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Equilibrium Configurations of a Fiber in a Flow PAMELA GUERRON, CHRISTOPHER BERGHOUT, BOGDAN NITA, ASHWIN VAIDYA, Department of Mathematical Science, Montclair State University — The aim of this study is to understand the coupled dynamics of flexible fibers in a fluid flow. In particular, we examine the equilibrium configurations of the fiber with changing Reynolds numbers, orientations and lengths of the fiber. Our study is motivated by biological phenomena such as ciliary bending, flexing of plants and trees in winds etc. Our approach to resolving this problem has been threefold: experimental, numerical and theoretical. In our experiments we create physical models of variable length fibers inserted into a basal body structure, which is then suspended in a flow tank and positioned at different angles. The structure (fibers) are subjected to different velocities of water flow, ranging from 0m/s to 0.53 m/s in increments of 0.038 m/s. The results of the experiment were analyzed using Adobe Photoshop and the effect of the above mentioned parameters upon the shape of the fiber is analyzed. In addition, we also simulate this problem using the software Comsol and also create a simple, toy mathematical model incorporating the competing effects of tension and fluid drag on the fiber to obtain a closed form expression. Our various approaches point to consistent results.

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