

Mechanical Engineering Doctoral Defense

Bioinspired interactions with complex granular and aquatic environments


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Abstract

With the integration of biology, physics and engineering, the classical approach of solving problems has transformed. Through such an integration, the presented research will address the following engineering solution: maneuverability on and through complex granular and aquatic environments. The basilisk lizard and the octopus are the key animals of inspiration for the solution we anticipate seeking. The basilisk lizard is a highly agile reptile with the ability to easily traverse on vast, alternating, unstructured, and complex terrains (i.e. sand, mud, water). This makes them a great medium for pursuing potential solutions for robotic locomotion on such terrains. The octopus, with a nearly soft, yet muscular hydrostat body and arms, is proficient in locomotion and its complex motor functions are vast. Their versatility, “infinite” degrees of freedom, and dexterity have made them an ideal candidate for inspiration in the fields such as soft robotics. Through conducting animal experiments on the basilisk lizard (i.e. morphology and locomotion) and octopus (i.e. arm and sucker control), insight can be obtained on the question: why and how does the animal do what it does? Following it through by conducting systematic robotic experiments, the capabilities and limitations of the animal can be understood. Integrating the hierarchical concepts observed and learnt through animal and robotic experiments can be used towards designing, modeling, and developing robotic systems. These will assist humanity and society on a diversified set of applications: home service, health care, public safety, transportation, logistics, structural examinations, aquatic and extraterrestrial exploration, search-and-rescue, environmental monitoring, forestry, and agriculture, just to name a few. By learning and being inspired by nature, we have the potential to go beyond nature for the greater good of society and humanity.



October 28, 2020; 8 AM;

Zoom Link: <https://asu.zoom.us/j/82185970218>