COLLOQUIUM

Robophysics: robotics meets physics

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Robots will soon move from the factory floor and into our lives (e.g. autonomous cars, package delivery drones, and search-and-rescue devices). However, compared to living systems, locomotion by such devices is still relatively limited, in part because principles of interaction with complex environments are largely unknown. In this talk I will discuss efforts to develop a physics of moving systems -- a locomotion ``robophysics'' -- which we define as the pursuit of the discovery of principles of self-generated motion [Aguilar et al, Rep. Prog. Physics, 2016]. We use the methods of physics to examine successful and failed locomotion in simplified laboratory devices using parameter space exploration, systematic control, and techniques from dynamical systems. Drawing from examples from my group and our collaborators, I will discuss how robophysical studies in terrestrial environments have inspired new physics questions in low dimensional dynamical systems (including creation of analog quantum mechanics and gravity systems) and soft matter physics, have been useful to develop models for biological locomotion in complex terrain, and have begun to aid engineers in the creation of devices that begin to achieve life-like locomotor abilities on and within complex environments. The rapidly decreasing cost of constructing sophisticated robot models with easy access to significant computational power bodes well for scientists and engineers to engage in a discipline which can readily integrate experiment, theory and computation.