Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A sliding-control switch stabilizes synchronized states in a model of actuated cilia. AMY BUCHMANN, RICARDO CORTEZ, LISA FAUCI, Tulane University — A key function of cilia, flexible hairlike appendages located on the surface of a cell, is the transport of mucus in the lungs, where the cilia self-organize forming a metachronal wave that propels the surrounding fluid. Cilia also play an important role in the locomotion of ciliated microswimmers and other biological processes. To analyze the coordinated movement of cilia interacting through a fluid, we model each cilium as an elastic, actuated body whose beat pattern is driven by a geometric switch that drives the motion of the power and recovery strokes. The cilia are coupled to the viscous fluid using a numerical method based upon a centerline distribution of regularized Stokeslets. We first characterize the beat cycle and flow produced by a single cilium and then present results on the synchronization states between two cilia that show that the in-phase equilibrium is unstable while the anti-phase equilibrium is stable under the geometric switch model. Adding a sliding-control switching mechanism stabilizes the in-phase motion.

Amy Buchmann
Tulane University

Date submitted: 01 Aug 2017 Electronic form version 1.4