





NASA Psyche Robotic Explorer

Joshua Dragony, Irene Salamakha, Bree Valley Instructor: Bogdan Kozul

Project Sponsor: Arizona State University; Advisor: Cassie Bowman

Introduction

Our senior design project is centered around building a robotic explorer to traverse the surface of an Asteroid named Psyche-16. This will help NASA generate potential ideas for future explorations of Psyche-16.

Coding

- Delivers input to Raspberry Pi
- Range of motion of the legs
- Operates electromagnet by toggling its power state
- Utilizes inverse kinematics to output series of servo angles based on an input in cartesian coordinates

- Located in the asteroid belt
- 2.5-3.3 AU from the Sun



- Gravity: 0.015G (0.144 m/s^2)
- 220 km (137 miles) in diameter
- Surface assumed to be primarily composed of metal and silicate
- Assumed to be the core of a destroyed planetesimal

Design Concept

- Crawling robotic spider
- Four legs connected to chassis
- Electromagnets as anchor
- Controlled with Raspberry Pi

Leg Unit



Anchoring System

- Electromagnet anchors rover to ferrous surface
- Can be toggled by controlling electrical current
- Screws fastened for quick swap



FEA Analysis

- Requires at least 3 degrees of freedom
- Lightweight design for fast mechanical response
- 3D printed for rapid prototyping
- Utilizes servo full range of motion
- Single leg assembly allow for cost effective troubleshooting and prototyping



Von Mises Stress



Displacement



Next Steps

- Finish assembly of legs to chassis
- Feasibility testing
- Alternative power sources