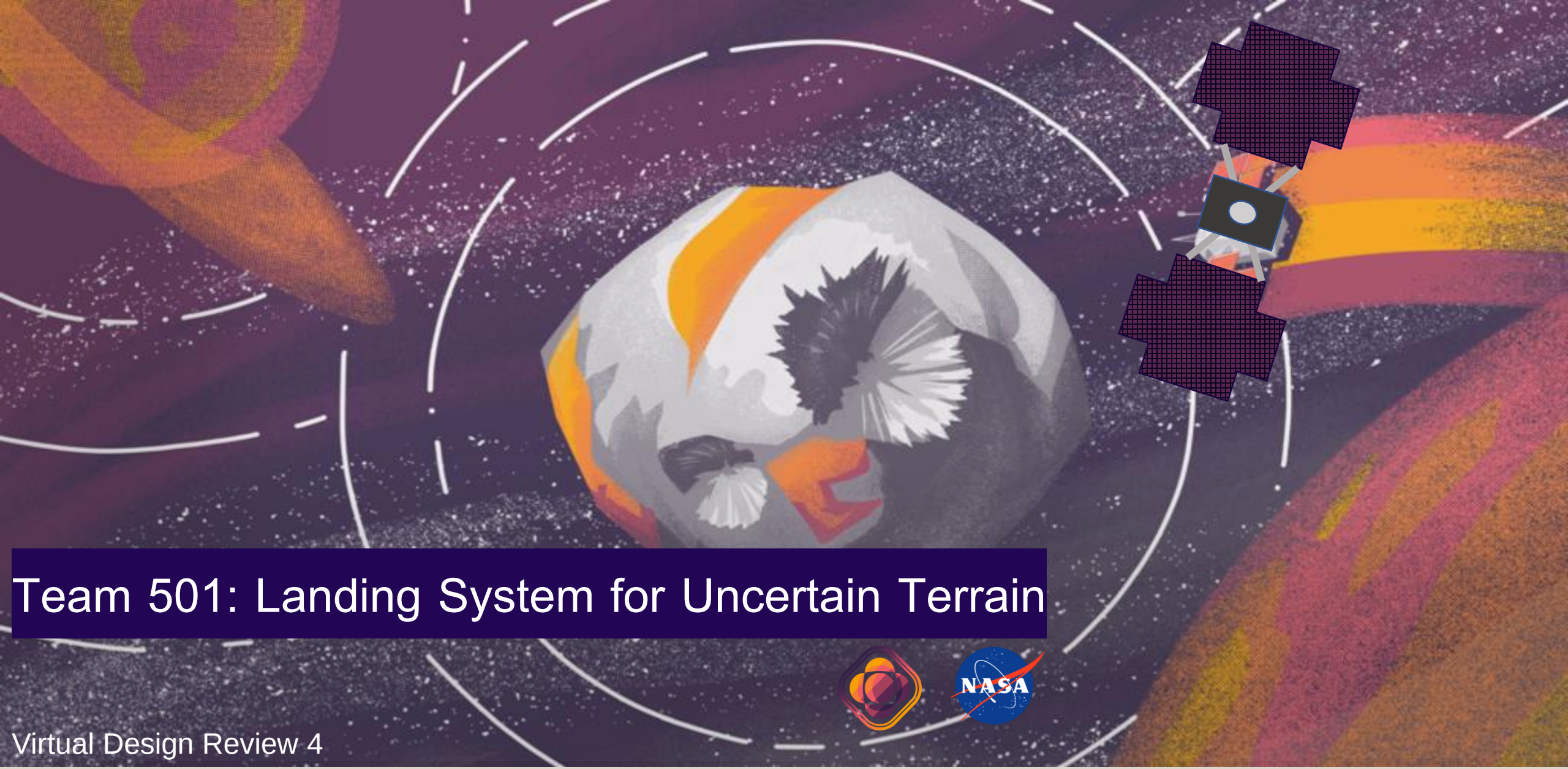
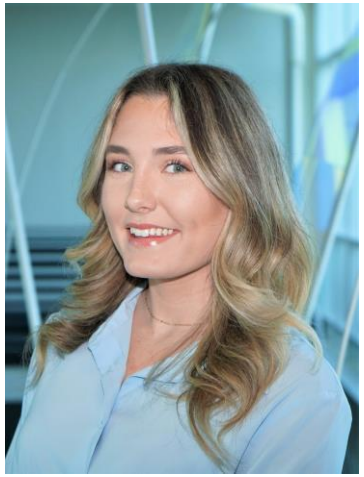


