Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Numerical simulations of microscale steady streaming using viscous vortex particle method KWITAE CHONG, JEFF D. ELDREDGE, Mechanical & Aerospace Engineering, University of California, Los Angeles, CA, USA — Microscale steady streaming created by localized cyclic boundary deformation provides an appealing option in microfluidic systems. High-frequency oscillatory body motion creates a large-scale circulatory motion in viscous fluid that is 'steady' compared to the timescale of oscillation, and this overall net flow can be used for manipulating discrete objects in a micro system. A typical steady streaming motion generated by one or more unidirectionally oscillating cylindrical probes is considered. A high-fidelity numerical approach is presented for simulating such problems using a viscous vortex particle method. By focusing on vorticity, which is confined to a narrow stokes layer surrounding each probe, the method gains computational efficiency over a typical grid-based method. In particular, the large-scale streaming motion can be computed as a post-processing step, and little additional effort is required for multiple probes. Parametric studies of varying geometric arrangement was conducted and reveal the microscale flow structures and particle transport.

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Date submitted: 03 Aug 2010 Electronic form version 1.4