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Phase drift between the in-line and cross-flow vortex-induced vibrations of a long flexible cylinder in shear flow REMI BOURGUET, IMFT, GEORGE KARNIADAKIS, Brown University, MICHAEL TRIANTAFYLLOU, MIT — Long flexible structures with bluff cross-sections placed in cross-flow exhibit vortex- induced vibrations. The in-line and cross-flow vibrations generally occur with a frequency ratio of two leading to figure-eight orbits in the plane perpendicular to the span. The structure is excited by the flow under a lock-in condition defined as the synchronization between vortex shedding and body displacement. Previously, we have shown that, in sheared current, the region of lock-in is characterized by trajectories where the structure moves upstream at the extremes of the cross-flow motion. Recent experimental and numerical studies have emphasized a phenomenon of phase drift between in-line and cross-flow vibrations dominated by traveling waves, that induces a continuous change in the shape and orientation of the flexible body orbit along the span. In the present work, we elucidate the link between this phenomenon and the departure from a ratio of two between the in-line and cross-flow excited structural wavenumbers and we show, by means of numerical simulation, that the effective added mass in each direction controls the phase drift.

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