

# Alessandro Sanchez

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## **EDUCATION**

**University of Colorado Boulder**, Boulder, CO

Bachelor of Science in Aerospace Engineering GPA: 3.56 / 4.00

Expected Graduation: May 2027

Relevant Coursework: Orbital Mechanics & Attitude Dynamics - Aerodynamics - Aircraft Dynamics - Thermodynamics & Heat Transfer - Differential Equations - Electronics & Communications - Structures

## **ENGINEERING EXPERIENCE**

**Undergraduate Research Assistant** – CubeSat Avionics (MAXWELL & SWARMEX) August 2025 – Present

- Built and validated a D flip-flop SEU testbench in LTSpice, characterizing bit-flip behavior under simulated particle strike.
- Assembled, inspected, and tested avionics hardware with Altium Designer and PartsBox inventory management.
- Worked in a cleanroom environment, following aerospace precision cleaning procedures for flight electronics.
- Implemented and evaluated fault mitigation techniques including triple modular redundancy (TMR), ECC scrubbing, and watchdog reset logic.

## **PROJECT EXPERIENCE**

**Space Truss Finite Element Analysis** (ANSYS Mechanical ADPL)

- Built and validated an ANSYS APDL finite element model of an integrated space truss, including scripted geometry creation, meshing, loads, and boundary conditions.
- Compared internal reaction forces, displacements, and internal moments from FEA to experimental recorded data.
- Performed sensitivity analyses on joints, boundary conditions, and material properties to evaluate models uncertainty.
- Assessed modeling fidelity by comparing results with corresponding derived beam bending equations.
- Collaborated with a team and took a leadership role in the project, helping delegate tasks to each member.

**High-Powered Model Rocket** (Altium Designer / C++ / MATLAB)

- Designed and built a custom avionics PCB in Altium Designer integrating barometric and inertial sensors, flash memory, and RF telemetry to support autonomous flight data collection and recovery system deployment.
- Engineered and 3D-printed custom airframe and avionics bay structures in SolidWorks, optimizing geometry for high strength to weight performance, while meeting integration and packaging constraints for flight board systems.
- Developed embedded C++ flight software for real-time apogee detection and parachute deployment, incorporating sensor fusion and low-pass filtering to improve reliability and noise tolerance.
- Guided mechanical design decisions using MATLAB based flight and stability simulations, performing trade studies on fin geometry, nose cone design, and stability margins.
- Integrated mechanical, electrical, and software subsystems into a cohesive flight system, supporting iterative ground testing, validation, and refinement prior to flight operations.

**Trajectory Optimization & Flight Dynamics Simulation** (MATLAB/ C++)

- Modeled flight regimes thrust, deceleration coast, and ballistic coast, all governed by Newton's laws, Bernoulli's equation, and isentropic flow assumptions.
- Developed a multi-phase trajectory simulation modeling thrust and ballistic flight using systems of nonlinear ODEs.
- Solved equations of motion using MATLAB's ODE45, conducting a sensitivity analysis across pressure, mass, drag coefficient, and launch angle.
- Conducted trajectory optimization to achieve a target landing constraint, validating numerical results against analytical checks and verification cases.

## **TECHNICAL SKILLS**

Engineering Tools & Software: C/C++, Python, SolidWorks, Altium Designer, ANSYS, LTSpice, MATLAB, Python, Git, SPENVIS, Arduino IDE

Fabrication & Hardware: PCB design, assembly, and test, 3D printing, CNC machining, laser cutting, 2 & 3 axis milling