Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

A fully spectral efficient algorithm for Stokes suspension simulations in doubly periodic confined geometries JAE SUNG PARK, Department of Chemical and Biological Engineering, University of Wisconsin-Madison, DAVID SAINTILLAN, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — The calculation of hydrodynamic interactions between suspended particles under confinement in low-Reynolds number flows is a computationally expensive task. In this study, we develop an efficient spectral method for the calculation of these interactions in a doubly periodic geometry between two infinite parallel no-slip walls in Stokes flow, a geometry commonly encountered in microfluidic devices. We consider the flow generated by a distribution of point forces inside a unit cell, and decompose it into the sum of two Stokes problems. The first one involves triply periodic boundary conditions and makes use of our previously developed fast smooth particle-mesh Ewald algorithm, while the second one provides a correction to the periodic solution to satisfy the no-slip boundary condition on the confining walls. This second problem is based on an analytic solution for the flow between two flat plates with prescribed Dirichlet wall boundary conditions that are determined from the first problem, and the total solution can be then obtained by superimposing the solution of each problem using the linearity of the Stokes equations. We conclude by presenting an application of this method to a confined suspension of spherical particles.

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Date submitted: 03 Aug 2012 Electronic form version 1.4