Team 501: Landing System for Uncertain Terrain

Virtual Design Review 4

Team Introductions



Saralyn Jenkins
Mechanical Systems Engineer

Elzbieta Krekora
Materials Engineer

Andrew Sak
Controls Engineer

Julio Velasquez
Mechanical Engineer

Elzbieta Krekora

Sponsor and Advisor

Engineering Mentor
Cassie Bowman, Ed.D.
Associate Research Professor, ASU

Academic Advisor
Camilo Ordóñez, Ph.D.
ME Teaching Faculty

Elzbieta Krekora

Objective

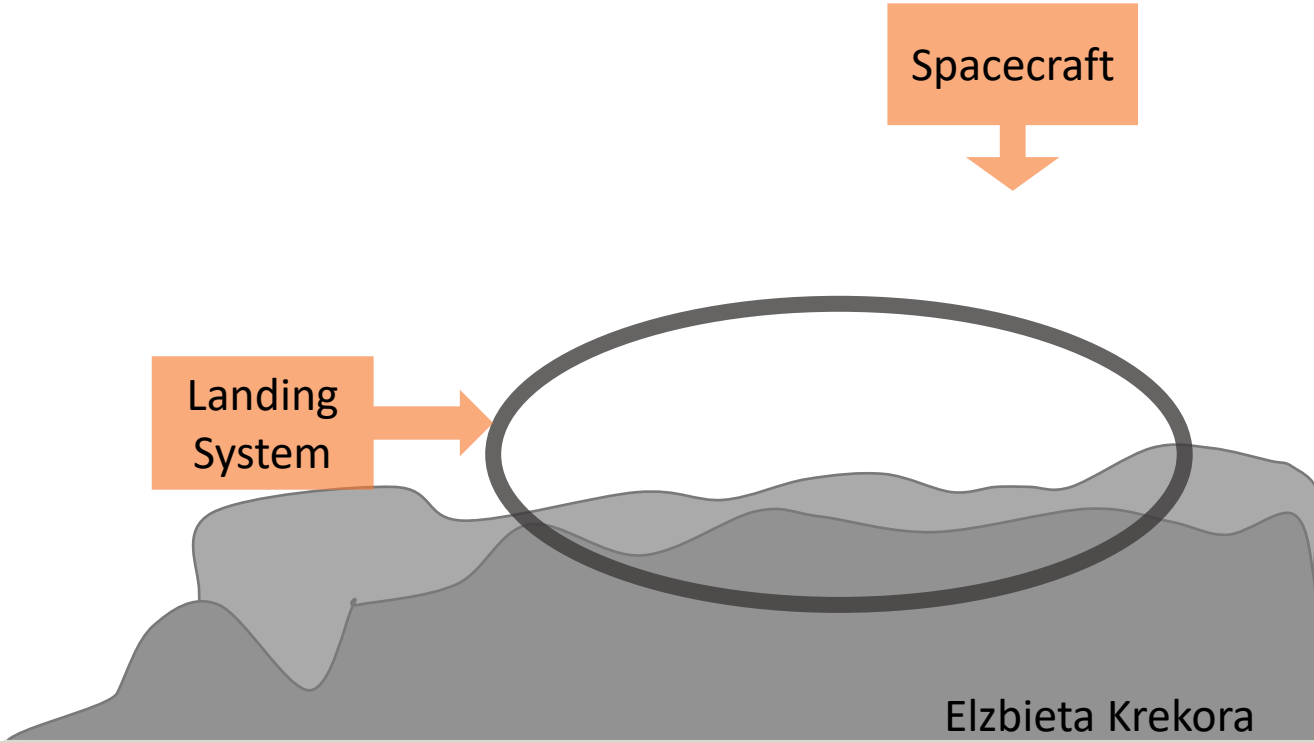
The objective of this project is to design a landing system capable of safely landing on the range of hypothesized surfaces and terrains of 16 Psyche.

Project Overview

Psyche: Believed to be an exposed core of an early planetesimal that lost its rocky outer layers due to violent collisions billions of years ago

Our Mission:
To design the landing system (i.e. what lands/supports the spacecraft)

Terrain:
Psyche has hypothesized uncertain terrain (i.e. rocky, uneven and metallic)



