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**Numerical Study of Particle Damping Mechanism in Piston Vibration System via Particle Dynamics Simulation** XIAN-MING BAI, BINOY SHAH, LEON KEER, JANE WANG, RANDALL SNURR, Northwestern University — Mechanical damping systems with granular particles as the damping media have promising applications in extreme temperature conditions. In particle-based damping systems, the mechanical energy is dissipated through the inelastic collision and friction of particles. In the past, many experiments have been performed to investigate the particle damping problems. However, the detailed energy dissipation mechanism is still unclear due to the complex collision and flow behavior of dense particles. In this work, we use 3-D particle dynamics simulation to investigate the damping mechanism of an oscillating cylinder piston immerged in millimeter-size steel particles. The time evolution of the energy dissipation through the friction and inelastic collision is accurately monitored during the damping process. The contribution from the particle-particle interaction and particle-wall interaction is also separated for investigation. The effects of moisture, surface roughness, and density of particles are carefully investigated in the simulation. The comparison between the numerical simulation and experiment is also performed. The simulation results can help us understand the particle damping mechanism and design the new generation of particle damping devices.

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