LINEAR SYSTEMS CLASS FALL 2007

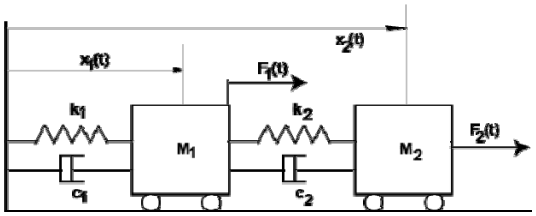
CMPE 240

INTRODUCTION TO LINEAR DYNAMICAL SYSTEMS

Instructor: Gabriel Hugh Elkaim (elkaim@soe.ucsc.edu)

ELECTIVE class for graduate SOE programs
Advanced Seniors in engineering, mathematics, economics also encouraged

$$\dot{x} = Ax + Bu$$
$$y = Cx + Du$$



$$x_{k+1} = Ax_k + Bu_k$$
$$y_k = Cx_k + Du_k$$

Learn the basics of linear dynamical systems for engineering applications

- automatic control systems
- signal processing
- communications
- economics and Finance
- circuit analysis, simulation, design
- mechanical and civil engineering
- aeronautics
- navigation, guidance

The usefulness of these techniques depend on the availability of computing power for design and implementation, however, computing power is increasing exponentially, so we will continue to see new applications of linear dynamical systems. Many dynamic systems are non-linear, however, if you do not understand linear dynamical systems, you certainly won't understand non-linear dynamical systems. In this class we'll cover an introduction to applied algebra and linear dynamical systems, with application to circuits, signal processing, communications, and control systems.

Topics: least-squares approximations of over-determined equations and least-norm solutions of underdetermined equations. Symmetric matrices, matrix norm, and singular value decomposition. Eigenvalues, left and right eigenvectors, with dynamical interpretation. Matrix exponential, stability, and asymptotic behavior. Multi-input/multi-output systems, impulse and step matrices; convolution and transfer matrix descriptions. Control, reachability, and state transfer. Least-norm inputs and associated Gramians. Observability and least-squares state estimation.

Prerequisites: Linear Algebra, Calculus (Laplace transforms, differential eqn's)
Schedule: Tu/Th 12-1:45, Porter College Room 249
http://www.soe.ucsc.edu/classes/cmpe240/Fall07/