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One- versus two-degree-of-freedom vortex-induced vibrations of a circular cylinder at Re=3900 SIMON GSELL, RÉMI BOURGUET, MARIANNA BRAZA, Institut de Mécanique des Fluides de Toulouse, UMR 5502 CNRS-INPT-UPS — The response of an elastically-mounted circular cylinder, immersed in a current and free to move either in the streamwise or cross-flow direction, or in both directions, is predicted by means of direct numerical simulation. The Reynolds number based on the inflow velocity and the cylinder diameter is kept equal to 3900. Each configuration is studied over a range of the reduced velocity (inverse of the oscillator natural frequency) encompassing the entire region of lock-in, i.e. where body motion and flow unsteadiness are synchronized. The impact of an additional degree of freedom on the body response and fluid loading is analyzed. Particular attention is paid to the synchronization between the streamwise and cross-flow oscillations, their frequency ratio and phase difference, and to the frequency content of the fluid forces, including the occurrence of large higher harmonic contributions. The reciprocal influence of flow patterns and body motion is investigated on the basis of three-dimensional visualizations of the wake; the formation and modulation of the shear layer vortices is explored in this context.

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