

## **Towards statistical mechanics of locomotor transitions in complex terrain**

### **Abstract**

Analogous to the fields of aerodynamics of flight and hydrodynamics of swimming, my lab is creating terradynamics of locomotion in complex terrain, by developing experimental tools and theoretical models to systematically study and understand how animals and robots physically interact with the terrain to move through. Such fundamental advancement will ultimately help robots robustly traverse terrain like earthquake rubble for search and rescue and Martian rocks for planetary exploration.

Despite decades of research, our understanding of physical principles of terrestrial locomotion has been relatively limited to near-steady-state, single-mode locomotion (e.g., running, walking, climbing, slithering). In this talk, I will highlight my lab's recent research towards creating "statistical mechanics" of locomotor transitions, by developing energy landscapes to understand how insects and legged robots probabilistically transition between different locomotor modes to traverse complex terrain. I will also talk about how body lateral oscillation and compliance together help limbless snakes stably traverse large obstacles by suppressing failure mode transitions and inspire a robot that outperforms previous snake robots.