

Syed Mustafa Ali Engineering Portfolio

Mechanical Engineering Student | University of Houston | Expected May 2029

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Selected work in mechanical design, robotic assembly and controls, MATLAB analysis, and hands-on troubleshooting.

Featured Build

Remote Controlled Candy Dispensing Deer

Team project | December 12, 2023 | Built and used in a classroom activity

Our team turned a decorative deer into a mobile candy dispenser for a special education classroom visit. The finished robot could be driven with a remote control; petting the deer triggered candy dispensing and music.



Finished deer during the classroom activity, alongside its drive chassis during assembly.

My contribution

- Wrote the robot code and configured remote-controlled operation.
- Assembled the wheels and drive frame and made the candy-release mechanism.

Team contributions: teammates worked on the petting sensor and its connection to the dispenser, the decorative body/frame, and decorations. The sensor interaction also triggered music.

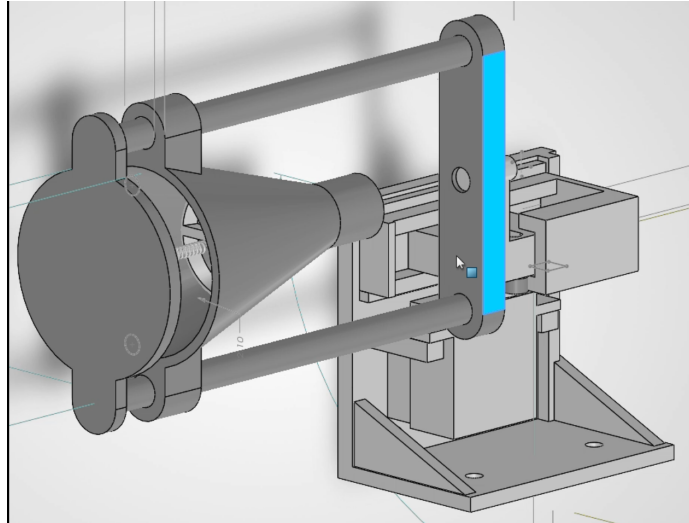
Tools and methods: VEX robotics hardware, robot programming, mechanical assembly, and control-system integration.

Mechanical Design

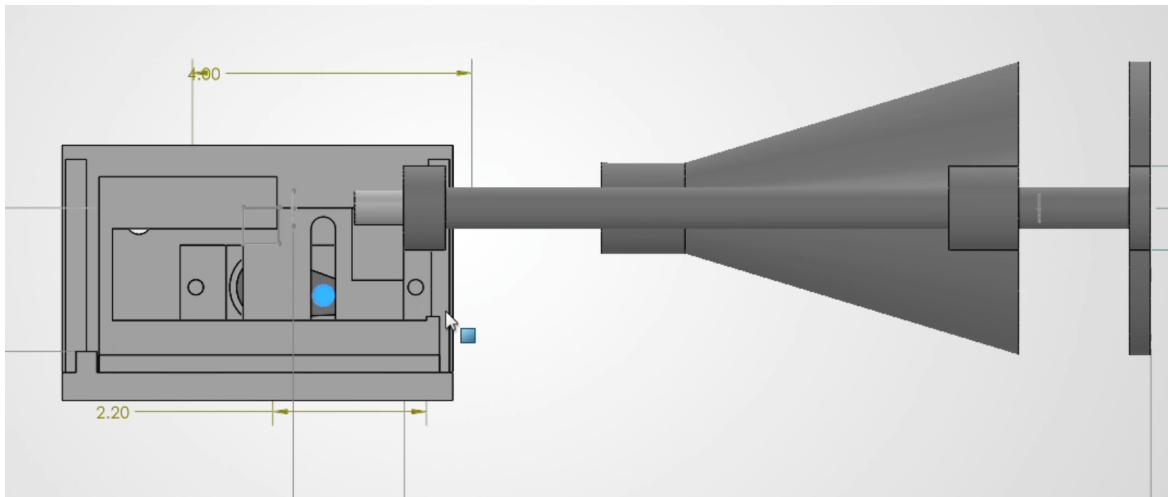
Microorganism Sampling Payload Cap | In development

Undergraduate Student Instrumentation Project | CubeSat and Mechanical Team Lead

The payload is intended to collect airborne microorganisms during a high-altitude balloon mission targeting 30,000 ft. Its external inlet cap must open to expose the sampling path.



