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Impulsive movements lead to high hops on sand[1] JEFFREY AGUILAR, DANIEL I. GOLDMAN, Georgia Tech — Various animals exhibit locomotive behaviors (like sprinting and hopping) involving transient bursts of actuation coupled to the ground through internal elastic elements. The performance of such maneuvers is subject to reaction forces on the feet from the environment. On substrates like dry granular media, the laws that govern these forces are not fully understood, and can vary with foot size and shape, material compaction (measured by the volume fraction ϕ) and intrusion kinematics. To gain insight into how such interactions affect jumps on granular media, we study the performance of an actuated spring mass robot. We compare performance between two jump strategies: a single-cycle sine-wave actuation (a "single jump") and this actuation preceded by an impulsive preload (a "preload jump"). We vary ϕ for both strategies, and find that ϕ significantly affects performance: we observe a 200% increase in the single jump height with only a 5% increase in volume fraction using a 7.62 cm diameter flat foot. The preload jump outperforms the single jump height by 150% for all ϕ. We hypothesize that this increase in performance results from higher intrusion velocities and accelerations associated with the preload.

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Jeffrey Aguilar
Georgia Tech

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