

设计与制造 II (2025年度) 课程项目展

项目名称: S.T.E.P.: A Gait Simulator

组号: A-13

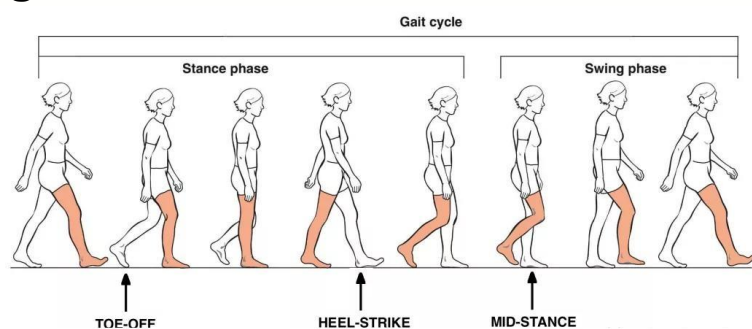
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指导老师: 梁庆华

I、项目介绍

1. Background

There is a lack of devices capable of accurately simulating real-world walking mechanics. Our project aims to replicate the gait of humans.



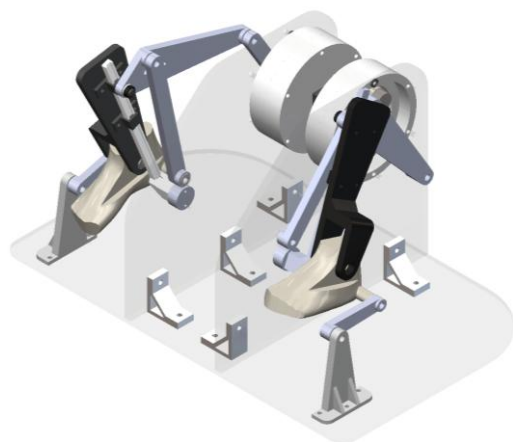
Products derived could be used in areas such as personalized shoe design and military boot wear testing.

2. Modelling

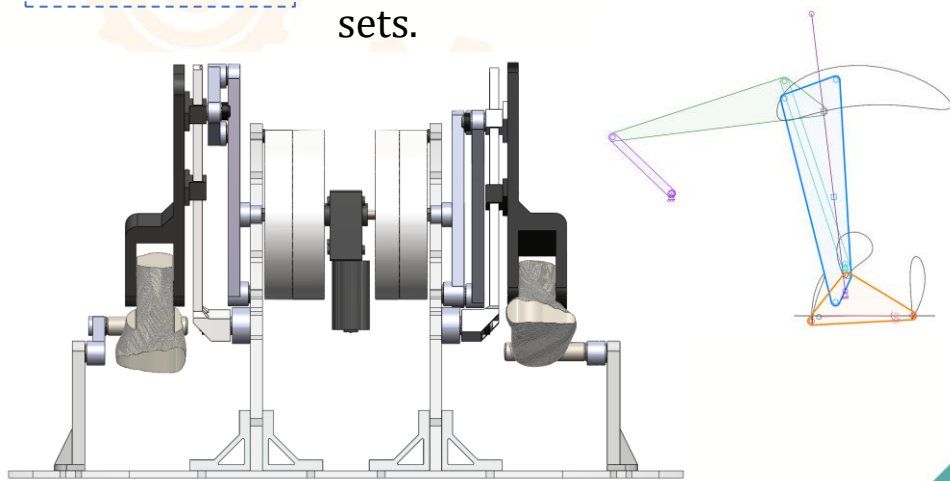
Realistic
Alternating
Design

1 DOF
Trajectory
Generation

Large
Mechanical
Advantage



The main part is an augmentation of a six-bar mechanism variation, providing a precise simulation of gait patterns. The driver consists of two synchronous planetary gear sets.



II、样机制作

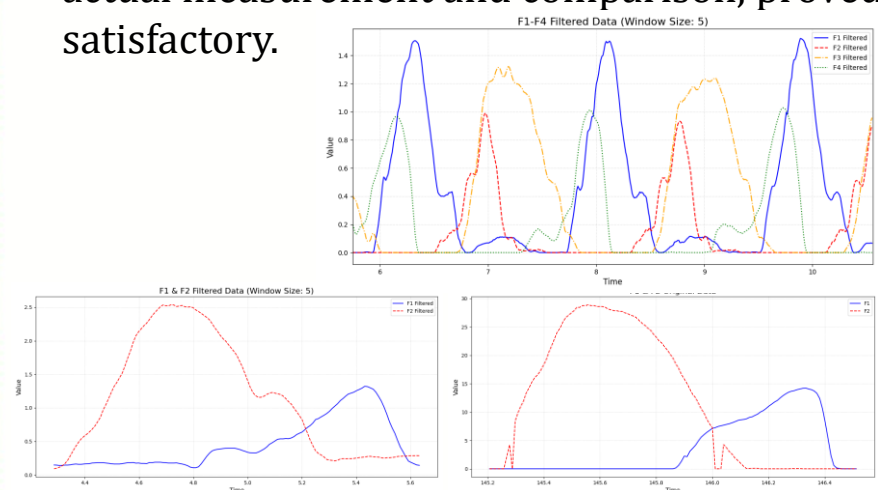
Prototype manufactured using 3D printing and laser cutting. Gearing calculated and tested safe for both contact and bending.



$$\begin{aligned} s_{F1} &= \frac{[\sigma_F]}{\sigma_{F1}} = 2.74 \\ s_{F2} &= \frac{[\sigma_F]}{\sigma_{F2}} = 7.23 \\ s_{F3} &= \frac{\sigma_B^{PLA}}{\sigma_{F3}} = 6.84 \\ s_{H1} &= \frac{[\sigma_H]}{\sigma_{H1}} = 1.37 \\ s_{H2} &= \frac{[\sigma_H]}{\sigma_{H2}} = 2.17 \\ s_{H3} &= \frac{\sigma_H^{PLA}}{\sigma_{H3}} = 1.65 \end{aligned}$$

III、创新点

Our innovation is that we simulated the gait motion using a novel method through trajectory optimization, without directly mimicking the human counterparts. The results, revealed by actual measurement and comparison, proved satisfactory.



致谢

- Gratitude to instructor Prof. Liang;
- Gratitude to engineer Chen Wei for his suggestions;
- Thanks to Piotr for participating.