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Simulation of Pattern Formation in a Rotating Suspension of non-Brownian Settling Particles TSORNG-WHAY PAN, ROLAND GLOWINSKI, Department of Mathematics, University of Houston, Houston, Texas 77204, USA, SUCHUNG HOU, Department of Mathematics, National Cheng Kung University Tainan 701, Taiwan, R.O.C. — We present numerical results of pattern formation for a settling suspension of non-Brownian spherical particles in a completely filled horizontal rotating cylinder. The experimental results have been recently reported [S.G. Lipson, J. Phys: Condens. Matter 13, 5001 (2001) and W.R.Maston, B.J. Ackerson, and P. Tong, Phys. Rev. E 67, 050301(R) (2003)]. We assume that these phenomena are modeled by the Navier-Stokes equations for incompressible Newtonian viscous fluids coupled to the Euler-Newton equations describing rigid-solid motions. The numerical methodology relies on the combination of a finite element method, operator-splitting, and a Lagrange multiplier based fictitious domain method allowing the flow calculations to take place in a fixed simple shape space region [R. Glowinski, T.W. Pan et al, J. Comp. Phys. 169, 363 (2001)]. We have studied the interactions of up to 640 balls. We found that the drafting, kissing, and tumbling among balls due to the initial forces is one of key factors for forming and maintaining the clusters and the competition between the rotation speed of the cylinder and the gravity acting on the balls is also crucial.

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