

AE 246: Advanced Aircraft Stability & Control

Professor Kamran Turkoglu, Department of Aerospace Engineering, San Jose State University, Spring 2017

Syllabus

Contact Information

Instructor: Kamran Turkoglu
Office Location: ENG 272C
Email: kamran.turkoglu@sjsu.edu
Office Hours: Monday 7.15pm-9pm
Class Hours: Monday, 4.30pm - 7.15pm
Classroom: Clark Hall 224
Prerequisites: BSc degree
Class Code:
Website: <http://www.engr.sjsu.edu/kamran/>
TA (Grader): TBA

Mid-term Exam(s):

There will be 2(two) 2hr45min in-class written exams and 4(four) Quizzes.
 NO make-up exams will be provided without a valid, documented excuse.

Final Exam

There will be a final project with a due date of the Final exam day of class at May 22nd, 2017 at 7.30pm. Delivery will be ONLINE at C

Text Book(s):

- Stevens, B. L. and Lewis, F. L., Aircraft Control and Simulation, Wiley, 2003, 2nd Ed.
- Classnotes & Handouts

References:

- Etkin: Dynamics of Atmospheric Flight
- Flight Dynamics Principles, Second Edition, Michael V. Cook. Elsevier Ltd. 2007.
- Nelson: Flight Stability and Automatic Control, Second Edition
- Roskam: Flight Dynamics of Rigid and Elastic Airplanes, Part I
- Blakelock: Automatic Control of Aircraft and Missiles
- McGruer: Aircraft Dynamics and Automatic Control
- Perkins & Hage: Airplane Performance and Stability & Control
- Nise: Control Systems Engineering

Schedule

Important

If you miss a lecture, please make sure that you obtain the notes of that specific class from your class-mates.
 'I did not know how to do this problem, because I missed lecture the day this material was covered' is, unfortunately, not a valid excuse.

- *Week-1 (01/30):
 - Kinematics and Dynamics of Aircraft Motion
- Week-2 (02/06):
 - Modeling the Aircraft
- *Week-3 (02/13):
 - Modeling Design and Simulation Tools (1/2)
- Week-4 (02/20):
 - Modeling Design and Simulation Tools (2/2) (**ONLINE!!**)
- Week-5 (02/27):
 - **Quiz_01 !!**

- Aircraft Dynamics and Classical Control Design (1/2)
- Week-6 (03/06):
 - Aircraft Dynamics and Classical Control Design (2/2)
- Week-7 (03/13):
 - **Exam_o1 !!**
- Week-8 (03/20):
 - **Quizz_o2 !!**
 - Modern Design Techniques (1/2)
- Week-9 (03/27):
 - **SPRING BREAK !! No Class !!**
- Week-10 (04/03):
 - **No Class !!**
- Week-11 (04/10):
 - Modern Design Techniques (2/2)
- *Week-12 (04/17):
 - **Quizz_o3 !!**
 - Robustness and Multivariable Frequency Domain Techniques (1/2)
- *Week-13 (04/24):
 - **Exam_o2 !!**
- Week-14 (05/01):
 - Robustness and Multivariable Frequency Domain Techniques (2/2)
- Week-15 (05/08):
 - **Quizz_o4 !!**
 - Digital Control
- Week-16 (05/15):
 - **Final project presentations !!**

Course Description

Natural longitudinal and lateral *directional motion of aircraft; mode shapes, eigenvalues, eigenvectors. Analysis and synthesis of various aircraft autopilots using* Aircraft performance and handling qualities; State space representation of dynamics and models of systems; Stability, controllability, and observability; Full state Application of modern control theory to the design of aircraft stability augmentation system (SAS) and autopilots; Discrete-time implementation.

Course Goals

- Introduce the topics in aircraft stability and control.
- Provide the fundamental background in aircraft dynamic characteristics and handling qualities.
- Identify aircraft dynamic parameters from frequency response.
- Analyze and synthesize the flight control systems using modern control techniques.

Student Learning Objectives

- Perform linearization to obtain state-space system description.
- Solve eigenvalue/eigenvector problems.
- Calculate the transfer functions related to aircraft longitudinal *lateral* directional motions.
- Design a stabilizing controller for multi-input multi-output (MIMO) systems.
- Design a stability augmentation system (SAS).
- Design an attitude control (pitch/roll) system.
- Design a directional (heading) control system.
- Use MATLAB/Simulink to develop aircraft control systems.

Exams

- 2(Two) 120minutes in-class Mid-term exams
- Final project.

Grading

- 4(Four) Quizzes 20%
- Two In-Class Exams 50%
- Final Project 30%

Important !!

All exams must be taken to receive a passing grade.

Grading Policy

- 100 - 95% A
- 94.99 - 90% A-
- 89.99 - 85% B+
- 84.99 - 80% B
- 79.99 - 76% B-
- 75.99 - 72% C+
- 71.99 - 68% C
- 67.99 - 64% C-
- 63.99 - 61% D+
- 60.99 - 57% D
- 56.99 - 53% D-
- < 53% F

Important !!

This is only a rough scale. This scale may be adjusted depending on the performance of the class. Any adjustments to the scale will only lower the cut-offs to achieve a specified grade; cut-offs will not be raised beyond those listed here.

Academic Success

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (no preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent work

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at <http://www.engr.sjsu.edu/kamran/>. You communication system as indicated by the instructor) to learn any updates.

University Policies

Dropping and Adding

Students are responsible for understanding the policies and procedures about *add/drop*, *grade forgiveness*, etc. Refer to the current semester's Catalog Policies s current academic year calendars document on the Academic Calendars webpage at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop l the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at <http://www.sjsu.edu/advising>. Consent for Recording of Class and Public Sharing students to obtain instructor's permission to record the course.

- Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the
- Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may n notes, or homework solutions without instructor consent.

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S07-2 at <http://www.sjsu.edu/faculty> Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to subm instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, pl Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must reg disability. In 2013, the Disability Resource Center changed its name to be known as the Accessible Education Center, to incorporate a philosophy of accessible ed

support to SJSU students with disabilities and the University's continued advocacy and commitment to increasing accessibility and inclusivity on campus.

Student Technology Resources

Computer labs for student use are available in the Academic Success Center at <http://www.sjsu.edu/at/asc/> located on the 1st floor of Clark Hall and in the Assoc engineering department. Computers are also available in the Martin Luther King Library.

A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include DV and HD digital camcorder systems, wireless microphones, projection screens and monitors.

SJSU Peer Connections

Peer Connections, a campus-wide resource for mentoring and tutoring, strives to inspire students to develop their potential as independent learners while they learn their services which include course-content based tutoring, enhanced study and time management skills, more effective critical thinking strategies, decision making

In addition to offering small group, individual, and drop-in tutoring for a number of undergraduate courses, consultation with mentors is available on a drop-in basis. Peer Connections also offers Writing Skills Test (WST), improving your learning and memory, alleviating procrastination, surviving your first semester at SJSU, and other related topics. A complete list of services is available on the Peer Connections website at <http://peerconnections.sjsu.edu> for more information.

Peer Connections is located in three locations: SSC, Room 600 (10th Street Garage on the corner of 10th and San Fernando Street), at the 1st floor entrance of Clark Hall, and the Peer Connections website at <http://peerconnections.sjsu.edu> for more information.

Consent for Recording of Class and Public Sharing of Instructor Material

University Policy S12-7, requires students to obtain instructor's permission to record the course.

- Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to record for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute them.
 - It is suggested that the greensheet include the instructor's process for granting permission, whether in writing or orally and whether for the whole session or part of the session.
 - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not post or share notes, or homework solutions without instructor consent.