CAD view showing the inlet cap separated from the funnel opening.



Side view showing the slotted mechanism and cap position. CAD dimensions are shown as captured; units are not specified here.

Problem and design response

Replaced an unreliable two-joint hinged linkage with a slotted SolidWorks design intended to provide 10 cm of cap travel.

My contribution and current status

- Developed the cap mechanism CAD and a spring-retention hook concept.
- Assembled the microorganism-sampling payload; the spring-hook concept has not been physically built.

The payload has not yet flown. Opening reliability and operation at altitude remain to be demonstrated. Planned checks include full travel, clearance, repeatability, and secure spring retention.

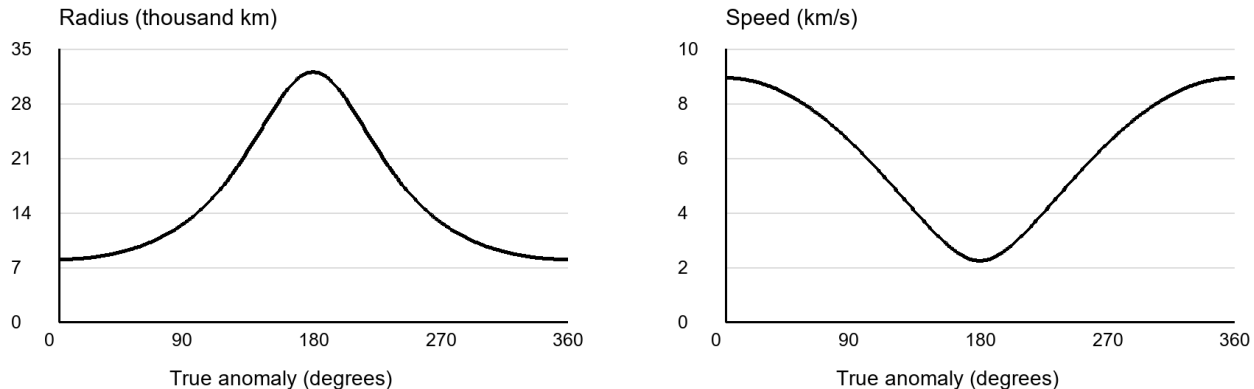
MATLAB Analysis

Individual coursework | ENGI 1331

I wrote the following coursework programs to apply numerical methods and visualize engineering calculations.

Elliptical Orbit Radius and Speed

Source: satellite.m. Calculated radius, speed, flight-path angle, and time across true anomaly for a 20,000 km semi-major axis and eccentricity of 0.6.

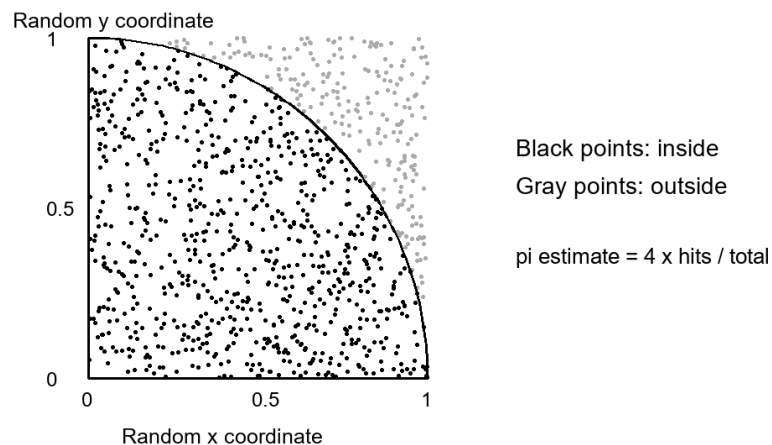


Recreated radius and speed plots from the coursework equations and inputs; not a MATLAB execution screenshot.

The radius and speed calculations show how the spacecraft moves faster near its closest approach and slower farther away. The separate time calculation needs quadrant-aware eccentric anomaly handling before use across a full orbit.

Monte Carlo Estimation of Pi

Source: finalexam.m. Generated random coordinates within a unit square, counted points inside a quarter circle, and estimated pi as four times the fraction inside.



