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Relaxation Time for Sedimenting Spheres of a Suspension with Periodic Boundary Conditions

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A system of spheres sedimenting in low-Reynolds-number fluid flow, with periodic boundary conditions, is simulated numerically for different classes of initial positions of the spheres, (1) chosen at random, (2) slightly and randomly perturbed from cubic lattice, and (3) randomly grouped into close pairs distributed at random. The numerical algorithm is based on the Stokes equations. The mobility coefficients are evaluated by the multipole method, corrected for lubrication. The equations of motion are integrated with the fourth-order Runge-Kutta algorithm. The mean sedimentation velocity and the mean velocity fluctuations are evaluated as functions of time. The averaging is performed over the particles and over random initial configurations, separately within classes listed above. It is analyzed how fast a steady state is reached and how the relaxation time depends on initial positions of the spheres, for a fixed low volume fraction.

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