Syllabus

AE 383, System Dynamics

Instructor: Prof. Dr. Ozan Tekinalp

Recommended Reference: Ogata, K., Modern Control Engineering, Prentice Hall, 4rd edition, 2002.

Other Books of Reference:

1- Beachley, N.H., Harrison, H.L., Introduction to Dynamic System Analysis, Harper and Row Publishers, 1978.
2- Cochin, I., Plass, H.J., Jr., Analysis and Design of Dynamic Systems, 2nd ed., Harper Collins Publishers, 1990.
3- Dorf, R.C, Bishop, R.H., Modern Control Systems, 10th ed., Pearson Prentice Hall, NJ, 2005.
4- Kuo, B., Automatic Control Systems, Prentice Hall, 1991.
5- Nise, N.S., Control Systems Engineering, 4th ed., Wiley International Edition, 2004.
6- Ogata, K., System Dynamics, 2nd ed., Prentice Hall, 1992.
7- Ercan, Yücel, Mühendsilik Sistemlerinin Modellemesi ve Dinamiği, 2nd ed., Literatür Yayıncılık, İstanbul, 2003.

Grading will be based on: 2 Exams, 1 Final, Homeworks and Quizes.
Laboratories: In this course, you should learn how to use Matlab and Simulink software. There will a presentation on the use of this software. Some homework assignments will require Matlab and Simulink.

Course Content:

1. Introduction
   - System concepts, examples on system modeling
   - Mathematical models, classification
2. Laplace Transformation
   - Properties of Laplace transformation
   - Inverse Laplace transformation using partial fraction expansion
   - Final value theorem
   - Solution of ODE's via Laplace transformation
3. Transfer Functions and Block Diagrams
4. Modeling of Physical Systems
   - Electrical, mechanical, thermal, & fluid flow problems
   - Examples on how to interconnect different physical systems
5. Linearization of Nonlinear Systems
   - Concept of equilibrium and operating point, Taylor series expansion
   - State space formulation of ODE
   - Linearization of non-linear state equations
6. Response of linear models to test signals.
7. Stability of Linear Time Invariant systems
   - Characteristic equation
   - s-plane stability regions
   - Routh's test
8. Time domain analysis of control systems
   - Performance specifications in time domain
9. Introduction to automatic control system design in time domain.
   - P, PD, PID control system, design according to the performance specifications.
10. Frequency response of Linear Time Invariant Systems
    - Asymptotic Bode Plot
    - Mathematical models from frequency response data