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The design, testing, and performance of RoboClam, a robot inspired by the burrowing mechanisms of Atlantic razor clams (Ensis directus) AMOS WINTER, ANETTE HOSOI, ALEXANDER SLOCUM, MIT — In this work we present the design, testing, and performance of RoboClam, a robot that mimics digging methods employed by the Atlantic razor clam (Ensis directus). Ensis is one of nature's most adept burrowing organisms, able to dig to 70cm at nearly 1cm/s using only 0.21J/cm. We have found that Ensis reduces burrowing drag by using motions of its shell to fluidize a thin layer of substrate around its body. Although these shell motions have an energetic cost, moving through fluidized rather than packed soil results in dramatically lower overall energy consumption. RoboClam was constructed to understand the limits of razor clam-inspired burrowing, how the relevant parameters scale for different environments and conditions, and how this understanding can be transferred into engineering applications. Through experimental data gathered in idealized granular, as well as real ocean substrates, we show that RoboClam exploits localized fluidization to attain nearly the same burrowing energy savings as Ensis.

Anette Hosoi
MIT

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