**Course number and name** ECE 431 Introduction to Feedback Control Systems

Credits, contact hours

3 credits3 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-Hurwitx 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