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Instabilities in a Freely Cooling Granular Gas: A Quantitative Comparison of DEM simulations and Kinetic-Theory-based models PETER MITRANO, Chemical and Biological Engineering, University of Colorado at Boulder, Boulder, CO, ANDREW HILGER, CHRISTINE HRENYA — Experiments, discrete element method (DEM) simulations, and kinetic-theory-based predictions have demonstrated the existence of clustering instabilities in flows of solid, inelastic grains. Such instabilities have also been studied via stability analyses of the continuum balances for rapid granular flows. Spurred by discrepancies between DSMC-based and kinetic-theory-based transport coefficients in extremely dissipative systems, previous work has shown that a modified Sonine approximation reduces this disagreement. However, the quantitative accuracy of this modified kinetic theory with respect to predicting instabilities has not been addressed. In this work, hard-sphere, event-driven DEM simulations of the homogenous cooling system are used to study instabilities in granular systems. Detection of instabilities is determined via Fourier analysis. The aim is to determine the critical system size at which clustering appears over a wide range of dissipation. By comparing the critical size from DEM with the predictions based on standard (Garzó 2005) and modified (Garzó 2007) Sonine approximations, this work aims to assess the quantitative ability of each model to predict instabilities for monodisperse granular flows.

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