Team 15

Adding a Sense of Touch to Prosthetics

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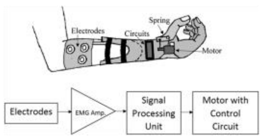
Mentors: Dr. Milton Aguirre

Customer Background

Current prosthetic solutions on the market lack force feedback which makes it difficult for users to interact with objects. Model hook arms are robust and lack grip sensitivity. Myoelectric prosthetics are often expensive and uncomfortable to use.



Myolectric vs. Hook Prosthetic

Problem Statement

The aim of this study is to develop a new product that is economical, sensitive to delicate objects and provides visual force feedback to the user. Testing needs to be conducted to compare the state-of-the-art model hook to a new compliant mechanism. User Interface development needs to allow nonamputees to test new prototypes.

Requirements

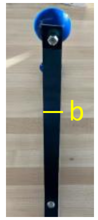
Requirements	Metric
Clamp Force	10 N
Grip Mechanism	Anthropometric
Length	< 240mm
Cost	< $200

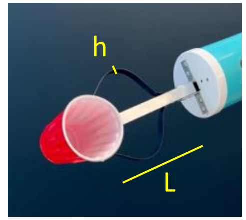
Daily Objects	Raw Meat	Cereal Bowl	Tennis Shoes	Glass of Water	Book
Weight (1lb = 4.45N)	4.45 N	5.34 N	3.34 N	3.45 N	3.34 N

L = 114.3mm

L = 138.7mm

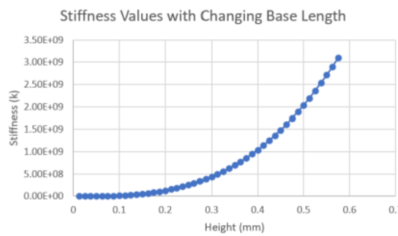
Design Concepts and Experimentation





k = stiffness
E = Modulus of Elasticity
*sheet metal steel: 190x10^9
b = base
h = height
L = length

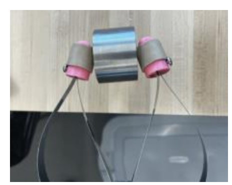
$$k = \frac{E \cdot \frac{b \cdot h^3}{12}}{L}$$



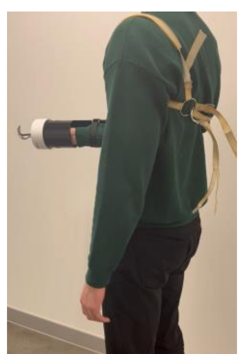
height	base	Stiffness (k)
0.254mm	17.4mm	0.0275 N/m
0.343mm	17.4mm	0.0677 N/m
0.508mm	17.4mm	0.2199 N/m

Final Design

Flexure Thickness	Max Pick-Up Weight
0.254mm	2.26 N
0.343mm	3.63 N
0.508mm	5.00 N



500g weight shown in image



Testing