Advance contact mechanism for robot ankles

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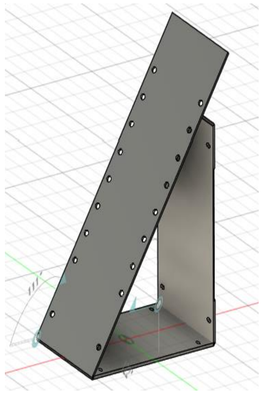
Introduction

Navigating uneven terrain remains a key challenge for robots, driven by unpredictable depth changes, obstacles, and shifting inclines. This project addresses the issue by developing durable, fiberglass-based ankles that enhance stability and enable smooth transitions between quadrupedal and bipedal locomotion. The result is a cost-effective, adaptable solution for robust robotic movement across diverse and challenging environments.

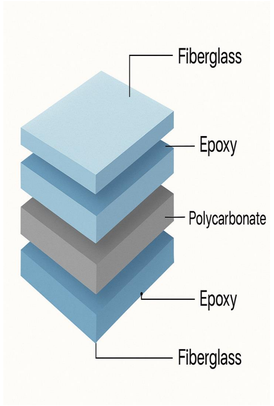
Goals

- Navigate diverse obstacles without losing control.
- Instantly switch between quadrupedal and bipedal modes.
- Compare real-world performance with simulations to analyse differences.
- Evaluate ankle stiffness and friction for optimal stability.

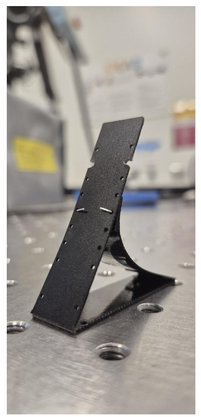
Design



CAD Ankle



Layered Fiberglass



Manufactured ankle

Research

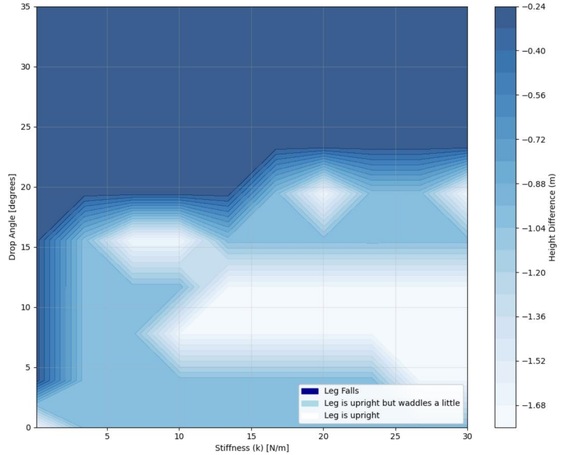
- Fiberglass-based components enable fast, reproducible fabrication with environmentally friendly materials.
- Spring angle modulation provides precise control over joint stiffness for adaptive locomotion.
- Ankle mechanism structurally validated to withstand vertical drop impacts from 1 meter.
- Modular ankle architecture supports transformation from quadrupedal to bipedal locomotion.

Ankles with the robot legs

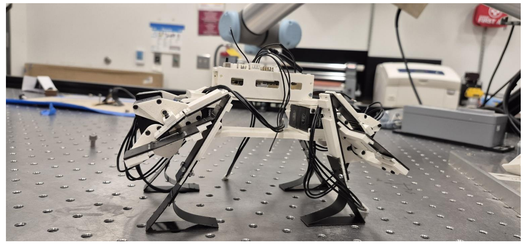
Future Scope

- Evaluate performance across diverse terrains and substrate materials for enhanced adaptability.
- Evolve the design into a dual-spring system to enable controlled resistance in both flexion and extension.
- Develop a plug-and-play ankle unit compatible with a wide range of quadrupedal robotic platforms.

Results



Drop test results of ankles



Assembled robot with legs and ankles

Acknowledgement

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