Engineering Portfolio

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Technical Summary

Systems-oriented engineer with experience in modeling, analysis, and verification of complex engineering systems. Skilled in requirements-driven design, simulation-based trade studies, and performance evaluation under uncertainty. Experienced with aerospace-relevant tools, standards, and analytical methods.

Core Competencies

- Systems Engineering & Requirements Analysis
- Control Systems & Dynamic Modeling
- Aerospace Structures & Dynamics
- Modeling & Simulation (MATLAB / Python)
- Verification & Validation (V&V)
- Risk & Trade Study Analysis

Project Case Studies

Space Telescope Shipping Container — Systems Definition (Capstone)

Context: Industry-sponsored academic capstone focused on the systems-level design of a shipping container for a sensitive space telescope payload, subject to transport-induced dynamic and environmental loads.

Objectives:

- Define system requirements for aerospace-grade payload protection
- Identify operational, environmental, and transport constraints
- Develop feasible enclosure and isolation concepts

Methods:

- Requirements decomposition and functional analysis
- System boundary definition and interface identification
- Conceptual trade studies of enclosure architectures and materials
- Development of a Work Breakdown Structure (WBS)

Key Outputs:

- Multiple enclosure concepts evaluated against system requirements
- Preliminary material trade study (aluminum, composite, sandwich panels)
- Defined system architecture aligned with transport constraints

Engineering Focus: Systems engineering, conceptual design, requirements-driven analysis

Space Telescope Shipping Container — Dynamic Modeling & Control (Capstone)

Objective: Model and analyze the dynamic response of the shipping container system and design a control strategy to mitigate vibration transmission to sensitive payload components.

Methods:

- Mathematical modeling of system dynamics
- Transfer function development
- Proportional control strategy design
- Root locus and Bode plot analysis

Tools: MATLAB, Simulink, LaTeX

Results:

- Improved system stability and damping characteristics
- Increased phase margin and reduced steady-state error
- Verified closed-loop performance using frequency-domain analysis

Engineering Focus: Control systems, dynamic modeling, verification and validation

Closed-Loop Control System Design (Academic)

Objective: Design and analyze a stable closed-loop control system meeting specified performance requirements.

Methods:

- Transfer function modeling
- Root locus and Bode analysis
- Steady-state error evaluation

Tools: MATLAB, Simulink

Results:

- Achieved phase margin greater than 45°
- Reduced steady-state error by approximately 90%

Propulsion Cycle Performance Analysis (Academic)

Objective: Evaluate Brayton cycle performance parameters under varying operating conditions.

Methods:

- Thermodynamic cycle analysis
- Isentropic efficiency modeling
- Sensitivity analysis

Tools: MATLAB, LaTeX

Results:

- Identified optimal compressor pressure ratio
- Quantified thermal efficiency trends

Tools, Methods & Standards

Software

MATLAB, Simulink, Python, LaTeX, Git

Engineering Methods

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

Standards (Familiarity)

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