Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Scattering of a legged robot in a heterogeneous granular terrain[1]

FEIFEI QIAN, DANIEL GOLDMAN, Georgia Institute of Technology — Many granular substrates are composed of particulates of varying size, from fine sand to pebbles and boulders. Ambulatory locomotion on such heterogeneous substrates is complicated in part due to fluctuations introduced by heterogeneities. To discover principles of movement in such substrates, we developed an automated system, the "Systematic Creation of Arbitrary Terrain and Testing of Exploratory Robots" (SCATTER), to create heterogeneous granular substrates of varying properties such as compaction, inclination, obstacle shape/size/distribution and obstacle mobility within the substrate. We investigate how the presence of a single "boulder" affects the locomotion of a 6-legged robot (15cm, 150g). The robot's trajectory is straight before boulder interaction, and is scattered to an angle after the interaction. Surprisingly, the interactions with the boulder can lead to both negative and positive scattering angles–an effective attraction and repulsion between the robot and the boulder. The scattering pattern depends sensitively on the leg-boulder contact position and the boulder mobility within the fine sand. However, the scattering pattern dependence upon contact position on the boulder is insensitive to boulder shape (created using 3D printing), orientation and roughness.

[1]This work is funded by DARPA Young Faculty Award and Army Research Laboratory (ARL)

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Date submitted: 14 Nov 2014 Electronic form version 1.4