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Legless locomotion in lattices PERRIN SCHIEBEL, Georgia Institute of Technology, JIN DAI, CHAOHUI GONG, Carnegie-Mellon University, MIGUEL M. SERRANO, Georgia Institute of Technology, JOSEPH R. MENDELSON III, Zoo Atlanta, HOWIE CHOSET, Carnegie-Mellon University, DANIEL I. GOLDMAN, Georgia Institute of Technology — By propagating waves from head to tail, limbless organisms like snakes can traverse terrain composed of rocks, foliage, soil and sand. Previous research elucidated how rigid obstacles influence snake locomotion by studying a model terrain–symmetric lattices of pegs placed in hard ground. We want to understand how different substrate-body interaction modes affect performance in desert-adapted snakes during transit of substrates composed of both rigid obstacles and granular media (GM). We tested *Chionactis occipitalis*, the Mojave shovel-nosed snake, in two laboratory treatments: lattices of 0.64cm diameter obstacles arrayed on both a hard, slick substrate and in a GM of ≈ 0.3mm diameter glass particles. For all lattice spacings, d, speed through the hard ground lattices was less than that in GM lattices. However, maximal undulation efficiencies η_u (number of body lengths advanced per undulation cycle) in both treatments were comparable when d was intermediate. For other d, η_u was lower than this maximum in hard ground lattices, while on GM, η_u was insensitive to d. To systematically explore such locomotion, we tested a physical robot model of the snake; performance depended sensitively on base substrate, d and body wave parameters.

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