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Vortex-induced vibrations under oblique shedding REMI BOURGUET, IMFT/CNRS, GEORGE KARNIADAKIS, Brown University, MICHAEL TRIANTAFYLLOU, Massachusetts Institute of Technology — A slender flexible body with bluff cross-section placed at normal incidence within a current may be subjected to vortex-induced vibrations (VIV). In practical applications, the structures (e.g. marine risers, towing cables) are often inclined with respect to the direction of the oncoming flow, sometimes at large angles. The vibrations that may appear in such configurations are investigated in the present work on the basis of direct numerical simulation results. We find that a flexible cylinder inclined at 80 degrees exhibits regular large-amplitude vibrations and that the structural responses are excited under the lock-in condition, i.e. synchronization between body oscillation and vortex formation, which is the central mechanism of VIV. We show that the lock-in condition may involve parallel vortex shedding, where the vortex rows are aligned with the body axis, but also oblique vortex shedding patterns. The excited structural wavenumber and the spanwise wavenumber of the obliquely shed vortices coincide; therefore, the flexible structure and the wake are locked both temporally and spatially. In addition, we find that the VIV occurring under oblique shedding may reach very high frequencies compared to the vibrations observed under parallel shedding.

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