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Vortex-induced vibrations of an elastically mounted sphere at Re = 300: Hysteresis and vortex shedding modes[1] SURESH BEHARA, IMAN BORAZJANI, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, University of Minnesota — We carry out fluid-structure interaction (FSI) simulations to investigate the excitation mechanisms and vortex shedding modes of an elastically mounted sphere that is free to oscillate in all three directions using the FSI-CURVIB method [Borazjani et al, J. Comp. Physics, 2008]. The simulations are performed for Re=300 over a range of reduced velocities. We report novel results showing hysteresis in the response curve depending on whether the reduced velocity is decreased or increased. Large amplitude oscillations are found to persist even for small reduced velocities when the reduced velocity is decreased from higher values. Increasing the reduced velocity from low values, on the other hand, causes the large-amplitude oscillations to be excited only at higher reduced velocities. Our simulations elucidate the 3D wake structures associated with each hysteresis branch and reveal a new vortex shedding mode. We show that the lower hysteresis branch exhibits the standard braided-hairpin wake mode while the upper branch exhibits a striking wake structure characterized by intertwined, longitudinal spiral vortices.

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