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Viscoelastic fluid-structure interactions between flexible circular cylinder and wormlike micelle solution: Role of structural natural frequency ANITA DEY, YAHYA MODARRES-SADEGHI, JONATHAN ROTHSTEIN, University of Massachusetts Amherst — It is well known that when a flexible or flexibly-mounted structure is placed perpendicular to a Newtonian fluid flow, it can oscillate due to the shedding of separated vortices at high Reynolds numbers. Unlike Newtonian fluids, the flow of viscoelastic fluids can become unstable even at infinitesimal Reynolds numbers due to a purely elastic flow instability. We have recently shown that these elastic flow instabilities can drive the motion of different flexible structures including sheets and cylinders. In this talk, we will present an investigation into the influence of a varying natural frequency of a flexible circular cylinder on the form, frequency and amplitude of the viscoelastic fluid-structure interactions with the goal of understanding lock-in behavior for these interactions. The static and dynamic responses of the cylinder will be presented for a range of flow velocities for wormlike micelle solutions with varying viscosity and relaxation time. The time variation and state of stress of the flow field will be shown using particle image velocimetry and flow-induced birefringence images. Finally, the non-linear dynamics of the structural motion will be investigated to understand an observed transition from a symmetric to an asymmetric flow field and oscillation behavior.

Anita Dey
University of Massachusetts Amherst

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