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Free Surface Deformation in Suspensions Near a Rotating Rod

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We have incorporated a model based on the shear-induced particle migration arguments into a massively parallel, three-dimensional, general purpose, multi-physics, finite element computer code developed at Sandia. In addition to solving the coupled heat and momentum transport equa-tions, the code supports fully coupled free-boundary parameterization. To validate the treatment of free-surface problems involving suspensions, we have studied the free surface near a rotating rod. Experimental data was taken with magnetic resonance imaging, which allows the visualization of suspended particle concentration profiles as well as detailed views of the free surface profile. Concentrated suspensions of up to 50 per cent by volume of spheres were subjected to a variety of rod rotation rates. The results show that the interface dips near the rotating inner rod, in agreement with earlier studies, and that our model captures this normal-stress induced behavior.

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