

Review- Sp. 2014

1. *Key concepts*

- systems, dynamic systems, linear/nonlinear systems,
- modeling, mathematical model
- analysis, design, synthesis

2. *Laplace Transform*

- Laplace Transform review

3. *Mathematical Model of Dynamic Systems*

- Mechanical Systems
- Electrical Systems, electro-mechanical systems
- Fluid Systems and Thermal Systems, Hydraulic Servo System

(3. Mathematical Model of Dynamic Systems)

- Newton's laws
- spring, mass, damper, friction
- Energy Method
- Linearization of nonlinear systems

- Kirchhoff's laws
- resistor, inductor, capacitance
- Operational Amplifiers
- Complex Impedance
- DC Servo Motors

4. Transfer Function Approach to Modeling Dynamic Systems

- Closed Loop Transfer Function**
- Transient Response Analysis with MATLAB**
- Step input response, Ramp input, Impulse response**

5. Mathematical Modeling of Dynamic System in State Space

- states, state space, state equations**
- matrix exponential**
- state transition matrix**
- solution of state equation**
- state transformation, diagonalization / Jordan Canonical Form**

6. Linear System Analysis in Time Domain

- **First order systems, time constant**
- **second order systems, natural frequency, damping ratio**
- **higher order systems: Poles and zeros**
- **characteristic equations, characteristic roots, complex poles**
- **transient response**

7. Frequency Response

- **definition: Steady State Frequency Response**
- **unit step response versus frequency response**
- **Bode Plot**
- **Vibration Isolation in Rotating Systems**
- **Transmissibility**
- **dynamic vibration absorber**
- **seismograph/accelerometer**

System Control (next semester)

1. System control: Key issues in control systems

- stability
- performance:
 - Command tracking
 - Disturbance rejection
- robustness
 - stability robustness
 - performance robustness

2. control system representation

- transfer function
- state equations
- graphical representation: block diagram, signal flow graph

3. Stability

- equilibrium
- stability definition
- stability of LTI systems
- stability tests

System Control (next semester)

4. Controller design

- feedback control systems (closed-loop control systems)
 - Root Locus method: pole placement
 - Frequency Response method : lead/lag compensators
 - analysis and design Using MATLAB
 - control system simulation using MATLAB/SIMULINK
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- PID Control
 - state space method