A Passive Variable-Force Stand-Assist Device for Seniors

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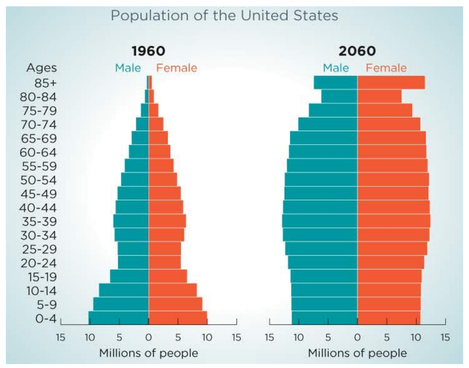
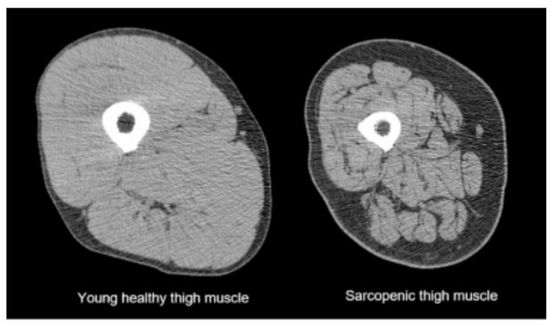
Background

The US population is aging. Currently, over 40,000 annual deaths from falls[1]



Sarcopenia weakens muscles with age. Exercise combats muscle loss[2]



Active exoskeletons are large, heavy, and less likely to be embraced by seniors[3]

Sit-to-stand is important for mobility, exercise, and thus fall prevention

Design

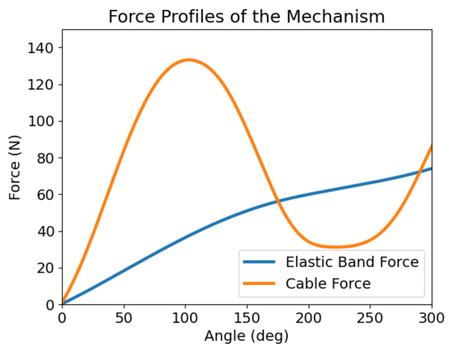
Goals

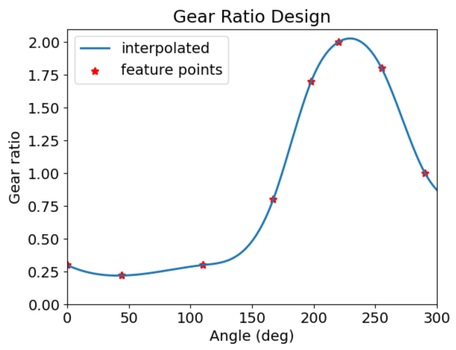
1. Deliver peak force during sit-to-stand
2. Low force while standing and seated
3. Lightweight
4. Low profile

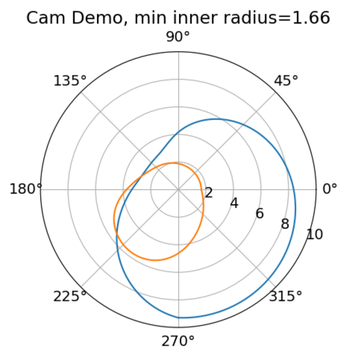
Strategy

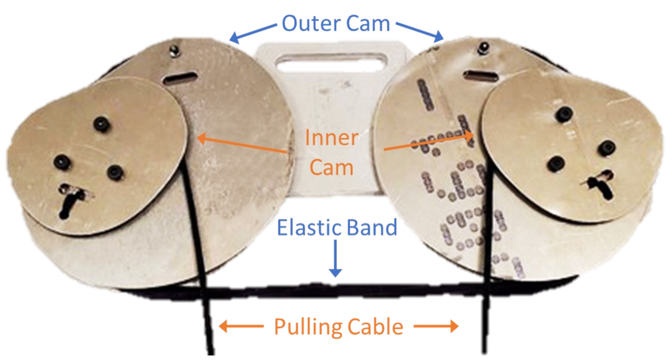
Wearable compound cam mechanism with variable gear ratio

- Elastic band stretches around outer cam, storing energy while sitting
- Force on user is low in seated configuration
- Higher force provided to assist user during sit-to-stand



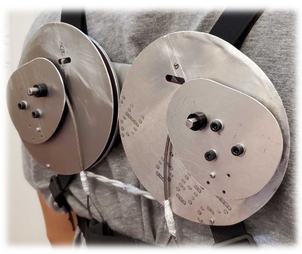


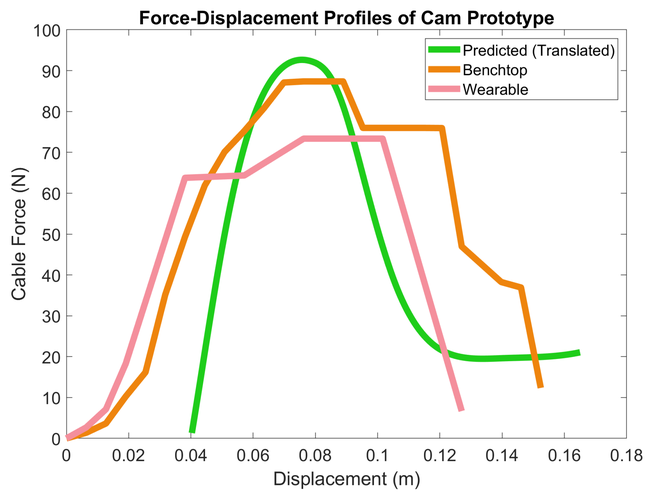




Results & Conclusions

Peak force: **15 lbf**
Seated force: **5 lbf**
Weight: **2.9 lbs**
Envelope: **14” x 6” x 1.5”**





Demonstrated how simple mechanism can store user’s energy and deliver assistive force appropriately

Future work will focus on minimizing energy loss and optimizing timing of energy return

References & Acknowledgments

[1] Centers for Disease Control Web-based Injury Statistics Query and Reporting System
[2] Unger et al. (2013). “Fall prevention in the elderly.” *Clinical Cases in Mineral and Bone Metabolism.*
[3] Chi-Hung Lo (2021). “A Study on Appearance Acceptance Appraisal of Elderly Mobility Assists.” *Sustainability.*

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