MAE 3134: Linear System Dynamics

Spring 2017
Lecture: Tuesday and Thursday 0935-1050, TBD
Recitation: Friday 1420-1510, TBD

Instructor Shankar Kulumani Email:skulumani@gwu.edu
Office Hours: SEH 2200, M 1400-1600, and by appointment

Teaching Assistant TBD Email:skulumani@gwu.edu
Office Hours: SEH 2200, M 1400-1600, and by appointment

Prerequisites ASPC 2113 and ASPC 2058
Ordinary Differential Equations, Complex Numbers, Linear Algebra, Scientific Programming (MATLAB, Python, etc.)

Course Goal This course will introduce students to the *fundamentals of linear systems analysis*. Students will learn techniques to describe simple electro-mechanical system in terms of a *mathematical model*. Using this model, students will learn how to predict the behavior of the system through both analytical and numerical techniques.

Textbook Katsuhiko Ogata. *System Dynamics*. Pearson Education Limited, 2004

Additional Resources Some additional references for your use.

- Norman S Nise. *Control Systems Engineering*. 4th ed. John Wiley & Sons, 2004
- Charles L Phillips and Royce D Habor. *Feedback Control Systems*. Simon & Schuster, 1995
- Graham Clifford Goodwin, Stefan F Graebe, and Mario E Salgado. *Control System Design*. Prentice Hall New Jersey, 2001

Course Objectives

1. Determine the equations of motion for simple mechanical systems.
2. Derive and solve a differential equation of motion for simple mechanical and electrical systems.
3. Describe and predict the performance of first and second order linear systems using time and frequency domain techniques.
4. Produce the Bode frequency response plot for a linear system.
5. Design parameter changes for open and closed loop linear systems in order to meet system performance specifications using s-plane tools and Bode plots.

Grading	Homework	40 %
	Recitation	10 %
	Midterm exam	25 %
	Final exam	25 %

Topics & Schedule

- System Modeling 14 weeks 1 midterm week Final Exam period
- First and Second Order Responses
- Frequency Response
- Closed Loop System Performance

Attendance Policy Students are expected to every class session. All absences require prior instructor approval. This means you should personally contact your instructor **prior** to missing a class. Last minute e-mail messages are **unacceptable**.

Homework Policy

- Approximately one assignment per week
- All graded work is due at the **beginning** of class.
- **Late homework** will **NOT** be accepted for any reason.
- Homework grading will be based on your ability to present the solution in a clear and neat fashion. An engineer's work must be understood by others, with each step of their work understandable and reproducible. The ability to write clear, professional, well-organized documents and reports is an essential skill you should hone now–it is critical to any profession.
  - Use one side of a clean sheet of letter paper (graphed, lined, blank are all acceptable). **Note:** Not from a spiral notebook
  - Write your name clearly on the first page
  - Clearly number your solutions and final answer using a box or some other method.
  - Assignments should be written/typed clearly and legibly. Any unacceptable work will be returned.
  - Use a stapler.
- All homework is **individual effort**. Students may discuss homework problems with others to develop and clarify their approach. However, the written solution, or computer programming, should be an independent and individual effort that reflects the personal understanding of the material. **Any copying or integrity violation will not be tolerated.**

Exam Policy

University Policy on Religious Holidays

Support for Students Outside the Classroom

Academic Integrity