Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Rheology measurements using ciliated surfaces ALEXANDER ALEXEEV, BRIAN T. JOHNSTON, YI YANG, Georgia Institute of Technology — We employ computational modeling to examine the utility of ciliated surfaces for measuring fluid viscosity. We consider a fluid-filled channel with a wall covered by compliant synthetic cilia that are arranged in a square pattern. The cilia can be actuated by a periodical force applied to their free ends and/or can be used to measure the bending moment at the points of cilium attachment to the wall. We show that the phase difference between the applied sinusoidal force and the bending moment at cilium root can be used to estimate fluid viscosity. We probe two types of ciliated surfaces. In the first scenario, alternating sensory and actuated cilia are arranged a chessboard pattern. In the second case, each cilium in the layer is both actuated and sensory. We compare these two layer arrangements in application to rheological measurements. In particular, we show that the phase signal is insensitive to the amplitude of applied force and layer density. Our results can be useful for designing sensory surfaces for microfluidic and biomedical applications.

Alexander Alexeev
Georgia Institute of Technology

Date submitted: 04 Aug 2011 Electronic form version 1.4