

Gait Generation of a Quadruped Robot on Flowable Terrains

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Introduction

- ❖ Legged Robots are quite good at traversing a variety of complex terrains.
- ❖ They have a wide variety of applications in space exploration, disaster response and rescue, underground mines exploration and so on.
- ❖ They are quite difficult to control.

Gait Generation

A gait is simply a repetitive pattern of foot placements

There are two main types of gait:

- ❖ Periodic Gaits
- ❖ Non-Periodic/Free Gaits

Gait generation is the formulation and selection of a sequence of gaits that propel a legged robot along the desired trajectory.

Problem Statement

- ❖ There have been recent studies on legged robot locomotion on flowable terrains. However, it is limited to generating models to describe the relationships.
- ❖ Flowable terrains have two main unique characteristics;
 - at an instant of time during a step, each element of a leg moves through the substrate at a specific depth, orientation, and movement direction, all of which can change over time.
 - They can have solid-like or fluid-like properties.

Related Study

- ❖ (Dholakiya et al., 2019) “*Design, Development and Experimental Realization of A Quadrupedal Research Platform: Stoch*” uses bio-inspired techniques such as central pattern generators to generate rhythmic patterns.
- ❖ (Kingsbury, 2016) “*A Robophysics Approach to Bipedal Walking in Granular Media*” develops a general principle that guides the behaviour of legged locomotion within flowable substrates. His principle is based on the empirical resistive force model.
- ❖ (Li, Zhang & Goldman, 2013) “*A Terradynamics of Legged Locomotion on Granular Media*” develops a new model that describes and predicts legged locomotion on flowable ground.

Proposed Tasks

- ❖ Understand fundamental concepts like robot kinematics, dynamics and trajectory planning
- ❖ Extend proposed models from related study to formulate custom gaits in simulation for the quadruped robot, Go1
- ❖ Test custom gaits on the real robot in controlled environment and then in a natural environment to validate gaits

Any Questions?