A two-phase solid/fluid model for dense granular flows including dilatancy effects. Part II: asymptotic analysis and numerical simulation

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Abstract

In this talk we focus on the thin-layer approximation used to derive the proposed two-phase model for fluidized debris flows that takes into account dilatancy effects (see [1, 2, 3]). The description of the physics of the model and their main characteristics will be presented in talk "A two-phase solid/fluid model for dense granular flows including dilatancy effects. Part I".

In the thin-layer approximation special attention is paid to the drag friction terms that are responsible for the transfer of momentum between the two phases and for the appearance of an excess pore pressure with respect to the hydrostatic pressure. Different definitions of the excess pore pressure are deduced, depending on the order of magnitude of the friction term. Moreover, dilatancy effects imply that when dilation occurs the fluid is sucked into the granular material. And in the case of contraction, the fluid is expelled from the mixture. To account for this transfer of fluid into and out of the mixture, a two-layer model is proposed with a fluid layer on top of the two-phase mixture layer. A depth-averaged model with a dissipative energy balance in accordance with the corresponding 3D initial system is deduced.

Finally, in this talk we also present a numerical discretization of the proposed models and some preliminary numerical tests.

References

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