ECE 4400 – Automatic Control Systems

Course Syllabus, winter 2018. Automatic Control Systems (4)

Course Description:

Mathematical modeling of dynamic systems, transfer functions and block diagrams. State-space representations and local linearization of nonlinear systems. Transient and steady-state analysis, stability criteria and state-feedback control. The root-locus method and frequency-response method for control systems analysis and design. Design of PID controllers and compensation networks. Controllability and observability for linear time-invariant systems. Computer simulations using Matlab.

Textbook: Control System Engineering 7th Edition by Norman S. Nise. Wiley. ISBN

Instructor: Dr. Hussein Dourra, Magna International (248) 631-5899. Email hdourra@oakland.edu or hdourra@outlook.com

Course Objectives:

Upon successful completion of ECE 4400, the students will
(1) Be able to model and/or write equations of motion for electrical and mechanical components and systems – these are some of the basic backbone elements of control engineering. (a, e, i, k)
(2) Be able to study system responses and characteristics subject to various types of inputs, such as step, ramp, impulse and sinusoidal, and analyze the characteristics by manual calculations and/or with Matlab. (a, b, e, i, k)
(3) Be able to develop state-space representations for control systems, obtain state-space realizations from transfer functions for linear systems, and conduct simulation studies with Matlab. (a, b, e, i, k)
(4) Be able to analyze and design control systems to meet desired performance criteria, such as system stability, damping ratio, maximum overshoot, rise time, peak time, settling time and steady-state error using root-locus, Routh-Hurwitz stability criterion, Bode plot, Nyquist plot and with Matlab. (a, b, e, i, k)
(5) Be able to communicate and practice teamwork skills in completing assignments of computer projects (or labs). (g)
(6) Be able to apply knowledge of mathematics, science and engineering for modeling, analyzing and designing feedback control systems. (a, b, e, i, k) 2

ABET/Outcomes:

Provide the students with

a. An ability to apply knowledge of mathematics, science, and engineering;
b. An ability to design and conduct experiments, as well as to analyze and interpret data;
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
d. An ability to function on multi-disciplinary teams;
e. An ability to identify, formulate, and solve engineering problems;
f. An understanding of professional and ethical responsibility;
g. An ability to communicate effectively;
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
i. A recognition of the need for, and an ability to engage in life-long learning;
j. A knowledge of contemporary issues;
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Class Schedule: 5:30 – 7:17 pm on every Monday and Wednesday. Jan 3rd – Apr 25th, 2017.
Dodge Hall 202

Grading System:

Home Work/Attendance - 10 %
Projects - 15 %.
First Exam - 25% (based on homework and class discussion)
Mid-Exam - 25 % (based on homework and class discussion)
Final Exam - 25 %. (based on homework and class discussion)

Class Policy:

(1) No late project report is acceptable;
(2) No later make-up exam is offered;
(3) Open-book/open-notes exams, but no wireless device is allowed.
(4) A better class attendance will earn up to 10 points, see the Table in detail

Number of Classes or HW Missed	Points
0-1	+10
2-3	+7
4-5	+4
6	+1
>6	0