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Legged locomotion on sand CHEN LI, School of Physics, Georgia Institute of Technology, PAUL UMBANHOWAR, Department of Mechanical Engineering, Northwestern University, HALDUN KOMSUOGLU, DANIEL KODITSCHEK, Department of Electrical and Systems Engineering, University of Pennsylvania, DANIEL GOLDMAN, School of Physics, Georgia Institute of Technology — To understand how and why animals modulate foot kinematics to achieve effective locomotion on granular media, we study the speed of a six-legged robot with c-shaped legs, SandBot, moving on granular media for varying volume fraction, ϕ, limb frequency, f, and gait timing parameters.[1] Speed is determined by step length which in turn depends on limb penetration. At low f and high ϕ penetration is small, step length is large, and SandBot advances with a rotary walking gait in which c-legs rotate about their centers by slipping relative to stationary grains. In the opposite extreme, grains cannot support the robot; its underside always contacts the ground and it advances slowly via thrust generated as the c-legs translate through the grains. For varied gait parameters, high speeds are only observed in a small area of parameter space. A yield stress based model predicts the speed and reveals that performance is maximized when gait parameters minimize limb acceleration and interference, and limbs utilize the solidification properties of the media.

[1]Li et. al, PNAS, **106**, 3029, 2009

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