

**University of Dayton**  
**Dept. Electrical and Computer Engineering**

**ECE 547 Nonlinear Systems and Control – Fall 2010**

**Instructor:** Prof. Raúl Ordóñez, KL341-E, raul.ordonez@notes.udayton.edu.

**Office Hours:** You can come almost any time I am there, but try to make an appointment if not during office hours: T, Th 1:30 to 2:30 p.m. and 4:30 to 5:30 p.m.

**Text book:** *Nonlinear Systems*, Hassan K. Khalil, Prentice Hall, NJ, 3<sup>rd</sup> edition, 2002.

**Reference:** *Linear Systems Theory and Design*, Chi-Tsong Chen, Oxford University Press, 3<sup>rd</sup> edition, 1999.

**Course Objective:** This course will provide you with a fundamental understanding of state variable systems and state feedback control, using linear and nonlinear techniques. The course will start with an overview of linear systems and linear state feedback control methods, and then will present nonlinear system analysis, concentrating on Lyapunov stability. The class will also introduce some of the more important approaches for nonlinear control. *The course will include a significant MATLAB simulation component.*

**Prerequisites:** A basic controls class (e.g., ECE415). A linear systems class (e.g., ECE509) is desirable, but we will review whatever concepts from it we need.

**Outline of topics**

- 1) Introduction. Linear systems and state variable models
- 2) Overview: transfer function methods
- 3) Overview: controllability, observability, and linear feedback control – pole placement
- 4) Nonlinear models and nonlinear phenomena
- 5) Second-order systems
- 6) Mathematical fundamentals
- 7) Lyapunov stability
- 8) Feedback linearizable systems
- 9) Backstepping
- 10) Sliding mode control, high-gain observers (time permitting)

<b>Grading:</b>	Homework	—	20%
<i>(Tentative)</i>	Quizzes	—	5%
	Computer and laboratory projects	—	35%
	Midterm exam	—	20%
	Final exam	—	20%

**Course web site:** <http://isidore.udayton.edu/>