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Direct Numerical Simulation (DNS) of Suspensions in Spatially Varying Electric Fields[1] NADINE AUBRY, Mechanical Engineering, Carnegie-Mellon University, MUHAMMAD JANJUA, SAI NUDURUPATI , PUSHPENDRA SINGH, Department of Mechanical Engineering, New Jersey Institute of Technology — We have developed a numerical scheme to simulate the motion of dielectric particles suspended in a dielectric liquid in uniform and nonuniform electric fields. The particles are moved using a direct simulation scheme in which the fundamental equations of motion of fluid and solid particles are solved without the use of models. The motion of particles is tracked using a distributed Lagrange multiplier method. The electric force acting on a particle is calculated by integrating the Maxwell stress tensor over its surface. In our numerical scheme the Marchuk-Yanenko operator splitting technique is used to decouple the difficulties associated with the incompressibility constraint, the nonlinear convection term and the rigid body motion constraint. Simulations show that the accuracy of the point dipole approximation diminishes when the distance between the particles becomes smaller than the particles radius, the domain size is comparable to the particles size, and also as the dielectric mismatch between the fluid and particles increases.

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