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Rayleigh-Taylor instabilities in dry granular flows, a stability analysis UMBERTO D'ORTONA, DENIS MARTINAND, Aix-Marseille University, CNRS, Centrale Marseille, NATHALIE THOMAS, Aix-Marseille University, CNRS — Rayleigh-Taylor instabilities also occur in dry granular flows (D'Ortona & Thomas, PRL 2020). In an assembly of dense particles lying above light particles, an instability develops when the system is tilted and set into motion. More surprisingly, if the system is initially homogeneous and dense particles are larger than the light ones, granular segregation first induces the formation of an upper layer of large dense particles, which subsequently destabilizes. Both initial conditions eventually evolve into a pattern of rolls aligned with the mean motion, analogous to Rayleigh-Benard convection rolls. This movement is sustained thanks to granular segregation. The stability analysis of an initially sinusoidal perturbation of the interface between two layers of dense and light particles is performed by numerical simulations. As in fluids, the amplitude of the perturbation grows exponentially and the growth rate varies linearly with the Atwood number. As in systems confined between two horizontal walls, the most unstable wavelength (l) is proportional to the flow thickness (H), with $l = 1.9\,H$. In the case of very thin systems (below $H = 10$ particles), a transition occurs where the cross diffusion of particles prevents the RT instability.

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