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Microstructural view of burrowing with a bioinspired digging robot KERSTIN NORDSTROM, Mount Holyoke College, DAN DORSCH, Massachusetts Institute of Technology, WOLFGANG LOSERT, University of Maryland, AMOS WINTER, V, Massachusetts Institute of Technology — RoboClam is a burrowing technology inspired by Ensis directus, the Atlantic razor clam. Atlantic razor clams should only be strong enough to dig a few centimeters into the soil, yet they burrow to over 70 cm. The animal uses a clever trick to achieve this: by contracting its body, it agitates and locally fluidizes the soil, reducing the drag and energetic cost of burrowing. RoboClam technology, which is based on the digging mechanics of razor clams, may be valuable for subsea applications that could benefit from efficient burrowing, such as anchoring, mine detonation, and cable laying. We directly visualize the movement of soil grains during the contraction of RoboClam, using a novel index-matching technique along with particle tracking. We show that the size of the failure zone around contracting RoboClam can be theoretically predicted from the substrate and pore fluid properties, provided that the timescale of contraction is sufficiently large. We also show that the nonaffine motions of the grains are a small fraction of the motion within the fluidized zone, affirming the relevance of a continuum model for this system, even though the grain size is comparable to the size of RoboClam.

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