence of a link between the occurrence of the lock-in condition and the orientation of these figure-eight trajectories, in shear flow, by means of a joint analysis of the structure response and wake pattern, based on detailed numerical simulation and experimental results. We show that trajectories in which the cylinder moves upstream at the extremes of the cross-flow motion (counter-clockwise trajectories) are preferred by the system to establish the lock-in condition. Also, we emphasize the impact of this orientation on fluid-structure energy exchanges.

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