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ECE 431-002: Introduction to Feedback Control Systems

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Course number and name

ECE 431

Introduction to Feedback Control Systems

Credits, contact hours

3 credits

3 hours per week

Name(s) of instructor(s) or course coordinator(s)

Cong Wang

Instructional materials

> Chalk talk notes in the lectures

> Reference books:

Control Systems Engineering, Norman Nise, 6th edition

Modern Control Engineering, Katsuhiko Ogata, 5th edition

Specific course information

> Catalog description:

Concept of feedback control. Typical feedback control systems. System dynamics by Laplace transform and state space methods. Stability definition and assessment: Routh-Hurwitz criteria. Graphical stability methods: Root locus, Nyquist and Bode plots. Performance evaluation and simulation. Matlab/Simulink used extensively. A good background in Laplace transform and linear (matrix) algebra highly desirable.

> Prerequisites: ECE 333, or ECE 232 and MATH 337

Educational objectives for the course

The students will be able to use transfer function-based methods to

> Model dynamic systems and examine their input-output responses;

> Analyze the stability of open-loop and controlled systems;

> Design PID control laws and tune feedback gains to meet stability and performance requirements.

Brief list of topics covered

> Introduction to dynamic systems, controls, and feedback

> Modeling with physics and differential equations

> Integral transformations and Laplace transforms

> Transfer functions and frequency responses

> Time response of basic systems

> Block diagrams

> Correlation between time domain and s-domain

> Graphic tools – Bode plots and Nyquist plots

> Stability

> Design of control laws and PID control

> Graphic tools – Root locus

> Performance analysis and compensation