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Comparison between Simulation and Experimentally Observed Interactions between Two Different Sized Magnetic Beads in a Fluidic System

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Abstract : The magnetic separation of biological cells using super-magnetic beads has been used widely for various bioassays. These bioassays can further be integrated with other laboratory components to form a biosensor which can be used for cell sorting, mixing, purification, transport, manipulation etc. These bio-sensing applications have also been facilitated by the wide availability of magnetic beads which range in size and magnetic properties produced by different manufacturers. In order to improve the efficiency and separation capabilities of these biosensors, it is important to determine the magnetic force induced velocities and interaction of beads within the magnetic field; this will help biosensor users choose the desired magnetic bead for their specific application. This study presents for the first time the interaction between a pair of different sized super-paramagnetic beads suspended in a static fluid moving within a uniform magnetic field using a modified finite-time-finite-difference scheme. A captured video was used to record the trajectory pattern and a good agreement was obtained between the simulated trajectories and the video data. The model is, therefore, a good approximation for predicting the velocities as well as the interaction between various magnetic particles which differ in size and magnetic properties for bio-sensing applications requiring a low concentration of magnetic beads.

Keywords : biosensor, magnetic field, magnetic separation, super-paramagnetic bead
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