AE 353
FINAL EXAM INFO

Date, Time: 1:30-4:30 p.m., Tuesday, December 19, 2017
Policy: open book/notes, calculators allowed, no cell-phones

Material for Final Exam

- Modelling Dynamic Systems: mechanical systems (spring, mass, damper translational and rotational systems) and the underlying laws to derive the equations of motion, electrical systems (resistance, capacitance, inductance systems) and the underlying laws to derive the equations of motion, electromechanical systems (DC motors). You should be able to linearize nonlinear equations by assuming small perturbations from equilibrium (for example, $\sin a = a$ for small a).
- Linear time invariant models and fundamental properties (superposition and time invariance).
- Laplace Transforms: definition, properties (differentiation, IVT,FVT etc.), calculation of inverse via partial fraction expansion, solution of linear constant coefficient differential equations via Laplace transform, decomposition of solution to zero IC and zero input part as well as transient and steady state.
- Dynamic Response of LTI Models: transfer functions and their connection with the impulse response and convolution integrals, poles-zeros and relation to stability, step response and DC gain, step response of first and second order systems, step response specifications, effect of poles and zeros on the response, response to sinusoidal inputs.
- Block diagrams: simple interconnections of LTI systems, representation of feedback control systems via block diagrams, transfer function evaluation given a block diagram.
- Introduction to Feedback Systems:
  why feedback, basic control actions (P, PD, PI, PID controllers) and their characteristics, closed-loop stability definition, pole/zero cancellations and CL stability, characteristic polynomial, Routh criterion for determining the unstable roots of the characteristic polynomial, system type and its relation to steady state tracking.
- Root-Locus Methods:
  what root-locus is, basic properties of the root-locus, step-by-step procedure to construct the locus, basic design philosophy via r-l, lead and/or lag compensation and where to use it.

- Frequency Response Methods:
  how to obtain ss-values due to sin/cos inputs from the transfer function, sketch of frequency response (Bode plots) and intrerpretation, reading error constants from Bode plots. Evaluating stability margins (GM, PM, CM) from Bode and/or Nyquist plots and their interpretation, time delays and their frequency response, frequency response specifications and their reflection on Bode plots