Active and Passive Deformation in the Motion of a Compliant Fiber

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Abstract (200 words maximum):

A numerical study of a two-dimensional flexible cantilever fiber in laminar cross-flow will be conducted. The main goal of the study is devoted to characterizing the roles of active and passive deformation in the motion of the fiber. The fiber will be given an initial perturbation and its passive response will be studied. In particular, we are interested in how the active and passive deformations complement one another, and how they correlate with unsteady flow features, such as boundary layer development, the formation and shedding of vortices and flow separation. This analysis considers the two-dimensional unsteady Navier-Stokes equations for an incompressible fluid, solved via a strongly implicit technique in conjunction with the Immersed-Boundary method. A parametric study will be conducted with the goal of relating structural deflection to material, geometric and flow properties. Several analytical models will be tested in an effort to describe the motion. This is a novel problem in fundamental flow physics and has application to locomotion and maneuvering of marine life.