

Triggering avalanches by transverse perturbations in a rotating drum

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Abstract

We study the role of small-scale perturbations in the onset of avalanches in a rotating drum in the stick-slip regime. By vibrating the system along the axis of rotation with an amplitude orders of magnitude smaller than the particles' diameter, we found that the order parameter that properly describes the system is the kinetic energy. We also show that, for high enough frequencies, the onset of the avalanche is determined by the amplitude of the oscillation, contrary to previous studies that showed that either acceleration or velocity was the governing parameter. Finally, we present a theoretical model that explains the transition between the continuous and discrete avalanche regimes as a supercritical Hopf bifurcation.