Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Low-Reynolds numbers vortex-induced vibrations by means of asymptotic methods JEAN-MARC CHOMAZ, LadHyX-Ecole Polytechnique - CNRS, PHILIPPE MELIGA, Ecole Polytechnique Federale de Lausanne- Lab. of Fluid Mechanics and Instabilities — We investigate the onset of vortex-induced vibrations in the wake of a spring-mounted circular cylinder by means of stability analyses and asymptotic methods. We carry out an expansion of the coupled flow-structure system, assuming that the Reynolds number departs from criticality at second order. The flow is forced by a third-order cylinder displacement under the form of an equivalent resonant blowing and suction velocity, applied at the wall of a virtually fixed cylinder. This imposes the classical compatibility conditions to be modified so as to encompass the effect of a resonant boundary condition. By analyzing the nonlinear dynamics of the associated limit cycles, we will show that the present model allows to recover the main phenomenology of vortex-induced vibrations, including subcritical vortex-shedding, lock-in and hysteretical behaviours. We will also use this model to assess the influence of the structural damping on the amount of energy that can be extracted from the flow and dissipated by the structure.

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Date submitted: 02 Aug 2010 Electronic form version 1.4