

LadHyX Seminar – March 26, 10:45

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Dynamics of collections of passive and active filaments

Abstract

Filaments (slender, microscopic elastic bodies) are prevalent in biological and industrial settings. They are commonly used by cells for propulsion and arise in manufacturing processes involving complex fluids made from stiff polymers. The direct simulation of collections of filaments remains a computational challenge due to numerical stiffness, coupled fluid-structure interactions, and constraints on filament deformation. In this talk, I will address these challenges for fully 3D filament motion through a combination of unit quaternions, implicit geometric time integration, quasi-Newton methods, and fast matrix-free methods for hydrodynamic interactions. I will discuss some recent results obtained using the methodology, including the role of flagellar dynamics on the collective behaviour of swimming cells, and the effect of elasticity on filament clouds sedimentation.