Elzbieta Krekora

Assumptions

Test model and forces are analogous to Psyche mission variables

Attaches to future spacecraft without issue

Controlled Autonomously

Operated in minimal gravity, space like temperatures and conditions

Perform a soft landing on Psyche

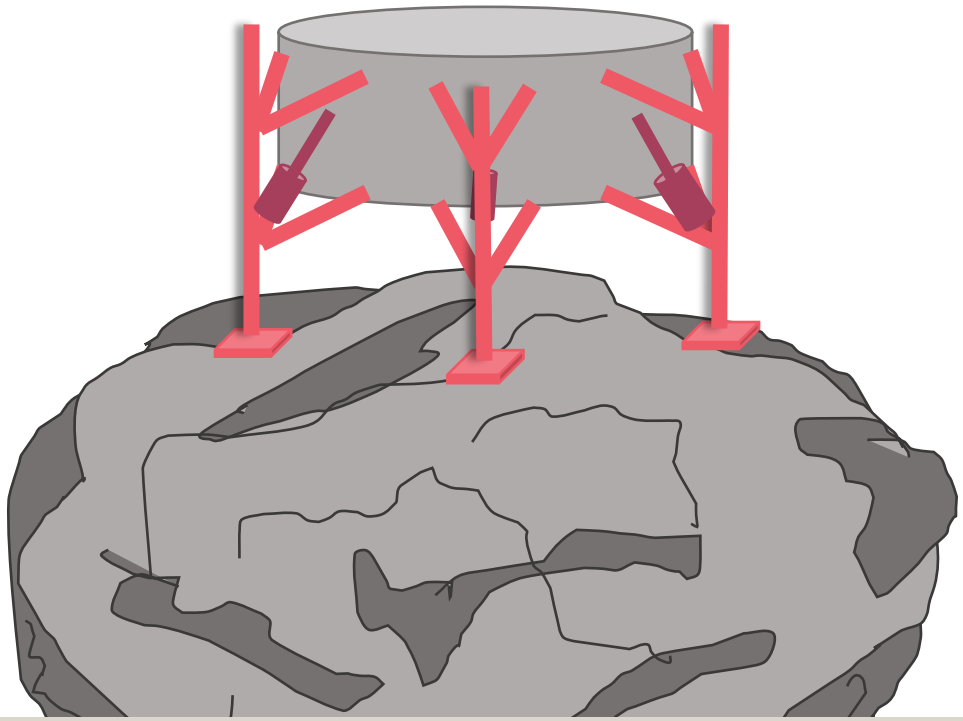
Power supplied by spacecraft

Elzbieta Krekora

Critical Targets

Dampens impact energy

Prevent lander from tipping



The system can support the weight of the lander

Lander can accommodate for any of the hypothesized surfaces

The lander is stable on Psyche's surface

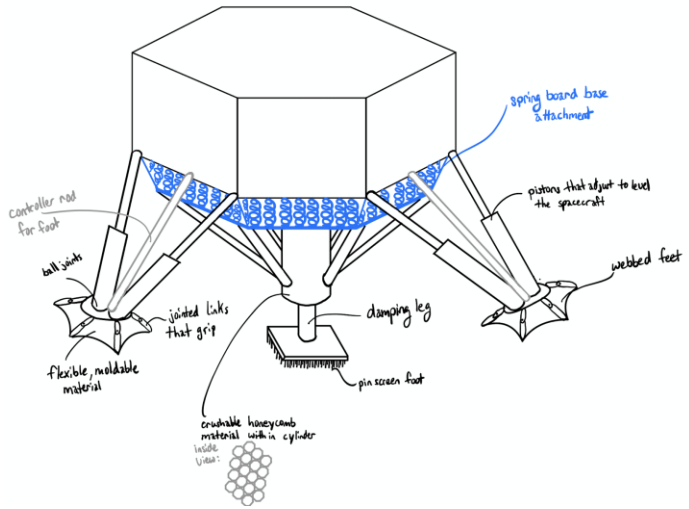
Elzbieta Krekora

Validation of Targets

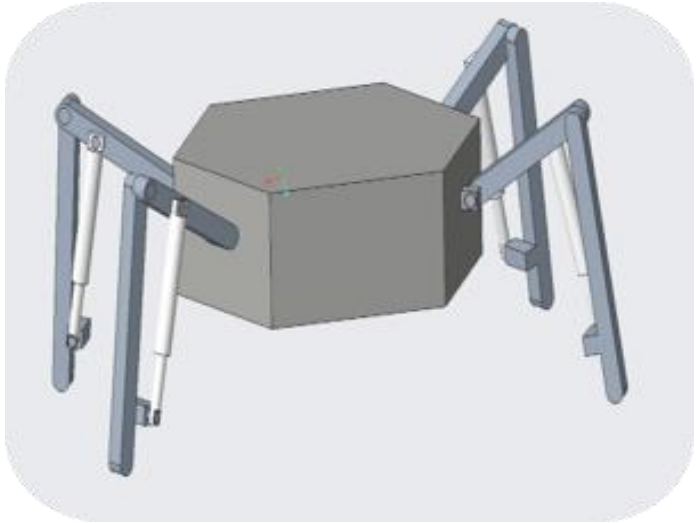
Constraints: Mass of Lander and Gravity	Psyche: 150 kg $0.144 \frac{m}{s^2}$	Earth: 23 kg $9.81 \frac{m}{s^2}$	Measure mass with appropriate scale to ensure following values are valid
Max Impact Velocity	Psyche: 6 m/s	Earth: 0.92 m/s	Read from sensors
Dampens Impact Energy	Psyche: 2700 J	Earth: 9.73 J	Virtual simulation of model and inspection of failed components
Supports Weight	Psyche: 21.6 N	Earth: 225.63 N	Measure weight of final working prototype, multiply by gravity

Saralyn Jenkins

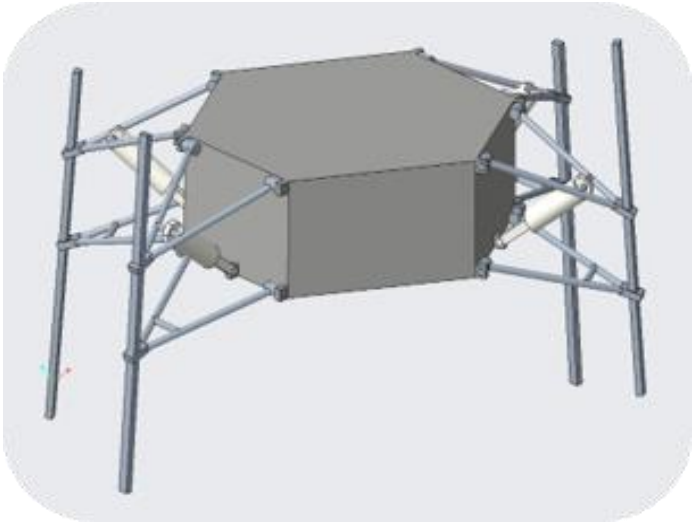
Concept Selection



Single Impact Leg, Springboard Base, 3 Stability Legs



Grasshopper Suspension



Double A-arm Suspension

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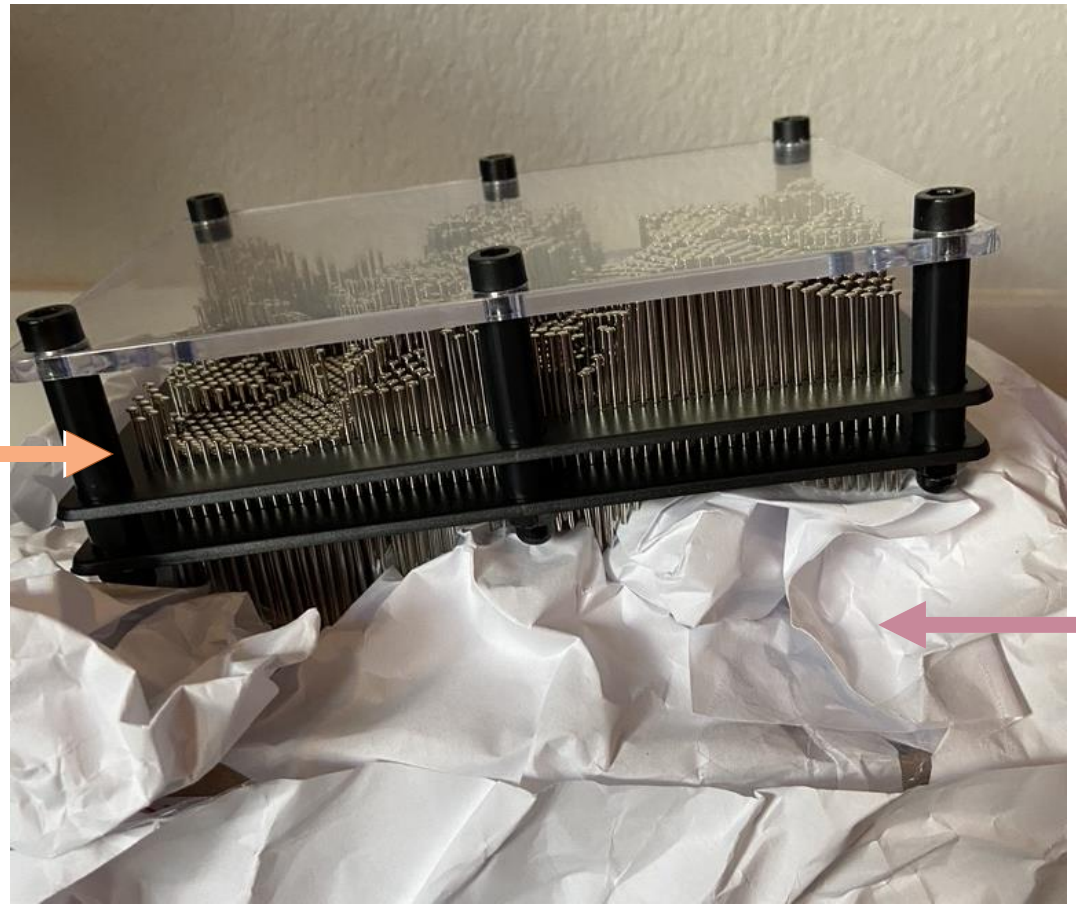
Original Landing Feet Design

