Multidisciplinary Simulation, Estimation, and Assimilation Systems

Joint MSEAS/OE Seminar

Prof. Emmanuel de Langre

Department of Mechanics-LadHyX, Ecole Polytechnique, Paris

Vortex-Induced Vibrations and Waves in Cables

Abstract: Vortex-induced vibrations (VIV) result from the coupling between the oscillating wake due to cross-flow on a structure and the structure motion. Practical applications are mainly found in the field of ocean engineering, where long flexible structures such as risers or mooring cables are excited by sea currents. The wake dynamics is here represented using a distributed wake oscillator coupled to the dynamics of the slender structure, a cable or a tensioned beam. VIV and the corresponding waves in the structure are analyzed by considering the non linear dynamics and the linear stability of the corresponding coupled system. Comparison is made with experimental and computational data for structures under uniform and non-uniform flows. Phenomena, such as mode switching when the flow velocity is varied, time sharing of the response between two frequencies, or the coexistence of several regions of VIV with different dynamics in the same structure, are discussed. Finally, we also investigate the possibility of harvesting energy using vortex-induced vibrations of long tensioned cables with localized energy extraction. Here, the cable extracts energy from the flow along its entire length, but it also responsible for the transport of the harvested energy toward the energy sinks. We present some preliminary results on the optimal damping distribution that maximizes the harvested energy.

Wednesday, Oct. 19, 2011

1:00PM; Rm. 5-232

Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

Host: Michael Triantafyllou