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A Shock-Driven Mechanism for Standing-Wave Patterns in Vertically Oscillated Grains[1] ALEX GILMAN, JON BOUGIE, Loyola University Chicago — We develop a simplified model for standing-wave pattern formation in vertically oscillated granular layers based on an instability in shocks found in these layers. When layers of particles are oscillated at accelerational amplitudes greater than that of gravity, the layers leave the plate, and shocks are created upon re-established contact with the plate. Additionally, standing-wave patterns form when the accelerational amplitude exceeds a critical value. For a given layer depth and accelerational amplitude, varying driving frequency alters the shock strength as well as pattern wavelength; increasing layer depth produces stronger shocks and longer pattern wavelengths for a given frequency. We demonstrate relationships between properties associated with shocks and properties associated with standing wave patterns, and present a simple mechanism by which a non-uniform shock front drives standing-wave configurations. We justify this mechanism using mathematical relationships derived from a continuum granular model. We then compare these mathematical relationships to full numerical solutions of continuum equations to Navier-Stokes order for uniform, frictionless, inelastic spheres.

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