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Continuum modelling of piston driven shock waves through granular gases and ensuing pattern formations NICK SIRMAS, MATEI RADULESCU, University of Ottawa — Two-dimensional event-driven Molecular Dynamics (MD) simulations were previously completed to investigate the stability of piston driven shock waves through dilute granular gases. By considering viscoelastic collisions, allowing for finite dissipation within the shock wave, instabilities were found in the form of distinctive high density non-uniformities and convective rolls within the shock structure. This work is now extended to the continuum level. Euler and Navier-Stokes equations for granular gases are modelled with a modified cooling rate to include an impact threshold necessary for inelastic collisions. The shock structure predicted by the continuum formulation is found in good agreement with the structure obtained by MD. Non-linear stability analyses of the travelling wave solution are performed, showing a neutrally stable structure and responding only to fluctuations in the upstream state. Introducing strong perturbations to the incoming density field, in accordance with the spacial fluctuations in upstream state seen in MD, yields similar instabilities as those previously observed. While the inviscid model predicts a highly turbulent structure from these perturbations, the inclusion of viscosity yields comparable wavelengths of pattern formations to those seen in MD.

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