Thesis title: Numerical Modeling of High Aspect Ratio Fibers in Fluid Flows

Author: MohammadJavad Norouzi

This thesis employs a particle-level fiber model to study fiber suspensions in fluid flows. In this model, each fiber is represented as a chain of cylindrical segments connected by ball and socket joints, experiencing hydrodynamic forces and torques. Two fiber models, flexible and rigid, are considered. The model is validated against theoretical and experimental results, capturing various fiber deformation regimes. The study also explores fiber dynamics in viscous cellular flows, emphasizing the impact of initial conditions and fiber properties on their behavior. Simulations investigate fiber flocculation in turbulent flows, revealing the role of ballistic deflection driven by fiber inertia and flow gradients in enhancing flocculation. The study highlights the importance of fluid flow resolution in analyzing fiber flocculation.