CPS : Synergy : Learning to Walk - Optimal Gait Synthesis and Online Learning for Terrain-Aware Legged Locomotion

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Description

advance abilities of cyber-physical systems by tying sensing, perception, and computing to the optimization and control of physical systems whose properties are variable and uncertain.

1. **Model interactions** (robot-environment);
2. **Stable gait generation** and **transition strategies**;
3. **Online learning** of interactions;
4. **Validated contributions** on experimental testbeds;
5. Communicate value of STEM **education**.
Findings

when modeled properly, online learning can be fast

learns in 5 trials; mostly gets it within 2

robust walking on granular terrain

with robot-terrain model, walks! yes footprints

wrong model, falls immediately! no footprints
Additional Findings

Foot-terrain interaction has speed dependence.

Force overshoot implies interesting terradynamics.

Optimal orbit transitions have nice fiber bundle structure.