Pin screen with closely packed pins that conform to shape of surface it is placed on



Uneven terrain made of paper

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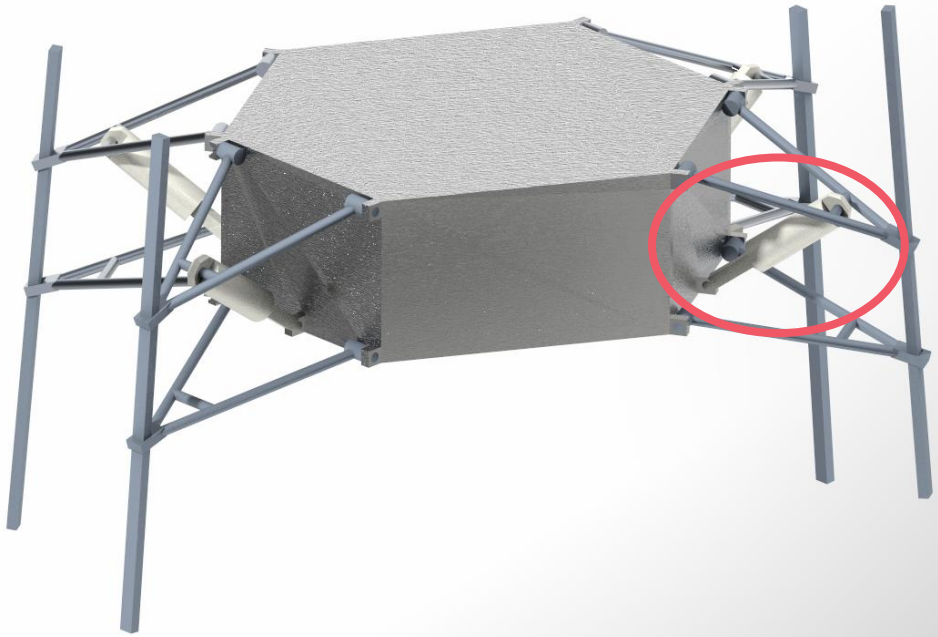
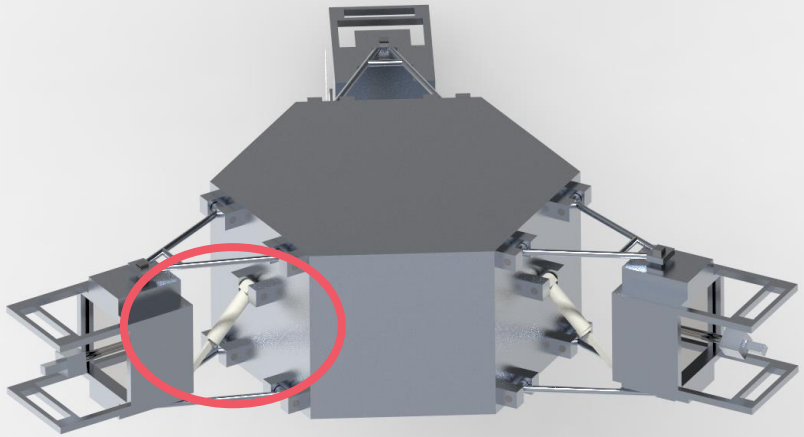
Adjustment of Design: Suspension



Original Design (Feet Not Shown)



Modified Design (Legs and Feet Not Shown)

