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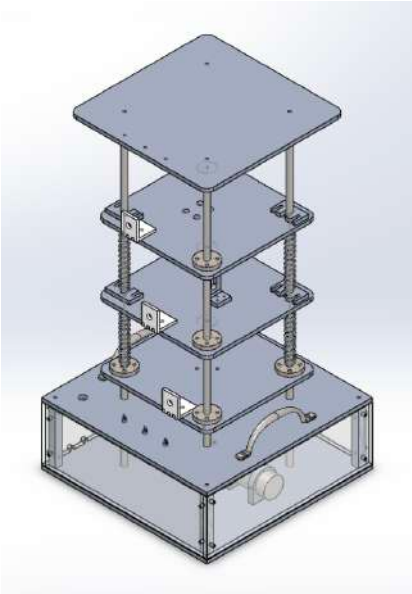
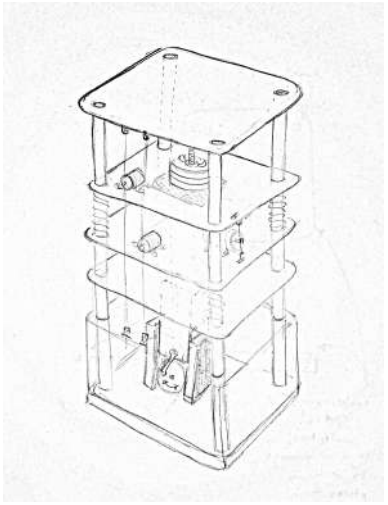
Active Suspension Demonstration Platform

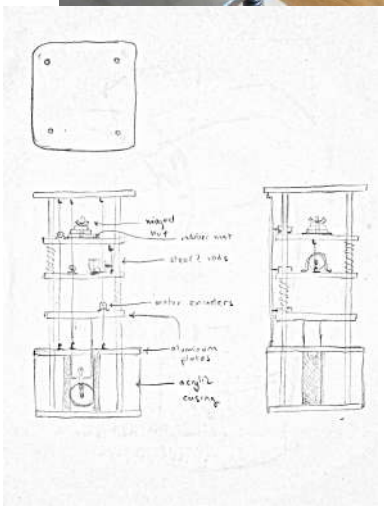
A road simulated quarter car model to aid students' learning in resonant frequency and controls.



Design

- Designed components to be easily machinable, reducing manufacturing lead-time and cost.
- Tested & validated to demonstrate spring mass damping for 4kg load
- Machined product out of aluminum using machine shop equipment such as the mill and lathe.
- Slider crank mechanism for low-budget, simple-control bottom plate actuation
- Removable spring-rests between levels allow for ability to change spring stiffness without requiring full disassembly
- Tension springs to keep strings taut and to mitigate effects of vibration on position encoder string
- Rubber gaskets placed at rigid connection to dampen unwanted vibrations





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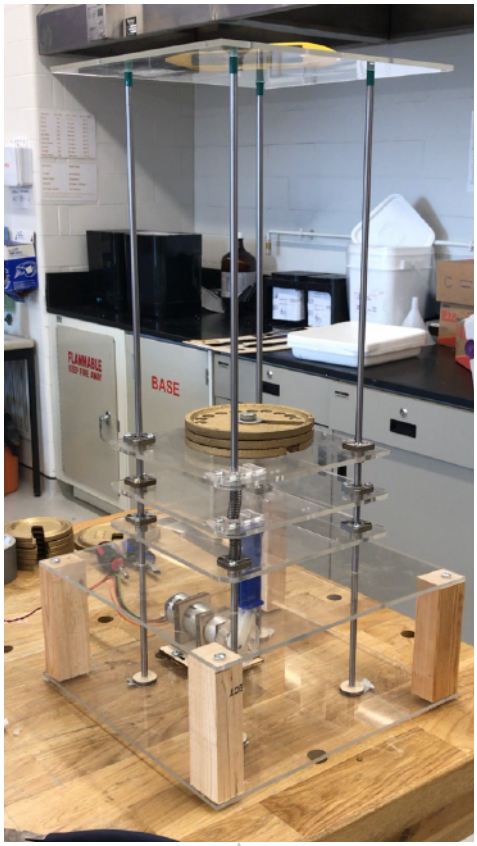
Active Suspension Demonstration Platform (continued)

