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**Flow-induced vibrations of a rotating cylinder** REMI BOURGUET, DAVID LO JACONO, IMFT - CNRS/INP/UPS — The flow-induced vibrations of a circular cylinder, free to oscillate in the cross-flow direction and subjected to a forced rotation about its axis, are studied by means of two- and three-dimensional numerical simulations, at a Reynolds number equal to 100. This problem serves as a paradigm to investigate the impact of symmetry breaking on the phenomenon of vortex-induced vibrations (VIV), previously described in the non-rotating case. The cylinder exhibits free oscillations up to a rotation rate close to 4. Under forced rotation, the vibration amplitude reaches 1.9 diameters, i.e. three times the maximum amplitude in the non-rotating case. Contrary to galloping responses, the free vibrations of the rotating cylinder are found to involve a condition of wake-body synchronization similar to the lock-in condition driving non-rotating cylinder VIV. A variety of flow patterns including novel asymmetric wake topologies is identified; it is shown that free oscillations may develop in the absence of vortex shedding. The symmetry breaking substantially alters the fluid force spectra and phasing mechanisms. The flow three-dimensional transition is found to occur at high rotation rates; its influence on the fluid-structure system behavior is analyzed.

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