Design of a Multi-Legged Robot With Extraterrestrial Terrain Exploration, Sample Retrieval, and Transportation Functions

Lu, Yanchen (Samuel) (School: Groton School)

Exploration of formerly uncharted terrain has sparked demand for robotic systems capable of locomotion across rough geometries of terrain. To construct such robots, researchers and engineers have drawn inspiration from biotic organisms. Multi-legged robots, mimicking the movement of multi-legged insects, could significantly advance robotic capabilities on uneven terrain. In industrial or urban settings, multi-legged robots play indispensable roles in negotiating treacherous settings, such as toxic nuclear plants and aftermaths of natural disasters. In environmental and agricultural settings, these robots can forecast parameters such as soil quality and mineral composition, and document collateral damage from storms. In rough geometries of other planets, these robots could ensure the reliable transport of tools, samples, or other data. The prototype proposed in this paper challenges contemporary designs in three primary ways. First, its elliptical gait scheme—which mimics the undulating movement of centipedes—differs from other multi-legged robots. Secondly, this unique mechanism eliminates the need for independent leg control, simplifying the construction process. Finally, the robot will be employed in extraterrestrial settings, a domain where multi-legged robots have yet to witness development. This paper will conclude with a series of experiments that verify the effectiveness of this prototype.