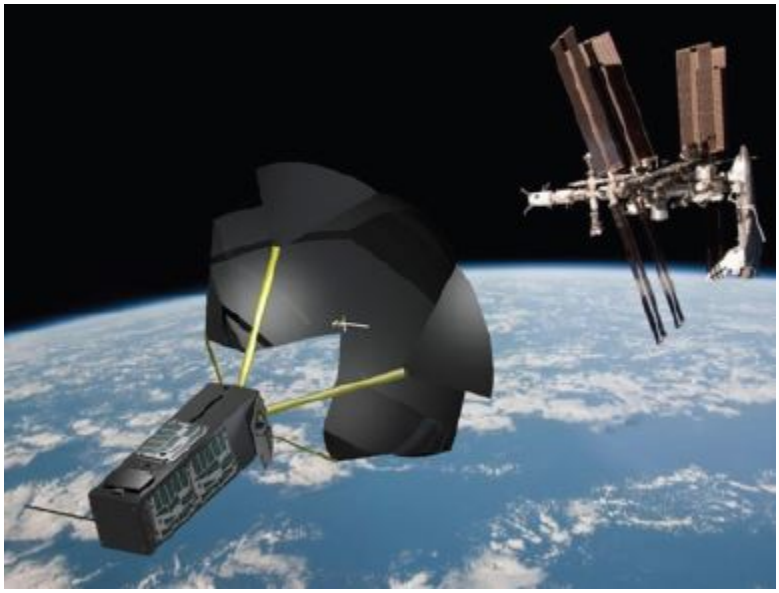
San José State University
Aerospace Engineering
AE110 Advanced Space Systems Engineering, Fa11 2017



Instructor Info	Dr. Periklis Papadopoulos (408) 924-7168 periklis.papadopoulos@sjsu.edu
Office Hours	MW 4:30 p.m. – 5:30 p.m.
Credit	3 units
Class Days / Time	MW 3:00 pm - 4:15 pm
Classroom	ENG 164
Prerequisite	Grade of "C-" or better in AE 165
Textbook	Understanding Space: An Introduction to Astronautics Jerry J Sellers, Wiley J. Larson, William J. Astore, Robert B. Giffen 3rd ed., Space Technology Series
References	*Fundamentals of Space Systems* Vincent Pisacane & Robert Moore, Oxford Press.
Description	Introduction to design, analysis and operation of spacecraft power, communications, attitude determination/control, structures, propulsion, thermal management systems. Typical payload systems

design and operation, including remote Earth sensors. System integration issues. Lab experiments and field trips.

Goals

1. Provide descriptions of the various elements comprising a space system.
2. Expose students to the challenge of integrating space system elements.
3. Provide an in-depth exposure to at least one spacecraft subsystem groups.
4. Educate students in the area of analysis and optimization of multidisciplinary space systems during the conceive and design phases.
5. Become familiar with the basic concepts of multi-objective optimization.

Learning Objectives

Students completing AE110 should be able to:

1. Identify each element of a space system.
2. Identify each subsystem of a spacecraft.
3. Perform a systems-level analysis of spacecraft subsystems including communication, power, thermal, attitude control, structures, guidance and navigation.
4. Formulate a high-level spacecraft design given basic design parameters, involving trade-offs between competing subsystems demands.
5. Study a single spacecraft subsystem in detail within a team of 2-3 students and present their findings in class in a series of lectures.
6. Support the product development process of complex, multidisciplinary engineering systems.
7. Rationalize and quantify a system architecture or product design problem by selecting appropriate objective functions, design parameters and constraints.
8. Subdivide a complex system into smaller disciplinary models, manage their interfaces and reintegrate them into an overall system model.
9. Use traditional numerical optimization algorithms.
10. Perform a critical evaluation and interpretation of analysis and optimization results, including sensitivity analysis and exploration of performance, cost and risk tradeoffs.
11. Develop and codify a prescriptive approach to multidisciplinary modeling and quantitative assessment of new or existing system/product architectures

Approximate Weekly Schedule

Week	Topic(s)
1	Introduction, Course Overview, Mission Analysis and Design
2	Space System characterization: i. Identification of objectives, design variables, constraints, subsystems ii. System-level coupling and interactions
3	Subsystem model development: i. Model partitioning, interface control ii. Subsystem model selection: fidelity versus expense
4	Space system design optimization and exploration techniques: i. Review of linear and nonlinear programming ii. Design Space Exploration: Design of Experiments (DOE)
5	Design sensitivity analysis, trade-off studies and approximations
6	Multi-objective system level optimization, spacecraft design and sizing
7	Launch vehicles and space environment
	Subsystem presentations:
7	Communications, Command and Data Handling
8	Power
9	Thermal
10	Propulsion
11	Attitude Dynamics and Control
12	Structures
13	Guidance, Navigation, and Control
14	Mission Operations, Spacecraft Integration
15	Miscellaneous Topics, Summary, Review

Grading:		
	Homework	300 points
	1st Midterm	350 points
	Final Project	350 points

Grading Scale:			
	A+	minimum score	950
	A	minimum score	900
	A-	minimum score	850
	B+	minimum score	775
	B	minimum score	725
	B-	minimum score	700
	C+	minimum score	675
	C	minimum score	625
	C-	minimum score	600
	D	minimum score	500
	F	below	500