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A theoretical study of burrowing in dry soil using razor clam-inspired kinematics AMOS WINTER, MONICA ISAVA, MIT — This work investigates whether the digging kinematics of *Ensis directus*, the Atlantic razor clam, could be utilized in dry soil. In wet soil, *E. directus* uses contractions of its valves to relieve stress on the surrounding soil, and then draw water towards its body to create a pocket of fluidized substrate. This locally fluidized zone requires much less force to move through than static soil, resulting in burrowing energy that scales linearly with depth, rather than depth squared. In dry soil, if the valves of a clam-like device are contracted fast enough, the horizontal stress in the soil could be brought to a zero-stress state. This would correspondingly reduce the local vertical stresses to zero, which could drastically lower the forces required to burrow compared to moving through static dry soil. Using analytical models of soil failure mechanics, we investigated the critical timescales for inducing a zero-stress state in soil surrounding an *E. directus*-like device with contracting valves. This device was modeled as a similar size to a real razor clam (15 mm wide). It was found that for most dry soils, the device would have to contract its valves in 0.02 seconds, a speed within the realm of possibility for a mechanical system. These results suggest that the burrowing method used by *E. directus* could feasibly be adapted for digging in dry soil.

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