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Dynamics of the Primary Cilium in an Oscillatory Flow YUAN-NAN YOUNG, New Jersey Institute of Technology — In this work we investigate the dynamics of a primary cilium under oscillatory flows. The primary cilium is modeled as an elastic slender beam coupled to an elastic shell with a local torque (mimicking the sub-axonemal anchorage) at the beam-shell junction. We examine how a primary cilium responds to oscillatory flows depending on its axonemal stiffness and the initial base angle. In particular we focus on the tension and forces at the cilium base where ion channels are speculated to be "activated" by fluid flow via cilium bending. We find that a tilted cilium base gives rise to slightly larger magnitude in tension and forces at the base. We further compare the cilium bending dynamics between oscillating and pulsing flows, and investigate the effect of oscillation frequency. From our simulation results we speculate that the reduced ability of periodic pulsing flow to stimulate the primary cilia responses at high frequencies may be due to lack of time for ion channels to respond to the stress at the filament base.

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