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Dynamics of a Tapped Granular Column ANTHONY ROSATO, Granular Science Lab, New Jersey Institute of Technology, DENIS BLACKMORE, Mathematical Sciences, New Jersey Institute of Technology, LUO ZUO, Granular Science Lab, New Jersey Institute of Technology, WU HAO, DAVID HORNTROP, Mathematical Sciences, New Jersey Institute of Technology — We consider the behavior of a column of spheres subjected to a time-dependent vertical taps. Of interest are various dynamical properties, such as the motion of its mass center, its response to taps of different intensities and forms, and the effect of system size and material properties. The interplay between diverse time and length scales are the key contributors to the column's evolving dynamics. Soft sphere discrete element simulations were conducted over a very wide parameter space to obtain a portrait of column behavior as embodied by the collective dynamics of the mass center motion. Results compared favorably with a derived reduced-order paradigm of the mass center motion (surprisingly analogous to that for a single bouncing ball on an oscillating plate) with respect to dynamical regimes and their transitions. A continuum model obtained from a system of Newtonian equations, as a locally averaged limit in the transport mode along trajectories is described, and a numerical solution protocol for a one-dimensional system is outlined. Typical trajectories and density evolution profiles are shown. We conclude with a discussion of our investigations to relate predictions of the continuum and reduced dynamical systems models with discrete simulations.

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