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Locomotion Effects of Redundant Degrees of Freedom in Multi-Legged Quadruped Robots

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Abstract : Energy efficiency and locomotion speed are two key parameters for legged robots; thus, finding ways to improve them are important. This paper proposes a locomotion framework to analyze the energy usage and speed of quadruped robots via a Genetic Algorithm (GA) optimization process. For this, a quadruped robot platform with joint redundancy in its hind legs that we believe will help multi-legged robots improve their speed and energy consumption is used. ContinuO, the quadruped robot of interest, has 14 active degrees of freedom (DoFs), including three DoFs for each front leg, and unlike previously developed quadruped robots, four DoFs for each hind leg. ContinuO aims to realize a cost-effective quadruped robot for real-world scenarios with high speeds and the ability to overcome large obstructions. The proposed framework is used to locomote the robot and analyze its energy consumed at diverse stride lengths and locomotion speeds. The analysis is performed by comparing the obtained results in two modes, with and without the joint redundancy on the robot's hind legs.

Keywords : genetic algorithm optimization, locomotion path planning, quadruped robots, redundant legs
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