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Numerical simulations of the separation of deformable particles in deterministic lateral displacement devices KENG-HWEE CHIAM, Institute of High Performance Computing, RAYMOND QUEK, DUC VINH LE — Using numerical simulations, we study the separation of deformable bodies, such as capsules, vesicles, and cells, in deterministic lateral displacement devices, also known as bump arrays. These arrays comprise regular rows of obstacles such as micropillars whose arrangements are shifted between adjacent rows by a fixed amount. We show that, in addition to the zigzag and laterally displaced trajectories that have been observed experimentally, there exists a third type of trajectory which we call dispersive, characterized by seemingly random bumpings off the micropillars. These dispersive trajectories are observed for large and deformable particles whose diameters are comparable to the gap size between micropillars. We then map out the regions in phase space, spanned by the row shift, particle diameter, and particle stiffness, in which the different types of trajectories are expected. We also shown that, in this phase space, there are transitions from zigzag to dispersive trajectories, bypassing lateral displacement. This is undesirable experimentally because it limits the ability of the device to fractionate. Finally, we discuss how our numerical simulations may be of use in device prototyping and optimization.

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