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Dynamics and pattern transition in a two-dimensional vibrofluidized granular bed

MOHAMMED ISTAFAUL HAQUE ANSARI, Indian Institute of Technology, Kanpur, MEHEBOOB ALAM, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India — Experiments are conducted in a two-dimensional monolayer vibrofluidized bed of glass beads, with an aim to study the dynamics and the transition scenario in different patterned states. At small shaking accelerations ($\Gamma = A\omega^2/g < 1$, where $A$ and $\omega = 2\pi f$ are the amplitude and angular frequency of shaking and $g$ is the gravitational acceleration), the particles remain attached to the base of the vibrating container; this is known as the solid bed (SB). With increasing $\Gamma$ (at large enough shaking amplitude $A/d$) and/or with increasing $A/d$ (at large enough $\Gamma$), the sequence of transitions/bifurcations unfolds as follows: SB (solid bed) to BB (bouncing bed) to LS (Leidenfrost state) to 2-roll convection to 1-roll convection and finally to a gas-like state. For a given length of the container, the coarsening of multiple convection rolls leading to the genesis of a single-roll structure (dubbed the "multiroll transition") and its subsequent transition to a granular gas are two findings of this work. We show that the critical shaking intensity $\Gamma_{LS}^{BB}$ for the $BB \rightarrow LS$ transition has a power-law dependence on the particle loading ($F$) and the shaking amplitude ($A/d$).

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