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The Mechanics of Localized Fluidization Burrowing AMOS WINTER, MIT Dept. of Mechanical Engineering — This presentation will focus on the granular mechanics and critical timescales related to localized fluidization burrowing, a digging method inspired by the Atlantic razor clam (*Ensis directus*). The animal uses motions of its valves to locally fail and then fluidize surrounding soil to reduce burrowing energy and drag. The characteristic contraction time to achieve fluidization can be determined from substrate properties. The geometry of the fluidized zone is dictated by the coefficient of lateral earth pressure and friction angle of the soil. Calculations using full ranges for these parameters indicate that the fluidized zone is a local effect, occurring between 1–5 body radii away from the animal. The energy associated with motion through fluidized substrate – characterized by a depth-independent density and viscosity – scales linearly with depth. In contrast, moving through static soil requires energy that scales with depth squared. For engineers, localized fluidization offers a mechanically simple and purely kinematic method to dramatically reduce energy costs associated with digging. This concept is demonstrated with RoboClam, an *E. directus*-inspired robot. Using a genetic algorithm to find optimal digging kinematics, RoboClam has achieved localized fluidization burrowing performance comparable to that of the animal, with a linear energy-depth relationship, in both idealized granular glass beads and *E. directus*' native cohesive mudflat habitat.

Amos Winter
MIT Dept. of Mechanical Engineering

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