INC 341 Feedback Control System

Semester: 1/2016

Schedule: INC Thu 9.30–12.20 **Classroom:** CB40704
AE Tue 13.30-16.20

Exams: Midterm Thu 22 July 2016 and Final Thu 28 Nov 2016

Instructors:

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Course web: Part I: http://staff.kmutt.ac.th/~sudchai.boo/Teaching/inc341/

Part II: http://inc.kmutt.ac.th/~yoodyui/courses/inc341/

Required pre-requisites:
INC 212 Signals and Systems

Course Description:
Open-loop and Closed-loop control. Mathematical models. Analysis of transfer functions and state equations. Block diagrams. Signal-flow graph. Linearization. Analysis of steady-state response. Routh- Hurwitz criterion. Frequency-domain analysis: Nyquists stability, Polar plot, Bode plot, Nichols chart. Root locus. Compensator design in time and frequency domain. Design with MATLAB.

Learning Outcomes:

1. To be able to construct mathematic models of the engineering dynamic systems.
2. To be able to show differential equations and their Laplace transform.
3. Can describe the difference between open-loop and closed-loop control systems.

4. Can analyze the time-domain specification both in transient and steady states.
5. Can design controllers such as P, PI, and PID controller using time-domain analysis.
6. To be able to develop and analyze controllers using graphical techniques such as root-locus, Bode plot, and Nyquist plot methods.

Course text: Norman S. Nise, "*Control Systems Engineering*", 6^{th}, Wiley, 2011

Reference:

1. Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini, "*Feedback Control of Dynamic Systems''*, 4^{th}, Prentice Hall, 2002
2. B. C. Kuo, "*Automatic Control Systems''*, 7^{th}, Prentice Hall, 1995
3. R. Dorf and R. Bishop, "*Modern Control Systems''*, 9^{th}, Addison-Wesley, 2001

Project:
Each student has to do some work related to realistic control problems.
Grading scheme:
Homework: 30% Midterm Exam: 35% Final: 35%

- I reserve the right to modify the grading scheme.

Course Schedule (Tentative)

Week	Topic	Time(hours)	Lecturer
1	Introduction to feedback control systems	3	Sudchai
2	Transfer Function of Physical Systems (mechanical systems)	3	Sudchai
3	Transfer Function of Physical Systems (electrical systems) & Nonlinearity and linearisation	3	Sudchai
4	Dynamic Response: first-order systems	3	Sudchai

Week	Topic	Time(hours)	Lecturer
5	Dynamic Response: second-order systems	3	Sudchai
6	Analysis of Stability	3	Sudchai
7	Analysis of Steady-State Error	3	Sudchai
8	Midterm Exam	3	Sudchai
9	Root Locus	3	Benjamas
10	Root Locus (cont.)	3	Benjamas
11	Compensator design using root locus	3	Benjamas
12	Compensator design using root locus (cont.)	3	Benjamas
13	Frequency response analysis (Nyquists Criterion)	3	Benjamas
14	Frequency response analysis (Bode plot)	3	Benjamas
15	Compensator design using frequency response analysis	3	Benjamas
16	Final exam	3	Benjamas

Note: All topics and timetable may be changed!