Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Simulating the motion of micro-capsules in complex geometries[1]

LAILAI ZHU, LUCA BRANDT, KTH Mechanics, Linne flow centre — We develop a code to resolve the fluid-structure interaction of capsules in low-Reynolds-number flow, in 3D general geometries. We use an accelerated boundary-integral method, the general geometry Ewald method (GGEM) to solve the Stokes flow in the framework of the Navier-Stokes solver NEK5000 based on the spectral element method. A global spectral interpolation employing spherical harmonics is incorporated simultaneously to resolve the membrane dynamics. Two cases are investigated to illustrate the generality of our implementation. Firstly we simulate a capsule transported in a $3D$ channel and/or duct with a corner, for a better understanding of moving soft objects in geometrically complex configurations. We examine the effect of capsule elasticity and wall confinement in detail. Our results give useful hints for the design of micro-devices. As a second case, we simulate the capsule flowing past a cylindrical obstacle with and without confinement, representing two popular cell separation configurations, pinched flow fractionation (PFF) and deterministic lateral displacement (DLL) respectively. In contrast to the original methodology using fluid inertia, particle size or steric effect, we numerically demonstrate the pure-elasticity-driven cell separation in such devices.

[1]We acknowledge the funding from VR (Swedish research council) and computer time from SNIC

Lailai Zhu
KTH Mechanics, Linne flow centre

Date submitted: 02 Aug 2013 Electronic form version 1.4