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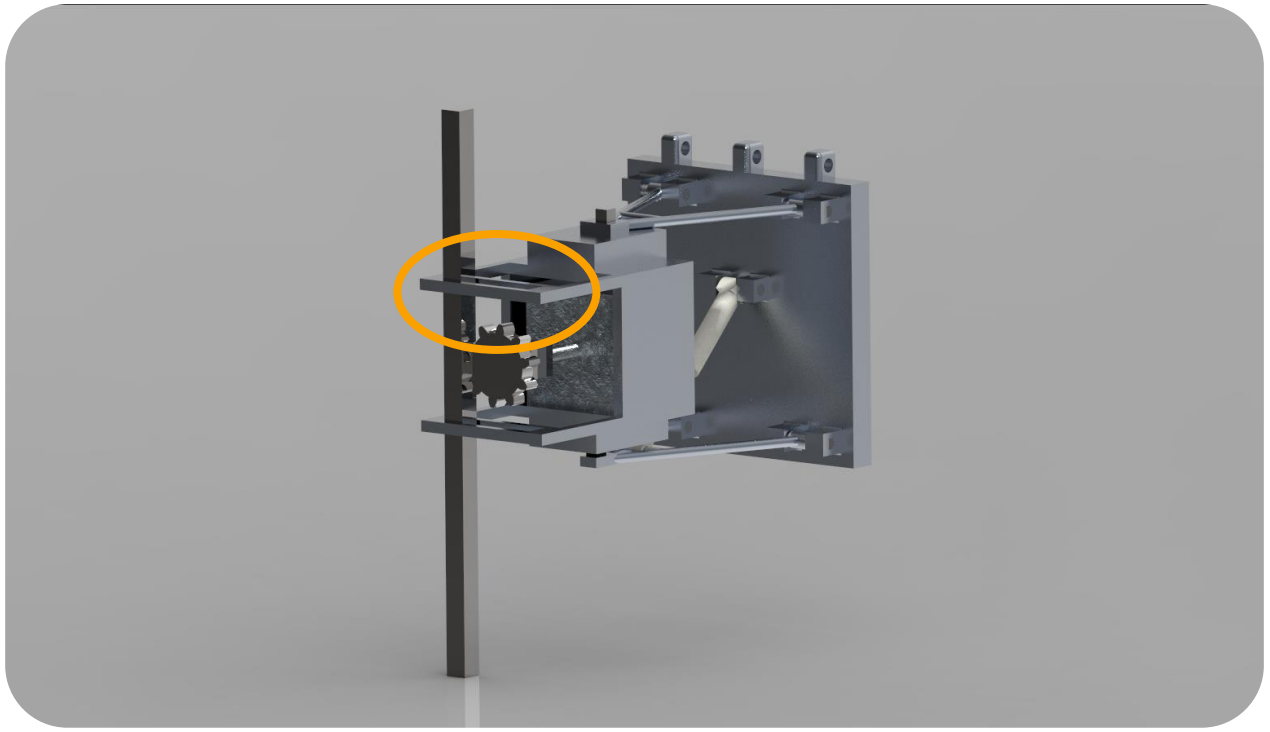
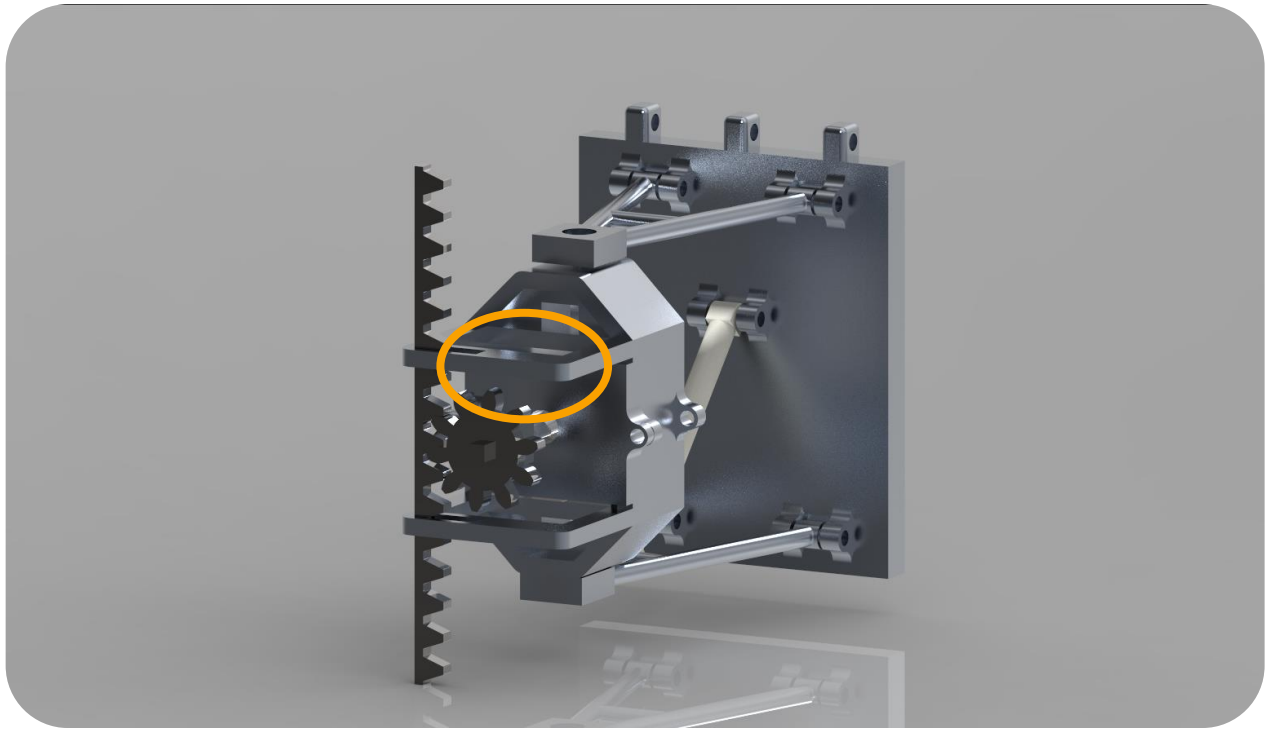
Adjustment of Design: Knuckle