Sampling-method illustration using 1,000 newly generated points; not output from the original MATLAB file.

The original counting loop implements the estimate. The plotting section remains a refinement task: classify and display the same samples used in the calculation, and retain both hit and miss series on one plot.

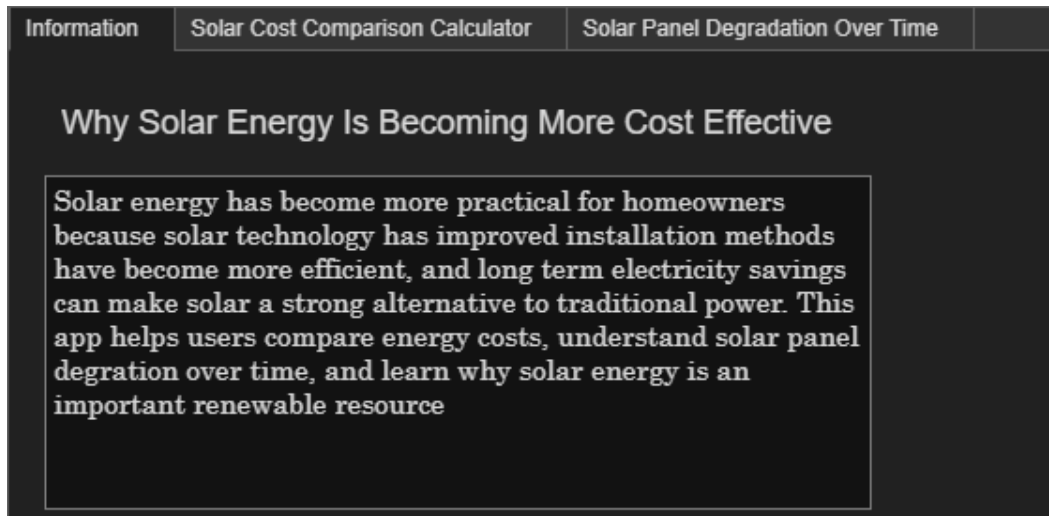
MATLAB Application and Small Builds

Interactive tools and practical design work

Solar Cost Comparison App

Source: [solarpanelcosteffectivenessapp.mlapp](#) | Individual coursework | MATLAB App Designer

Built a tabbed interface that accepts startup cost, monthly solar cost, and a conventional electricity bill. The app plots cumulative costs and searches for the first break-even month within a 24-month window.



Saved App Designer screenshot showing the information page and the three application tabs.

- Implemented input callbacks, cumulative-cost calculations, labeled plots, and break-even feedback.
- Added a panel-age input and a separate illustrative degradation plot using a linear loss of 0.5 percentage points per year.

Model scope: constant monthly costs and a fixed 24-month comparison. Financing, incentives, changing electricity rates, and degradation effects on savings are not included. The degradation tab is separate from the cost model.

3D Printing and CAD Explorations

Card holder: designed and 3D-printed a holder for my cousin's cafe, creating a small practical object for a specific setting.

Phone accessories: designed custom phone stands for personal use and explored two phone-case concepts in CAD. The case designs remained concepts.

Viewing-angle name design: created a design that displays either of my two cats' names depending on the viewing direction.

These smaller projects complement the larger builds through CAD practice, physical fabrication, and exploration of shape and usability.

Hands On Troubleshooting

Welding Machine Connection Repair | 2023

Participated in troubleshooting a welding machine with a connection fault. Our team opened the machine and inspected the circuit board and other components for visible problems before examining the plug.



Machine opened during troubleshooting. The fault was ultimately found in the plug wiring, rather than an internal board component.

Finding and repair

The wires inside the plug had pulled apart after repeated misuse. We reconnected the wires and tightened the connections. This was a plug-connection repair; it did not require replacement of the circuit board.

My involvement

Worked with the team during disassembly, inspection, and fault finding. The repair illustrates a hands-on troubleshooting experience in which the eventual cause was a basic connection issue.

Other Practical Work

Garden setup: purchased and arranged gardening equipment and plants, placing flowering plants such as marigold and lavender near peppers and other fruiting plants with the intention of supporting pollination. This was a personal garden-layout project; pollination and yield improvements were not measured.