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Viscoelastic fluid-structure interaction between a non-Newtonian fluid flow and flexible cylinder ANITA DEY, YAHYA MODARRES-SADEGHI, JONATHAN ROTHSTEIN, Univ of Mass - Amherst — It is well known that when a flexible or flexibly-mounted structure is placed perpendicular to the flow of a Newtonian fluid, it can oscillate due to the shedding of separated vortices at high Reynolds numbers. 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 present a series of experiments investigating the response of a flexible cylinder placed in the cross flow of a viscoelastic fluid. The elastic flow instabilities occurring at high Weissenberg numbers can exert fluctuating forces on the flexible cylinder thus leading to nonlinear periodic oscillations of the flexible structure. These oscillations are found to be coupled to the time-dependent state of viscoelastic stresses in the wake of the flexible cylinder. The static and dynamic responses of the flexible cylinder will be presented over a range of flow velocities, along with measurements of velocity profiles and flow-induced birefringence, in order to quantify the time variation of the flow field and the state of stress in the fluid.

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