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Dynamics of gravity-driven, particle-laden thin-film flows ALIKI MAVROMOUSTAKI, ANDREA BERTOZZI, UCLA — Our study focusses on gravity-driven, particle-laden flows which are pertinent to a wide range of industrial and geophysical settings in which transport of suspensions occur. In the case of gravity-driven, single-species, particle-laden flows, there exist three distinct regimes which are dependent on the plane angle of inclination and bulk particle volume fraction: settling of particles to the substrate versus settling to the front of the flow and, an intermediate, unstable, "well-mixed" regime. The dynamics is described by a previously derived equilibrium model, using lubrication theory, based on a balance between hindered settling and shear-induced migration; this consists of a coupled system of hyperbolic conservation equations which describe the interface position and the particle volume fraction. We investigate the governing system analytically and numerically; an analysis of the governing equations exhibits rich mathematical structure where we observe the formation of double-shock wave solutions while, as the limit of maximum permissible particle concentration is approached, the numerical solutions are described by singular shocks. Finally, we discuss the physical interpretation of our solutions as applied to the experimental setting.

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