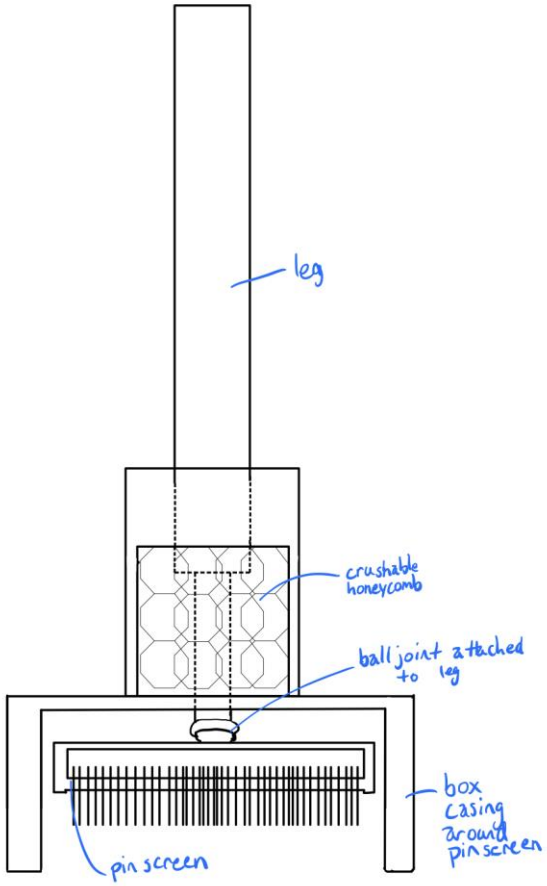
Original Design of Knuckle



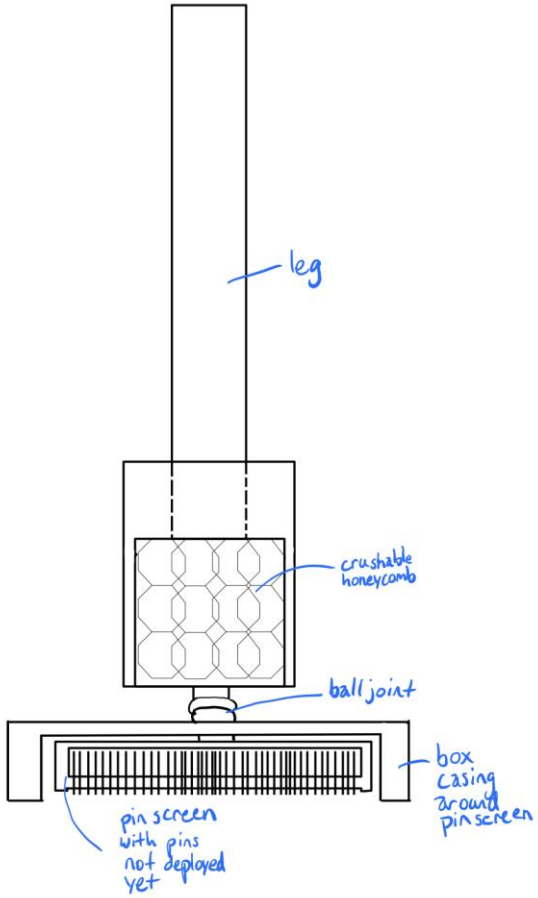
Modified Design of Knuckle

Elzbieta Krekora

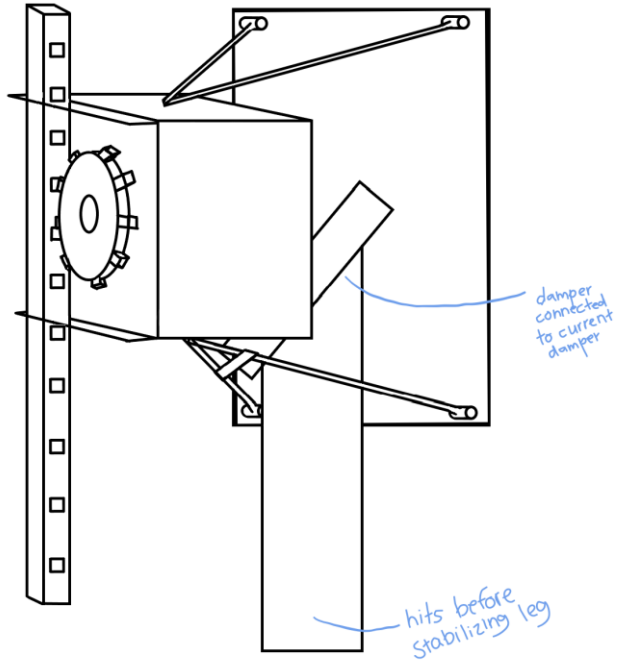
Adjustment of Design: Additional Damping



Design 1: Damping Attached to Foot (Attachment 1)



Design 2: Damping Attached to Foot (Attachment 2)



Design 3: Damping Attached to Separate Component

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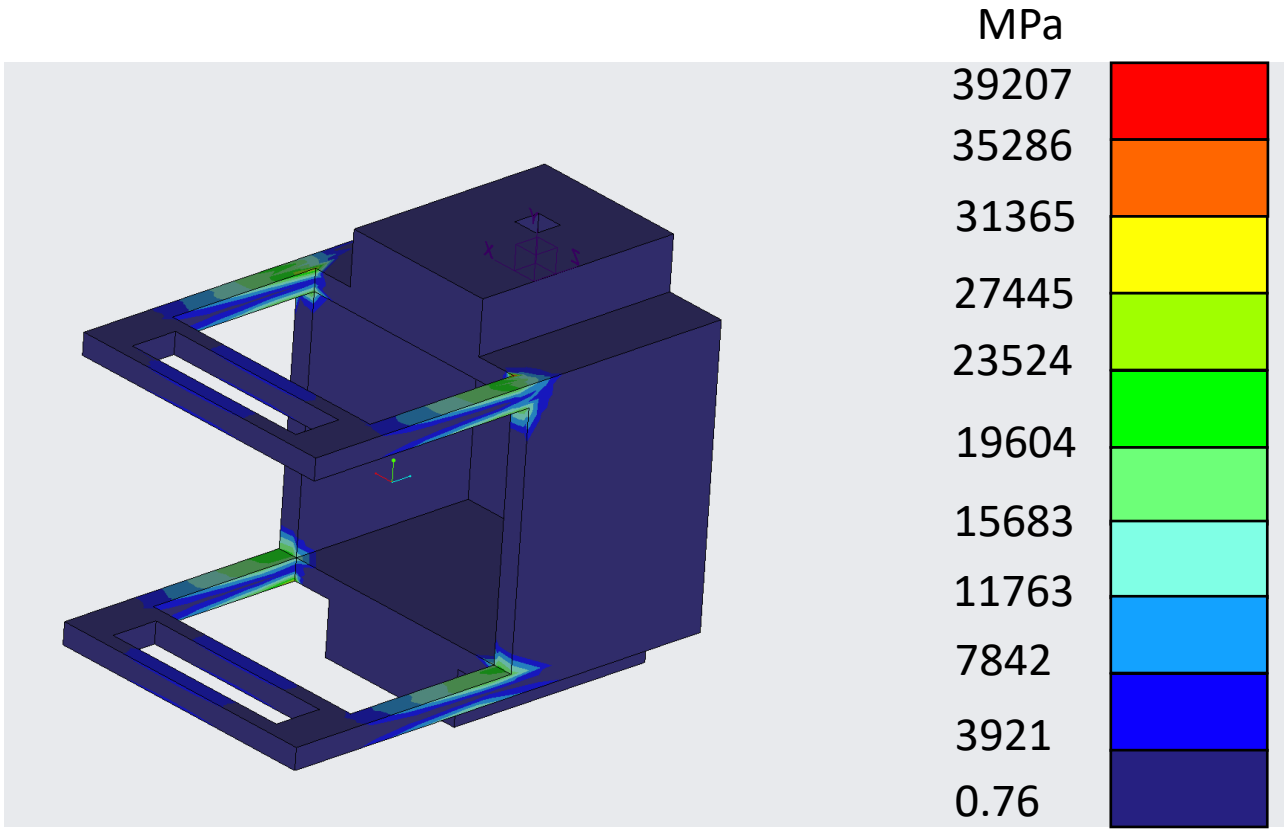
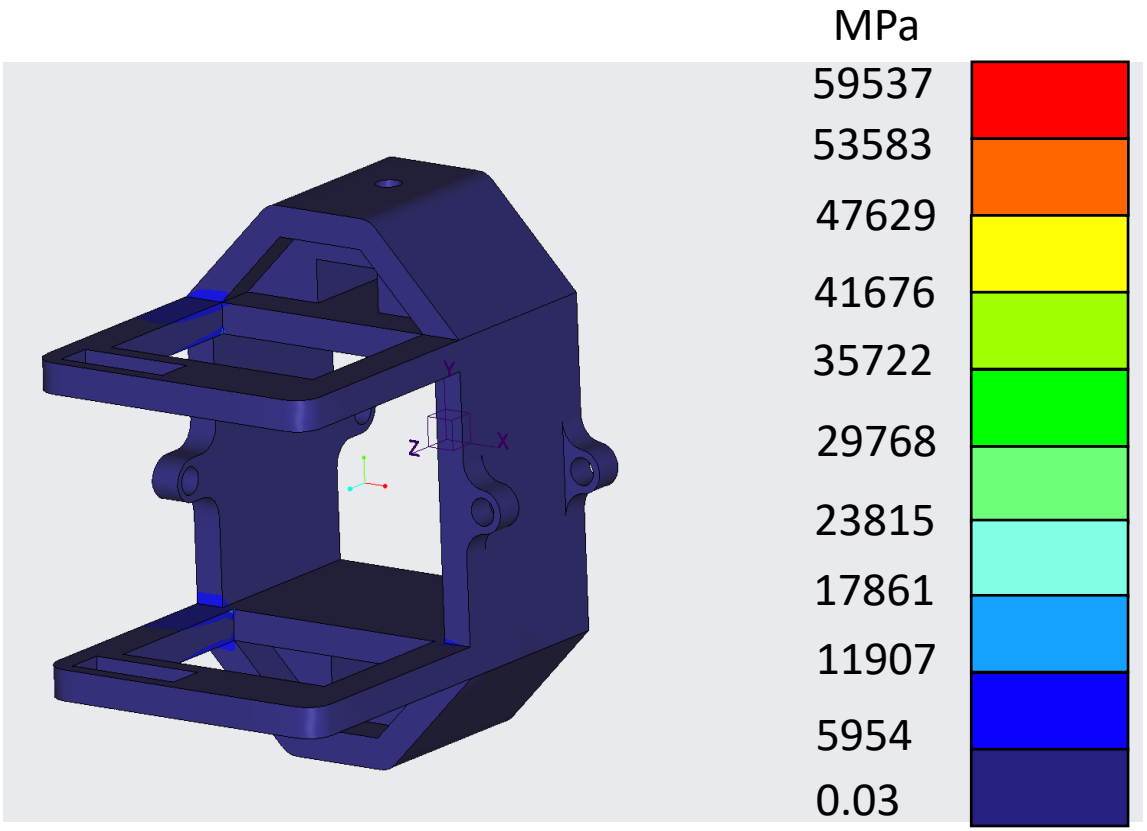
Creo Simulation: Knuckle



