Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

A Quasi-Dynamic Approach to modelling Hydrodynamic Focusing ADITYA KOMMAJOSULA, SONGZHE XU, Iowa State Univ, CHUEH-YU WU, DINO DI CARLO, University of California, Los Angeles, BASKAR GANAPATHYSUBRAMANIAN, Iowa State Univ, COMPM LAB TEAM, DI CARLO LAB COLLABORATION — We examine a particle's tendency at different spatial locations to shift/rotate towards the equilibrium location, by constrained simulation. Although studies in the past have used this procedure in conjunction with FSI methods to great effect, the current work in 2D explores an alternative approach by utilizing a modified trust-region-based root-finding algorithm to solve for particle position and velocities at equilibrium, using "snapshots" of finite-element solutions to the steady-state Navier-Stokes equations iteratively over a computational domain attached to the particle reference frame. Through an assortment of test cases comprising circular and non-circular particle geometries, an incorporation of stability theory as applicable to dynamical systems is demonstrated, to locate the final focusing location and velocities. The results are compared with previous experimental/numerical reports, and found to be in close agreement. A thousand-fold increase is observed in computational time for the current workflow from its transient counterpart, for an illustrative case. The current framework is formulated in 2D for 3 Degrees-of-Freedom, and will be extended to 3D. This framework potentially allows for quick, high-throughput parametric space studies of equilibrium scaling laws.

Aditya Kommajosula
Iowa State Univ

Date submitted: 12 Sep 2016 Electronic form version 1.4