Motivation
Animal observations and muscle models suggest that damping is beneficial for legged locomotion [1-3]. Legged robots implement virtual damping, while mechanical damping is often overlooked, despite its potential advantages. It remains unclear which type of damping (viscous, Coulomb friction, etc.) is preferable.

Virtual damping
- High frequency force control
- Act instantaneously, less control
- Strong actuators
- Share load of actuators

Mechanical damping

Research Goal
Our goal is to study the effectiveness of mechanical damping on the leg-system total energy dissipation within one drop cycle.

Key Messages
1. Viscous damping is generally superior to Coulomb friction damping, and a trade-off exists between energy efficiency and fast rejection of ground perturbation.
2. Adjustable mechanical dampers exhibit complex mechanic response when embedded into real legged systems.

Simulation

Hardware Experiment

Work loop components

“Free drop” and “slow drop” to separate dissipated energy components:
Viscous damper 1 (1214H): 150mJ = 60mJ + 60mJ (40%) + 30mJ
Viscous damper 2 (1210M): 401mJ = 50mJ + 311mJ (77%) + 30mJ

References

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