MODEL PREDICTIVE CONTROL OF AN 8-DOF QUADRUPEDAL ROBOT

A Master's Thesis Defense in Mechanical Engineering

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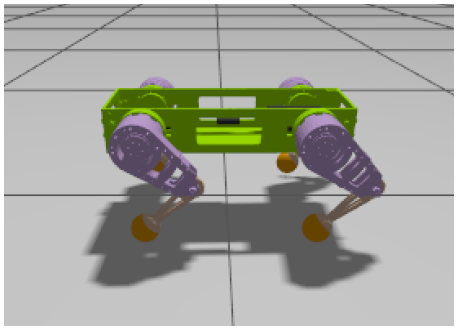
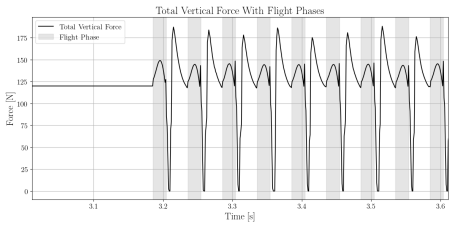
Quadrupedal robots offer a versatile locomotion option that can extend the operating space of a robot into uneven terrains. However, controlling these systems presents significant challenges due to nonlinearities introduced by various factors.

In this thesis, model-predictive control (MPC) is applied to an 8-DOF legged robot developed by Cal Poly's Legged Robotics group. The MPC framework employs a lumped rigid-body model that treats the robot as a single rigid body with forces applied directly at the foot contact points. The controller is developed within the ROS2 environment, with integration of state estimation and gait-pattern generation, to provide maximum modularity and flexibility for various locomotion scenarios.

The efficacy of the controller is demonstrated in the simulation environment through generating various stable symmetric (and even asymmetric) gaits at speeds exceeding 1 m/s. Notably, the control system relies exclusively on proprioceptive sensing, operating without exteroceptive feedback from the surrounding environment. This research provides a foundation for implementation on real hardware.





3:00 PM Thursday, June 12 in building 192 room 118
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