Engineering Portfolio

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Technical Summary

Systems-oriented engineer with experience in modeling, analysis, and verification of complex mechanical and aerospace systems. Skilled in requirements-driven design, dynamic modeling, and performance evaluation using analytical and experimental methods. Experienced in translating engineering theory into validated system-level results.

Core Competencies

- Systems Engineering & Requirements Analysis
- Control Systems & Dynamic Modeling
- Structural Dynamics & Vibration Analysis
- Propulsion and Thermodynamic Analysis
- Modeling & Simulation (MATLAB / Python)
- Verification & Validation (V&V)

Project Case Studies

Space Telescope Shipping Container — Systems Design and Dynamic Validation (Capstone)

Overall system architecture and payload configuration	*Isolation system and dynamic modeling representation*	*Vibration transmissibility and frequency response results*

Figure 1: Space telescope shipping container system design and dynamic performance (placeholders).

What: Designed and validated a transportation shipping container for a high-value space telescope payload, ensuring mechanical protection and vibration isolation during handling and ground transportation operations.

How: Applied a systems engineering methodology beginning with requirements flowdown derived from payload sensitivity, transportation environments, and logistical constraints. Developed a functional and physical system architecture defining enclosure structure, isolation interfaces, and load paths. Formulated analytical dynamic models of the payload–isolation–container system and derived transfer functions to evaluate vibration transmission characteristics. Performed frequency-domain analysis to assess damping effectiveness, isolation performance, and stability margins across relevant excitation ranges.

Results: Delivered a traceable system architecture compliant with aerospace payload protection requirements. Dynamic analysis demonstrated reduced vibration transmissibility within critical frequency bands and acceptable stability margins, providing verification evidence that the design meets transportation and handling performance objectives.

Engineering Focus: Systems engineering, requirements decomposition, dynamic modeling, vibration isolation, verification and validation

Selected Engineering Projects

Structural Vibration Analysis and Modal Testing

Experimental test setup	*Frequency response functions*	*Extracted mode shapes*

Figure 2: Structural vibration testing and modal analysis results (placeholders).

What: Experimentally identified the dynamic characteristics of a mechanical structure to determine natural frequencies, damping ratios, and mode shapes.

How: Applied impact excitation and accelerometer measurements to obtain vibration response data. Generated frequency response functions and extracted modal parameters using frequency-domain signal processing techniques.

Results: Identified dominant vibration modes and validated experimental trends against analytical expectations, supporting informed vibration mitigation strategies.

Tools: Accelerometers, impact hammer, MATLAB, signal processing.

Miniature Turbojet Engine Experimental Performance Analysis

Turbojet test setup	*Instrumentation layout*	*Performance curves*

Figure 3: Miniature turbojet engine performance evaluation (placeholders).

What: Evaluated the real-world performance of a miniature turbojet engine under controlled laboratory conditions.

How: Instrumented the engine to measure pressure, temperature, fuel flow, and rotational speed. Applied thermodynamic relations to compute thrust, specific fuel consumption, and thermal efficiency.

Results: Quantified performance deviations from ideal Brayton cycle predictions and identified losses associated with component inefficiencies and experimental uncertainty.

Tools: Thermocouples, pressure sensors, tachometer, MATLAB.

Classical Control Systems Design and Frequency-Domain Analysis

Root locus analysis | *Bode magnitude and phase* | *Time-domain response*

Figure 4: Control system design and validation results (placeholders).

What: Designed feedback controllers to satisfy stability, transient response, and steady-state performance requirements.

How: Developed system transfer functions and designed PI and lead–lag controllers using root locus techniques. Evaluated robustness using frequency-domain stability margins.

Results: Achieved stable closed-loop behavior with improved steady-state accuracy and enhanced transient response characteristics.

Tools: MATLAB, Control System Toolbox, analytical modeling.

Engineering Data Analysis and Technical Documentation

Raw data processing | *MATLAB plots* | *LaTeX documentation*

Figure 5: Engineering data analysis and documentation workflow (placeholders).

What: Performed structured analysis and professional documentation of experimental and simulation-based engineering data.

How: Processed datasets using MATLAB, generated reproducible plots, and documented results using LaTeX with consistent formatting and traceability.

Results: Produced clear, technically rigorous documentation suitable for academic and industry engineering reviews.

Tools: MATLAB, LaTeX, data visualization.

Tools, Methods, and Standards

Software

MATLAB, Simulink, Python, LaTeX, Git

Engineering Methods

- Model-Based Systems Engineering (MBSE)
- Trade Studies and Sensitivity Analysis
- Failure Modes and Effects Analysis (FMEA)
- Verification and Validation (V&V)

Standards (Familiarity)

- NASA Systems Engineering Handbook
- MIL-STD-499 / 881
- DO-178 (Awareness)