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Swimming movements of filaments in a linearly viscoelastic medium HENRY FU, THOMAS POWERS, Brown University, CHARLES WOLGEMUTH, University of Connecticut Health Center — Motivated by the swimming of sperm in the non-Newtonian fluids of the female mammalian reproductive tract, we examine beating filaments in a linearly viscoelastic medium. The forces exerted by the medium are incorporated via a resistive force theory approriate for a Maxwell fluid, in which the force per unit length acting on a filament relaxes to the force per unit length exerted by a purely viscous fluid. We calculate the shapes of beating patterns of filaments with prescribed driving forces in two models: 1) an elastic passive filament forced from one end; 2) a simplified sliding-filament model for sperm flagellum with active internal sliding forces. We note that in a linearly viscoelastic model, for prescribed beating patterns, swimming velocity is the same in viscoelastic and viscous fluids, and there is a simple relation between the power dissipated in each fluid. In contrast, for prescribed driving forces, beating patterns may be different in viscoelastic and viscous fluids leading to changes in swimming velocities and power dissipated.

Henry Fu
Brown University

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