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Instability-Driven Frequency Decoupling between Structure Dynamics and Wake Fluctuations YAQING JIN, JIN-TAE KIM, LEONARDO P. CHAMORRO, University of Illinois at Urbana Champaign — Flow-induced dynamics of flexible structures appears to be strongly modulated by periodic vortex shedding. Experiments and numerical simulations suggest that the frequencies associated to the dominant motions of the structures are highly coupled with those of the wake under low turbulence and uniform flow. We present new experimental evidence that demonstrates a significant decoupling between the dynamics of simple structures and wake fluctuations for various geometries, Reynolds numbers and mass ratio. High-resolution 2D particle tracking velocimetry (PTV) was used to track instantaneous motions of fiducial points on the structure and a hotwire anemometry were used to characterize and gain the insight of wake fluctuations. For all samples oscillating in the streamwise direction, the natural frequency of the structure dominates the body dynamics, while the wake fluctuations are governed by the Strouhal-type vortex shedding. This phenomenon might be a consequence of flow instability, where the structural characteristics of the body dominate the oscillations. For structures allowing to oscillate in the spanwise direction, the footprint of both natural frequency and vortex shedding can be observed in the body dynamics.

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