Original Design of Connector



Modified Design of Connector

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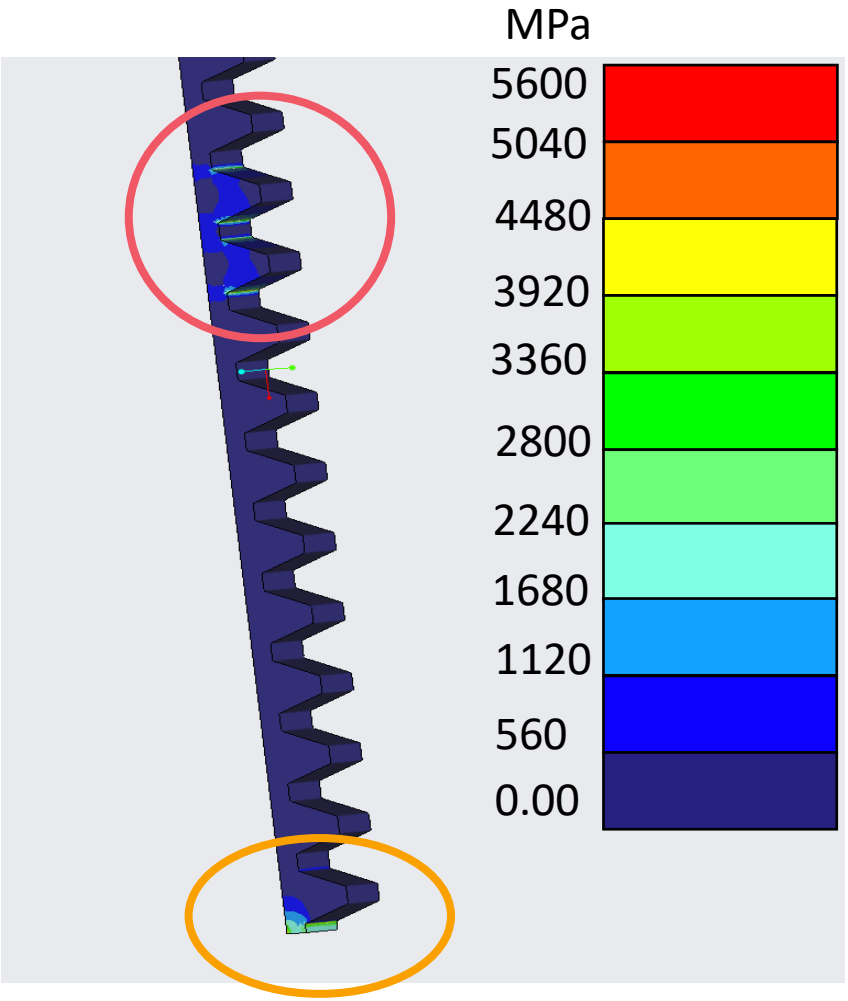
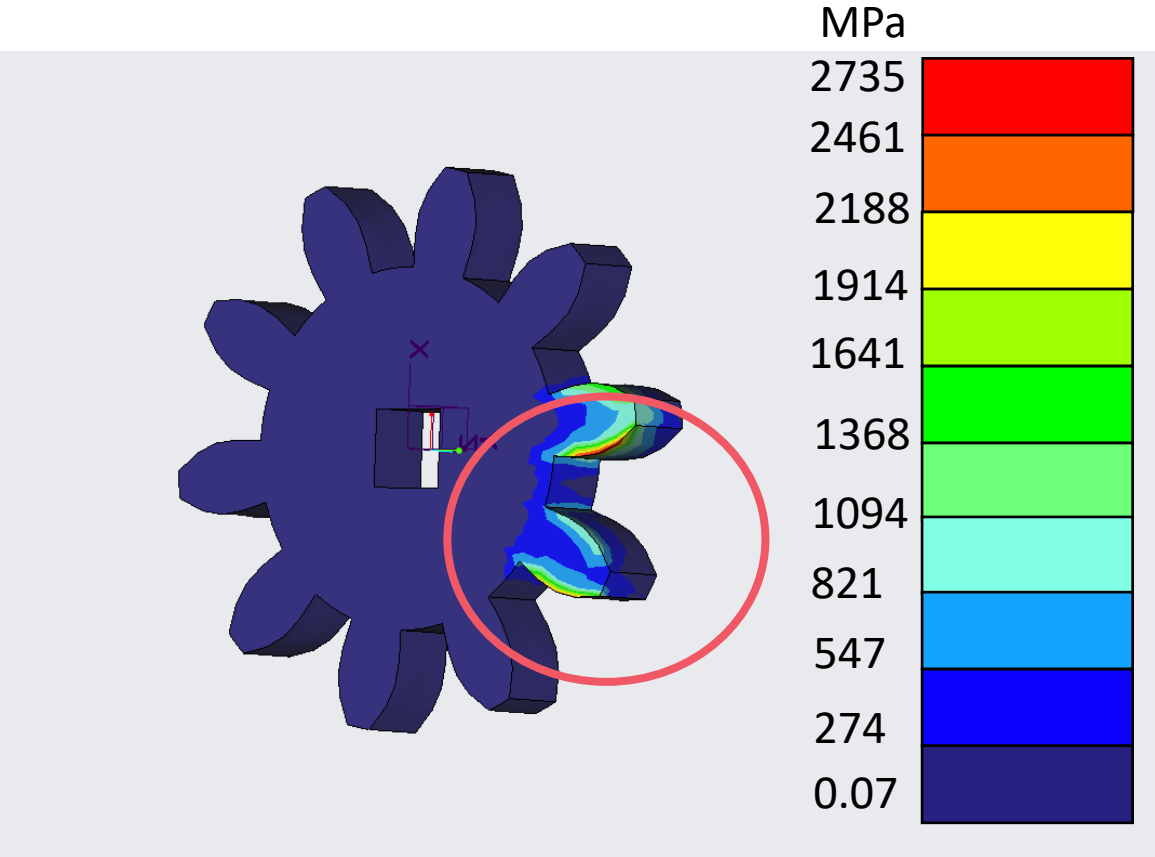
Creo Simulation: Rack and Pinion





