

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Interaction between microfluidic droplets in a Hele-Shaw cell ITAI

SARIG, YULI STAROSVETSKY, AMIR GAT, Technion - Israel Institution of Technology — Various fluidic systems, such as chemical and biological lab-on-a-chip devices, involve motion of multiple droplets within an immersing fluid in narrow micro-channels. Modeling the dynamics of such systems requires calculation of the forces of interaction between the moving droplets. These forces are commonly approximated by superposition of dipoles solutions, which requires an assumption of sufficiently large distance between the droplets. In this work we obtain exact solutions for two droplets, and a droplet within a droplet, located within a moving immersing fluid and without limitation on the distance between the droplets. This is achieved by solution of the Laplace equation for the pressure in a bi-polar coordinate system, Fourier method and transformation and calculation of the force in a Cartesian coordinate system. Our results are validated with numerical computations, experimental data and with the existing dipole-based models. We utilize the results to calculate the dynamics of a droplet within a droplet, and of two close droplets, located within an immersing fluid with oscillating speed. The obtained results may be used to study the dynamics of dense droplet lattices, common to many current micro-fluidic systems.

Amir Gat
Technion - Israel Institution of Technology

Date submitted: 28 Jul 2015

Electronic form version 1.4