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Passive Suppression of Vortex-Induced Vibration of a Cylinder at $Re = 100$ RAVI KUMAR R. TUMKUR, RAMON CALDERER, ARIF MASUD, LAWRENCE A. BERGMAN, ARNE J. PEARLSTEIN, ALEXANDER F. VAKAKIS, University of Illinois at Urbana-Champaign — For a Reynolds number (Re) based on cylinder diameter of 100 and a ratio of cylinder density to fluid density of 10, we investigate the use of an essentially nonlinear approach to passive suppression of vortex-induced vibration (VIV) of a rigid circular cylinder restrained by a linear spring, and constrained to move perpendicular to the mean flow. The variational multiscale residual-based stabilized finite-element method used to compute approximate solutions of the incompressible Navier-Stokes equations about the moving cylinder is coupled to a simple model of a "nonlinear energy sink" (NES), an essentially nonlinear oscillator consisting of a mass, a linear damper, and a strongly nonlinear spring. The NES promotes nearly one-way transfer of energy from the primary structure (the cylinder) to itself, resulting in reduction of the amplitude of the limit cycle oscillation by as much as 75%, depending on the parameters characterizing the NES. Various mechanisms of VIV suppression by the NES are discussed, along with results showing the effectiveness, over a range of Re, of passive suppression using an NES whose parameters were selected to work well at $Re = 100$.

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