EE 550
Linear Control Systems

Professor Samir A. Al Baiyat

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Course Information

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GRADING:	Homework	15%
	Project	20%
	Major Exam	25%
	Final Exam	40%
INFORMATION:	http://webcourses.kfupm.edu.sa	

TEXTBOOK **Linear System Theory and Design, 3rd Edition, C. T. Chen**

References

- Linear System, Panos Antsaklis and Anthony Michel
- Linear System, Thomas Kailath
- Linear System Theory, W. Rugh

EXAMINATIONS:

Major Exam: Monday April 9, 2007

Final Exam: Wednesday June 6, 2007

Course Objective:

This course provides a basic understanding of linear multivariable systems through their modeling and analysis. Both continuous-time and discrete-time systems will be discussed in the course. After taking this course, the student will be in a position to move on to more advanced courses and topics in systems, control, communications and signal processing.

TENTATIVE COURSE OUTLINE

- Overview
- Mathematical Description of Systems
  - Input-Output Description
  - State-Variable Description
- State Space Solutions and Realization
- Stability of Linear Systems
- Controllability and Observability
- Canonical Decompostion
- Minimal Realizations
- State Feedback and State Estimators
- Other Topics as Time Allows

The Study of Systems

Systems: It is a medium that relates a cause to an effect, or an input to an output.

The study and design of physical systems often consists of:

Performance specifications

Modeling

Simulations

Analysis

Optimization

Physical Realization

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1. Performance specifications
2. Modeling
3. Simulations
4. Analysis
5. Optimization
6. Physical Realization

Modeling is the representation of a system and all its components in a mathematical form.

Depending on the questions asked, or depending on the operating ranges, a physical system may have different models

Example: An Automobile may be modeled as a single particle if we are studying traffic flow **but** may be modeled as a spring-mass-damper system if we are interested in the vibration of the occupants

- Once a model is selected for a physical system, the next step is to develop mathematical equations to describe the system from the fundamental physical principles such as:

- Newton’s law for mechanical systems
- Kirchhoff’s voltage and current laws in electrical systems
- Laws of thermodynamics and transport phenomena in fluid and thermal systems

- After the mathematical equations for the model have been obtained the next step in the study of systems involves both

- Quantitative
  - System responses to specified inputs

- Qualitative
  - Stability
  - Controllability
  - Observability

- If the response of the system is found to be unsatisfactory then an engineering design phase termed improvement or optimization is initiated

- In some cases a system parameter may be adjusted to improve the response but in other cases compensation devices must be injected into the system

- Finally in the realization phase the proposed system must be built using actual physical hardware

System Classification