BioSystems Science and Engineering

BSSE Seminar

4:00 PM, August 3rd, 2018
MRDG Seminar Hall, 1st Floor
Biological Sciences Building

Principles of Robustness in Biological and Bio-inspired Systems

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Robots are touted to deliver tremendous benefits to society. However, many of them are considered fragile for real world utilization because they break easily. Once damaged, they are often limited to pre-specified compensatory behavior and therefore, unable to recover adequately for sustained operation. In contrast, animals are remarkably robust, i.e., they possess the ability for persistent behaviors despite disturbances. They thrive in complex natural environments by rapidly adapting to changing conditions, tolerating construction flaws and sensing uncertainties to avoid fatal damage. These observations have thus prompted the question central to my research: *What are the fundamental principles of robustness that enable superior locomotion capabilities in biological organisms compared to their robotic counterparts?*

Discoveries from my research indicate that fault-tolerant and fail-safe mechanisms, aware and adaptable structures, and a design methodology based on sufficiency rather than optimality, are critical to realizing robust locomotion in animals and bioinspired robots. Using an integrative approach that necessarily draws upon comparative experimental biology, engineering design and advanced manufacturing and physical and mathematical sciences, I lay out my research program that aims to (1) create a principles-based framework to identify, measure and model robustness in biological (and robotic) systems, and to (2) utilize robustness principles to design and fabricate robots capable of effective behavior in unstructured environments.

About the Speaker

Kaushik Jayaram is presently a post-doctoral scholar in Prof. Rob Wood's Microrobotics lab at Harvard University. He obtained his doctoral degree in Integrative Biology in 2015 from the University of California Berkeley mentored by Prof. Bob Full. He graduated with a dual degree - (undergraduate) in Mechanical Engineering and (Masters) in Manufacturing from the Indian Institute of Technology-Bombay in 2009, with interdisciplinary research experiences at University of Bielefeld, Germany, and Ecole Polytechnique Federale du Lausanne, Switzerland. Kaushik's research combines biology and robotics to uncover the principles of robustness that make animals successful at locomotion in natural environments, and, in turn, inspire the design of next generation of novel robots for effective real-world operation. His work has been published in a number of prestigious journals and gained significant popular media attention. Kaushik is actively involved in outreach activities and currently serves as a member of the Broadening Participation Committee for the Society of Integrative and Comparative Biology.