San José State University
Aerospace Engineering
AE157 Aerospace Automatic Control Systems Design, Spring 2016

Instructor:	Dr. Karmen Turkoglu
Office Location:	E331
Email:	

Office Hours:	TBA
Class Days/Time:	TBA
Classroom:	E164
Prerequisites:	“C-“ or better in Math 129A, Math 133A, and ME101

Course Description

Modeling and analysis of aerospace feedback control systems. Stability analysis, root locus design, and frequency response methods for aerospace vehicles and associated automatic control systems. Nyquist/Bode diagrams. Lead-lag, PID compensator designs for aircraft and spacecraft.

Course Goals

1. Develop an understanding of aerospace automatic control systems design and develop specific strategies to tackle practical engineering problems in the field of aerospace engineering.
2. Provide background in automatic control systems design with specific applications on aircrafts, spacecraft and satellites.
3. Develop an understanding of the fundamental elements in classical control theory as applied to the aircrafts and spacecrafts.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Outline the fundamental concepts of classical control theory as applied to aircraft and spacecraft.
2. Describe transient response and frequency response of aerospace automatic control systems.
3. Formulate basic control actions and frequency response of aerospace automatic control systems.
4. Explain the concept of feedback and its function in aerospace vehicles.
5. Analyze stability and stability margins in aerospace vehicle motions.
6. Outline the fundamentals of modern control theory as it is applied to aerospace vehicles.
7. Determine the natural frequencies and damping ratios of aerospace vehicle dynamics. Evaluate the effect of time-delay on aircraft and satellite control system performance.
8. Evaluate the effect of time-delay on aircraft and satellite control system performance.
9. Justify the significance of the negative and positive feedback.
10. Derive transfer functions and plot vehicle time response.
11. Use root locus and frequency response techniques to design closed-loop control systems: rate-damping, attitude control, altitude control.

12. Design a satellite control law using classical/modern automatic control system design principles.
13. Design a 3-axis control law for a spacecraft controlled by cold-gas jets.

Required Texts/Readings

Textbook

K. Ogata, Modern Control Engineering, Prentice Hall, 5th Edition, 2010.

Grading Information

Homework	20%
Project + Presentation	20%
Midterm Exams	40%
Final Exam	20%

Determination of Grades

100 – 97% A+
– 93% A
– 90% A-
– 85% B+
– 80% B
– 76% B-
– 72% C+
– 68% C
– 64% C-
– 53% D
< 53% F. All exams must be taken to receive a passing grade.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/.

AE Department and SJSU policies are also posted at http://ae.sjsu.edu/program-policies.

AE157 Aerospace Automatic Control Systems Design Spring 2016 Course Schedule

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1		Introduction to aerospace control systems design
2		Laplace transforms, Introduction to Matlab & Simulink
3		Mathematical modeling of aerospace and dynamic systems

Week	Date	Topics, Readings, Assignments, Deadlines
4		Stability analysis of aerospace control systems
5		Time domain response of aerospace vehicle dynamics
6		Classical control techniques
7		Effect of zeros and poles on aerospace vehicle response
8		Interconnection of systems
9		Impulse response analysis
10		Steady-state frequency response of aerospace vehicle dynamics
11		Bode-plots and frequency domain analysis of aerospace systems
12		Loop shaping design and practical applications on aerospace sys.
13		Gain, phase, and time-delay margins in stability analysis of aerospace system
14		Nyquist stability theorem
15		Robustness margins and applications on aerospace systems
16		Implementation of discreet aerospace automatic control systems
17		Final Exam Review