Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

A scattering approach for locomotion on heterogeneous granular media[1] TINGNAN ZHANG, FEIFEI QIAN, ADAM KAMOR, PREDRAG CVITANOVIC, DANIEL GOLDMAN, Georgia Institute of Technology — Locomotion on homogeneous particulate media has been recently studied using biological and robotic experiment and modeled using multi-particle discrete element simulation and empirical resistive force theory. Little is known about how locomotion is affected when environments are composed of particles with a large distribution of sizes. We study in experiment and a reduced order model, locomotion dynamics when particle sizes are widely separated. A hexapedal robot ($\sim$15 cm, $\sim$100 g) interacts with a single boulder (whose size is comparable to the robot) during runs on a substrate of homogeneous, loosely packed poppy seeds. We vary the perpendicular distance between the center of the boulder and the trajectory of the robot's center of mass (CoM) before collision (the impact parameter), and measure the post-collision direction. For fixed impact parameter, the CoM deflection sensitively depends on the boulder contact point and leg phase. Counterintuitively, the interactions are largely attractive; the robot turns towards the scattering center. To understand the long-time dynamics, in a reduced-order model, we treat the scattering angle as a function of only the impact parameter with other effects modeled as noise; we thereby extend the study to an infinite field of boulders.

[1]This work is supported by DARPA

Tingnan Zhang
Georgia Institute of Technology

Date submitted: 15 Nov 2013 Electronic form version 1.4