SYLLABUS

ME 403: Atmospheric Flight Mechanics

Fall 2011

Prof. Hua Wang

Course Description

- **Joy** *of Flight: Dynamics, Stability and Control*
- BU Aerospace Engineering: *End of an era* and beginning of a new chapter

Lectures

- Time & Location: Tues & Thurs 2:00-4:00PM – Room 202 Photonics Center
- Attendance will be taken and used as one indicator of your level of effort
- Ringers on cell phones should be turned off during lecture

Instructor

- Professor Hua Wang
- Email: wangh@bu.edu
- Office: Room 128, 15 St. Mary's Street
- Phone: 617-353-8860

- Office hours: Tues. & Thur. 11:00AM-12:00PM or by appointment or just drop by whenever I am available

Graduate Teaching Fellow

- Trevor Ashley
- Email: tashley@bu.edu

Course Materials

- Required Text: *Dynamics of Flight*, Third Edition, Bernard Etkin and Lloyd Duff Reid, ISBN 0-471-03148-5.
- Recommended Text (placed on reserve in library): *Flight Stability and Automatic Control*, Second Edition, Robert C. Nelson, ISBN 0-07-046273-9.
- Recommended Text (placed on reserve in library): *Feedback Control Systems*, Third Edition, John Van de Vegte, ISBN 0-13-016379-1.
- Handouts will be given throughout the semester.
- Web: `http://blackboard.bu.edu/`

Grading

- Grades are computed according to the following table:

Homework	20%
Lab	5%
Project	20%
Midterm Exam	25%
Final Exam	30%

- Remember that grades are not given, they are earned. I expect each and everyone of you to work hard for the course. Your level of effort will be noted. If you are not satisfied with your progress, please consult with me **as early as possible**.

Topics (time spent in weeks)

1. Aerodynamic forces and moments (0.5 weeks)
2. Static stability and control (2 weeks)
3. Aircraft equations of motion (1.5 weeks)
4. Stability derivatives (0.5 week)
5. Dynamic stability (1.5 week)
6. Laplace transform (0.5 week)
7. System response and transfer function (1 week)
8. Feedback performance measures (0.5 weeks)
9. PID controllers and feedback design using root locus (1.5 weeks)
10. Aircraft open-loop response (0.5 weeks)
11. Flying quality standards (USAF Spec. MIL-F-8785C) (0.5 weeks)
12. Longitudinal and lateral autopilots (3 weeks)
13. In-class exams (0.5 weeks)

Homework

- Homework assignments will be due at the beginning of lecture.
- The lowest homework grade is dropped when computing your homework average.
- Consultation with classmates is encouraged, but copying from others or allowing others to copy is grounds for disciplinary action.
- The following criteria are used in homework and exams:

    1. Neatness: If it cannot be read, it cannot be graded. Use clean, untorn, 8-1/2 by 11 inch paper. Staple all pages together.

2. Organization: There are often several ways to do a problem. If you present your solution methodically, the grader will be able to follow your train of thought.
3. Setting Up the Problem: Always put down in general form the formulas you wish to use. This will gain you partial credit. Often, drawing diagrams is beneficial.
4. Units: Carry the units of all quantities though each step of the solution.
5. Lastly: Substitute numbers into the final equations and calculate the numerical answer.

Lab

- The laboratory component will consist of a set of control experiments performed on the flying wing outside class hours. The specific dates and times are TBA.

Class Project

- In this project you will analyze the dynamics of an existing aircraft (part I) and design a feedback control system for improving the aircraft dynamics (part II).

Exams

- **No make-up exams will be given.** Any conflicts with exam attendance or homework submission must be discussed with me in advance.
- The **midterm exam** will be given in class on **Thursday, October 20, 2011**.
- There will be a **final exam** during the exam period. The date of the final exam will be determined by the registrar. Do not make travel plans until the date of the final exam is known. Early exams will not be given.

Matlab Software

- Some homework problems and the class project will require the use of Matlab and the associated Control Systems Toolbox. They are available on most BU computers. An online tutorial for Matlab is available at www.bu.edu/eng/matlab. The most useful matlab command is *help commandname*.

  You must hand in both Matlab input and output. It is often easiest to type your Matlab input commands into an m-file which can later be printed and submitted along with the output generated.