Iterations

- Modified slider crank wheel to create room for screwhead, eliminating need for spacer and decreasing length of moment arm experienced by tip of motor
- Optimized slider crank for 3D printing by adding ribs to increase second moment of area and printing on PLA filament; decided based on material properties



Prototype

- FDM 3D printed and laser-cut components
- Slotted holes for laser-cut prototype mount designed for ease of assembly

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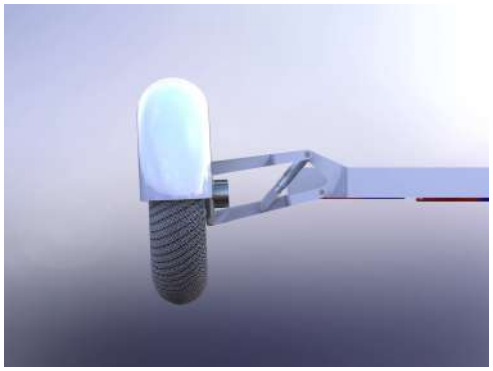
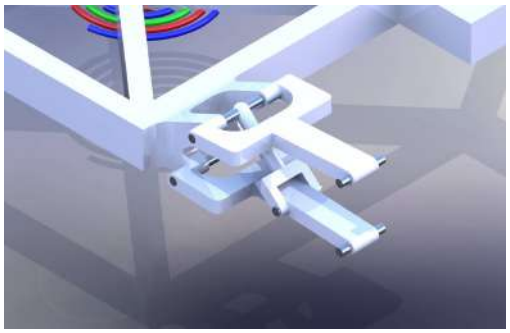
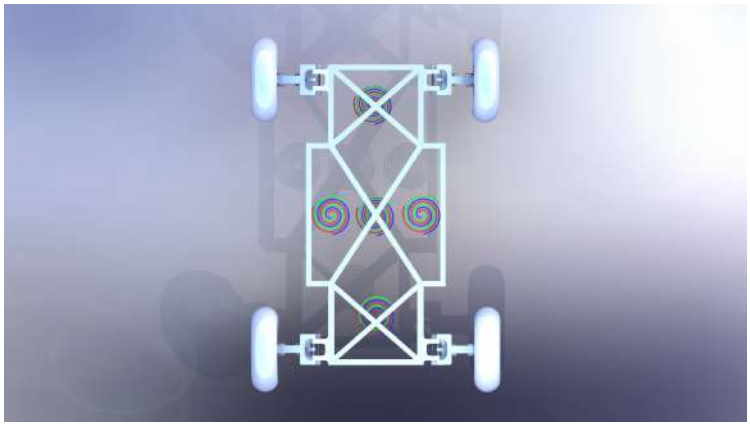
Lunar Dust Repulsion Concept Design

Lunar dust is highly abrasive and often is the cause of failure in current lunar rover designs. As an attempt to alleviate the issues associated with lunar dust, this concept design uses a dust repellent system which takes advantage of the electronegativity of dust particles on the moon.







Design

- Double-wishbone suspension system
- Incorporates method of dust particle removal by electrostatic forces researched and developed by NASA, using AC current and 3 conductors out of phase by 2PI/3
- NASA's researched shape-memory alloys for non-pneumatic, compliant tires immune to deflation and punctures

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Lathed Ring and Ring-Turning Chuck

Machined a ring-turning chuck out of aluminum to aid in machining a stainless steel ring on the lathe.

