



ESPCI
Laboratoire PMMH
10 rue Vauquelin, 75231 Paris Cedex 05



Séminaire PMMH

Bureau d'Études, Bâtiment L, 2^{ème} étage

Vendredi 12 juin 2015, 11h00-12h00

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Viscoelastic Fluid Structure Interactions : How Elastic Flow Instabilities can Induce Motion in Flexible Solid Structures

When a flexible object such as an elastic sheet is placed in a flow of a Newtonian fluid, the shedding of separated vortices at high Reynolds number can drive the motion of the structure. This phenomenon is known as Vortex-Induced Vibration (VIV) and has been studied extensively for Newtonian fluids. If the same flexible object is placed in non-Newtonian flows, however, the structure's response is still unknown. Unlike Newtonian fluids, the flow of viscoelastic fluids can become unstable at infinitesimal Reynolds numbers due to a purely elastic flow instability. In this talk, we will investigate the fluid structure interaction between a wormlike micelle solution at high Weissenberg number and a flexible elastic sheet in cross flow. Elastic flow instabilities have been observed for wormlike micelle solutions in a number of flows including flow into a contraction and flow past a circular cylinder. Here we will present a detailed study of the unstable flow past a cylinder for a series of wormlike micelle solutions whose rheology we have fully characterized. Next we will show that a similar elastic flow instabilities can occur in the vicinity of a thin flexible polymer sheet. We will show that the time varying fluid forces exerted on the flexible sheet can grow large enough to cause a structural motion which can in turn feed back into the flow to modify the flow instability. The static and time varying displacement of the flexible sheet including its oscillation frequency and amplitude will be presented for a series of flexible sheet oriented at different angles to the flow direction, for varying fluid flow rates, and for varying fluid compositions and properties. In addition, measurements of flow induced birefringence will be presented in order to quantify the time variation of the flow field and the state of stress in the fluid.

Prochain séminaire : vendredi 19 juin, Stéphane Roux (LMT, ENS Cachan)
Programme des séminaires : www.pmmh.espci.fr, onglet *Séminaires PMMH*
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