An Under-Actuated Fast-Running Bipedal Lizard Robot With Optimized Lateral Bending

Li, Arielsie (School: Phillips Academy)

This paper reports on an innovative under-actuated bipedal lizard-inspired robot that utilizes lateral bending of its body to achieve high-speed stable running. A digital dynamic model of the robot was developed, simulated, and optimized based on the anatomy and movements of a real-life bipedal lizard. A prototype of the robot was built to reproduce the modeled movements, and subsequent testing revealed flaws in the design, which led to the development of an improved version. The optimal lateral body motions that yields the most stable and effective robot running were then experimentally determined. The introduction of lateral bending provides a reliable and novel solution to the problem of stability in bipedal robots. One of the major contributions of this work is the use of fuzzy adaptive control in an algorithm that enables the robot to identify obstacles and adjust its movements accordingly. The core of the fuzzy control lies in the integration of infrared sensors and open MV to detect obstacles, an unconventional approach to obstacle avoidance. The result is a robot that weighs only 561.05 g, measures only 65.4 cm long, and is capable of a maximum running speed of 1.532 m/s while maintaining an upright posture and an absolute yaw angle of below 3 degrees. The state-of-the-art outcomes of this study demonstrates the potential of lateral bending as well as fuzzy adaptive control algorithms in enhancing bipedal robot performance. Future studies may attempt unconstrained robotic motions through further utilization of such novel methods and explore applications of the robot in medical and environmental fields.

Awards Won:

Association for the Advancement of Artificial Intelligence: AAAI Student Memberships for each finalist that is part of the 1st, 2nd, and 3rd Prize Winning projects and 5 Honorable Mention winning projects (up to 3 students per project) (in-kind award / part of the 1st-3rd prize)

Association for the Advancement of Artificial Intelligence: Third Award of $500