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Efficient Implementation of Elastohydrodynamic Integral Operators for Stokesian Filaments ATTICUS HALL-MCNAIR, THOMAS MONTENEGRO-JOHNSON, University of Birmingham, HERMES GADLHA, University of Bristol, DAVID SMITH, MEURIG GALLAGHER, University of Birmingham — Models for simulating the dynamics of flexible biological filaments have historically been mathematically complex and numerically expensive, in part due to numerical stiffness associated with satisfying fiber inextensibility. Moreau et al. (2018) recently demonstrated that a filament could be modeled efficiently by expressing the governing elastohydrodynamic problem via integral equations written in terms of the evolving tangent angle. Combined with a method of lines discretization, the required degrees of freedom for accurate simulation are reduced, alleviating numerical stiffness and enabling efficient computational simulation. In this presentation, I outline recent work which builds upon the Moreau et al. framework, augmenting their formulation with the method of regularized stokeslets of Cortez et al. (2001, 2005) to enable the modeling of non-local hydrodynamic interactions within and between filaments. From this, the non-linear filament deformations caused by shear flows and sedimentation are modeled efficiently, revealing how fiber interactions can lead to geometric buckling instabilities. We also consider the dynamics of active moment driven swimmers for different moment types, and investigate optimal parameter pairings to produce fast swimming in active filaments.

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