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Induced vibrations facilitate traversal of cluttered obstacles GEORGE THOMS, SIYUAN YU, YUCHENG KANG, CHEN LI, Johns Hopkins University — When negotiating cluttered terrains such as grass-like beams, cockroaches and legged robots with rounded body shapes most often rolled their bodies to traverse narrow gaps between beams. Recent locomotion energy landscape modeling suggests that this locomotor pathway overcomes the lowest potential energy barriers. Here, we tested the hypothesis that body vibrations induced by intermittent leg-ground contact facilitate obstacle traversal by allowing exploration of locomotion energy landscape to find this lowest barrier pathway. To mimic a cockroach / legged robot pushing against two adjacent blades of grass, we developed an automated robotic system to move an ellipsoidal body into two adjacent beams, and varied body vibrations by controlling an oscillation actuator. A novel gyroscope mechanism allowed the body to freely rotate in response to interaction with the beams, and an IMU and cameras recorded the motion of the body and beams. We discovered that body vibrations facilitated body rolling, significantly increasing traversal probability and reducing traversal time ($P < 0.0001$, ANOVA). Traversal probability increased with and traversal time decreased with beam separation. These results confirmed our hypothesis and support the plausibility of locomotion energy landscapes for understanding the formation of locomotor pathways in complex 3-D terrains.

George Thoms
Johns Hopkins University

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