Stainless steel ring

Ring chuck, being used to machine ring

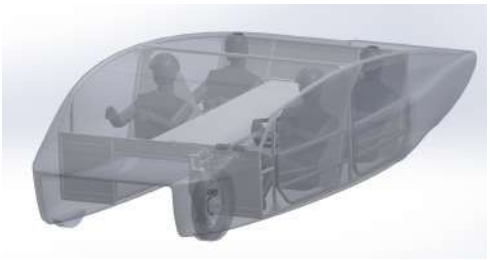
Ring-turning chuck

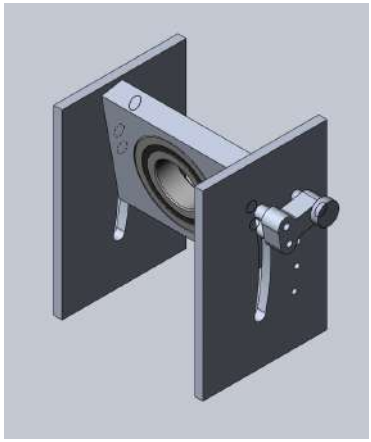
Design

- Designed adjustable ring chuck for simple set-up by incorporating the tailstock of a lathe into the ring chuck expansion mechanism, minimizing part count from two parts to one
- Used ring chuck to machine a stainless steel ring with beveled edges

Midnight Sun Solar Car Design Team

Researched and designed several components in the steering system of Midnight Sun XIV: a scratch-built, 4-seater solar car capable of driving across highways.





Design

- Steering wheel height adjustment mechanism designed to increase driver comfort
- Curved slot to guide pivot path of laser-cut Teflon sleeve bearings
- Retractable spring plungers pull out to disengage steering wheel from locked angle
- Ball bearing houses steering column and ensures smooth rotation

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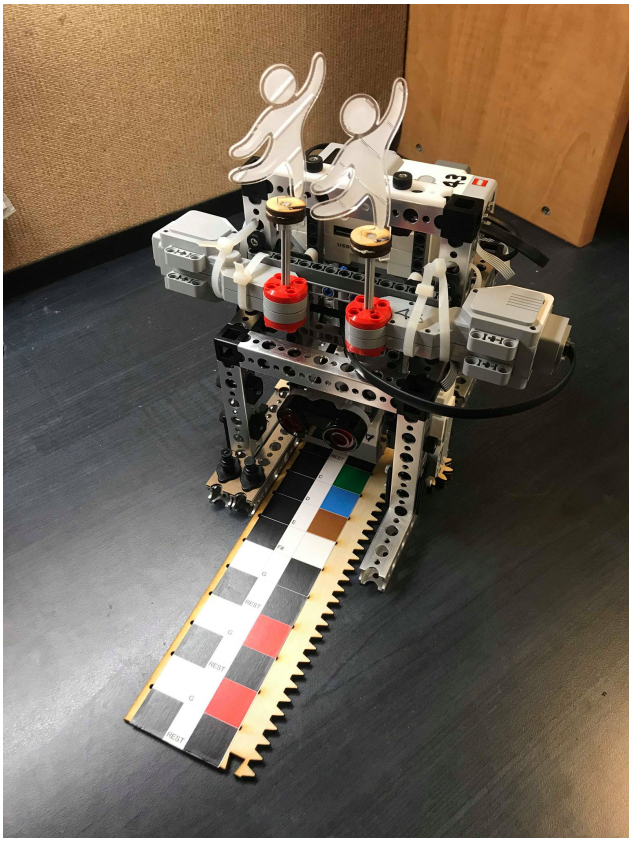
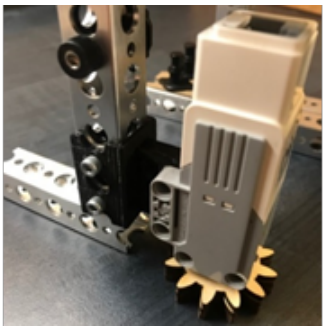
Music Robot

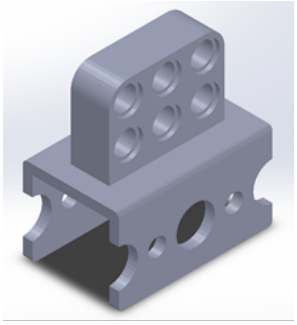
A robot capable of reading colour-coded, laser-cut music tracks and outputting music using onboard audio.



Design

- Laser-cut plywood music tracks with dovetail connections to simplify board extension process for longer songs.
- 3D printed components to interface between LEGO and TETRIX pieces





Troubleshooting

- Simulated robot demonstration environment to test colour sensors, troubleshooting to find most reliable colours for maximum repeatability