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A Hybrid Immersed Boundary-Immersed Interface Method for Cell Tracking in Microdevices MOHAMMAD HOSSAN, PRASHANTA DUTTA, ROBERT DILLON, Washington State University — The manipulation of cells in microfluidic devices has become routine for biomedical applications such as cell sorting and trapping. To date most of the designs used for cell manipulation are based on experimental trial and error. A fast and accurate numerical algorithm can provide important insight into the design of these devices. In this study, a hybrid immersed boundary-immersed interface method is developed to study the complex behavior of cells in liquid. The immersed boundary method provides an accurate prediction of particle motion in a fluid while the immersed interface method gives second-order accurate solutions for the ion concentrations and electrostatic potential in the presence of moving cells. Both methods employ a fixed computational grid without the need for remeshing at each time step. Cells of different size, shape and charge are allowed to move under both hydrodynamic and electrokinetic forces. Moreover different channel geometries are considered to obtain the best trapping and separation performance. The present immersed boundary-immersed interface model is particularly suitable for bioMEMS devices as this method can accurately predict viscous and electrostatic forces as well as particle velocity, location, and particle membrane deflection.

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