

Numerical Simulations of Particle Suspensions in a Rotating Flow

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We have developed an algorithm to simulate the motion of suspended solid particles in a rotating cylinder. The hydrodynamic interactions are calculated from the flow fields generated by point forces, with a Green's function that enforces a zero-velocity boundary condition on the surface of the cylinder. We have implemented a parallel version of the algorithm, which also scales linearly with the number of particles. For the time scales of interest, typically of the order of 100-200 rotations of the tube, simulations of a few thousand particles per processor are feasible. The code has been applied to the investigation of pattern formation in a rotating suspension. In these experiments a cylinder filled with a suspension of heavy particles is rotated about a horizontal axis, and a number of different phases or particle patterns have been observed and characterized experimentally. We plan to use numerical simulations to elucidate the hydrodynamic mechanisms leading to pattern formation.

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