

ECE 528/GE 520/ME 546: Analysis of Nonlinear Systems (Spring 2017)

Schedule: Mondays and Wednesdays 11:00am-12:20pm in 3020 Electrical & Computer Engineering Building (ECEB)

Instructor: Dušan M. Stipanović

Office hours and location: Mondays 1pm-2pm in 312 Transportation Building (TB)

Offices: 312 TB and 147 Coordinated Science Laboratory (CSL)

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Prerequisites: ECE 515 and MATH 444 or MATH 447.

Required textbook: H. K. Khalil, Nonlinear Systems, 3rd edition. Prentice Hall, 2002.

Official course description: Nonlinear dynamics, vector fields and flows, Lyapunov stability theory, regular and singular perturbations, averaging, integral manifolds, input-output and input-to-state stability, and various design applications in control systems and robotics.

Brief course outline:

1. Introduction: basic definitions, linearization, essentially nonlinear phenomena, second order systems (linearization and classification, limit cycles, periodic orbits).
2. Fundamental properties of dynamical systems: existence and uniqueness of solutions, continuous dependence on initial conditions and parameters, comparison principles.
3. Stability analysis: Lyapunov stability of autonomous and nonautonomous systems, LaSalle's invariance principle, converse Lyapunov theorems, stability of feedback systems, effects of perturbations.
4. Systems with inputs and outputs: input-to-state stability and related notions, Lyapunov characterizations.
5. Advanced topics (time permitting): control Lyapunov functions, center manifold theorem, averaging, singular perturbations.

Grade composition (subject to changes):

- One in-class midterm exam, Wednesday 3/8/2017, 11.00am-12.20pm in 3020 ECEB: 15%.
- Homework assignments (3-4 problem sets): 45%.
- Comprehensive take-home final exam: 40%.

General information: Late homework submissions will not be accepted unless you have prior approval by the instructor.