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A Particle-Substrate Model and Its Applications ROBERT BEHRINGER, Dept of Physics, Duke University, MEENAKSHI DUTT, Dept of Materials Science and Metallurgy, University of Cambridge — Systems of monodisperse particles moving on a substrate which is driven externally have been studied from the perspective of understanding the nonlinear behavior responsible for phenomena such as subharmonic waves, pattern formation or supersonic behavior. A complete understanding of the microscopic dynamics in such systems must encompass the effects of collisions and the substrate on the particles. We begin from first principles by considering collections of spherical frictional particles that roll and slip on a flat static substrate. Experiments performed by Painter et al. (Phys. Rev E (2000)) on two particle collisions emphasized the importance of the role played by substrate friction, in particular kinetic friction, on the particle dynamics after collision on a substrate. We present a numerical model which accounts for collisional and surface frictional dissipation and their influence on particle dynamics for a quasi 2-dimensional cooling granular material. We apply this model to a simulation of the granular collider experiment (Painter et al., Physica D (2003)), in which collections of particles collided as they moved radially inward on a substrate. We find an agreement between the experimental and numerical results. We will also be presenting further applications of the model.

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