Contact Point with Ground

Contact Point Between Gears

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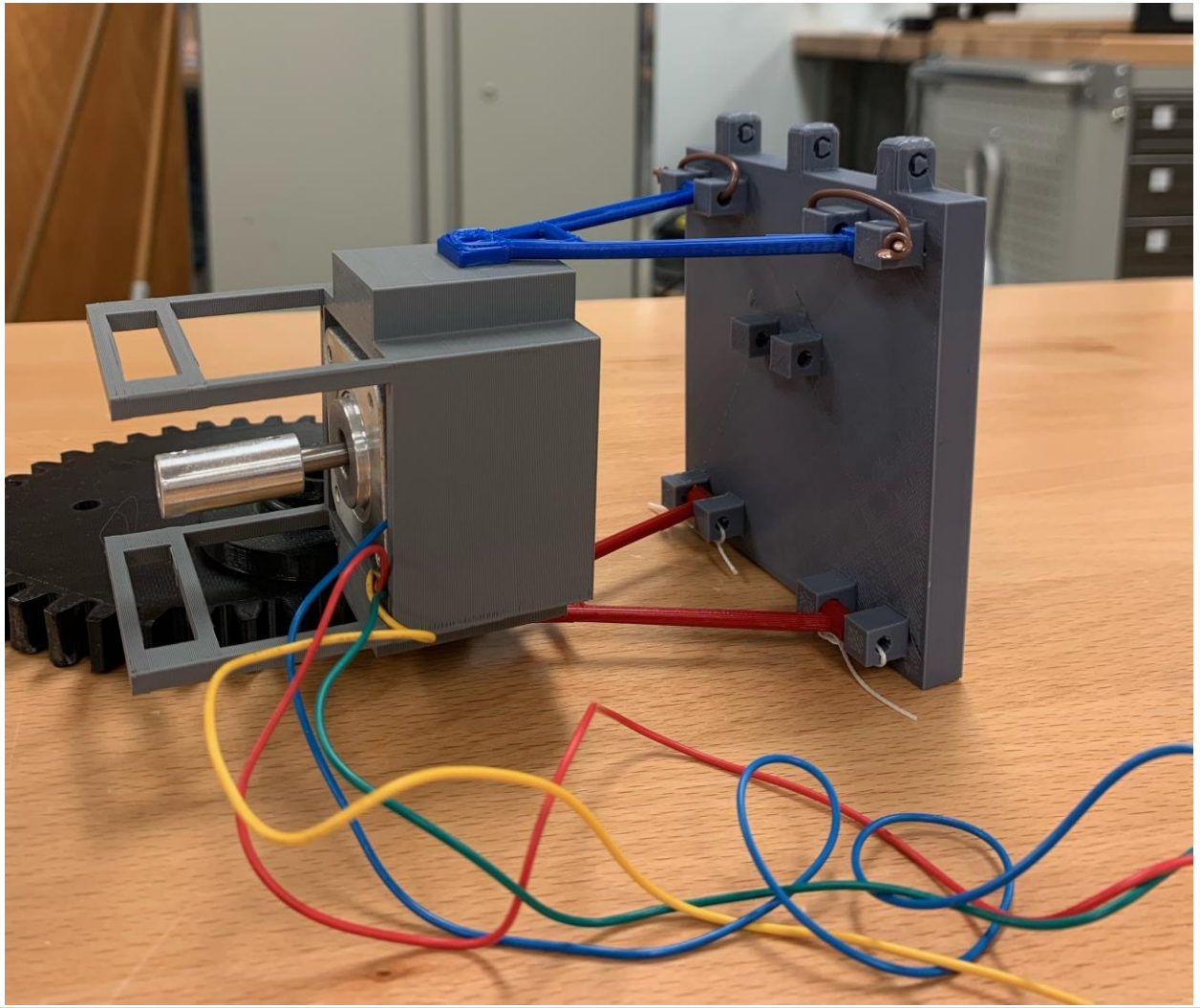
3D Print of Model - Original



Elzbieta Krekora

Prototype/Testing Planning

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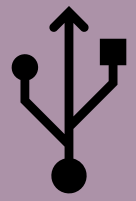
Continuing/Future Work

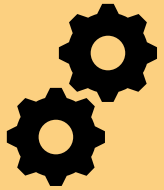
Experimentation with Sensors



Adjust Parts List and Order Parts for Prototype

Simulate Model and Individual Components

Begin Building Test Rig and Pieces of Prototype



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