

Effects of Viscous and Pressure Forces in Vortex and Wake Induced Vibrations

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Abstract : Cross-flow vortex-induced vibrations of a circular cylinder are compared with the wake-induced oscillations of the downstream cylinder of a tandem cylinder arrangement. It is known that the synchronization of the frequency of vortex shedding with the natural frequency of the structure leads to large amplitude motions. In the case of tandem cylinders, the large amplitudes of the downstream cylinder found are compared to single cylinder setup. In this work, in the tandem arrangement, the upstream cylinder is fixed and the downstream cylinder is free to oscillate in transverse direction. We show that the wake from the upstream cylinder interacts with the downstream cylinder which influences the response of the coupled system. Extensive numerical experiments have been performed on single cylinder as well as tandem cylinder arrangements in cross-flow. Here, the wake interactions in connection to the forces generated are systematically studied. The ratio of the viscous loads to the pressure loads is found to play a major role in the displacement response of the single and tandem cylinder arrangements, as the viscous forces dissipate the energy.

Keywords : circular cylinder, vortex-shedding, VIV, wake-induced, vibrations

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