Instructor and Office Hour:

Dr. Murat Arcak (**arcak@berkeley.edu (mailto:arcak@berkeley.edu)**), Tuesdays 2:30-3:30 pm, Cory 569

GSI and Office Hour:

Eric Kim (eskim@berkeley.edu), Mondays 1:00-2:00 pm, Cory 529

Class Hours and Room: Monday and Wednesday, 2:00 pm - 3:30 pm, 521 Cory

Web site: bCourses will be used for announcements, and to post lecture notes and homework solutions

Prerequisite: EE 221A: Linear Systems Theory, or equivalent

References: Class notes will be made available. Recommended books:

1. Sastry, Nonlinear Systems: Analysis, Stability and Control, Springer, 1999
2. H.K. Khalil, Nonlinear Systems, Prentice Hall, 3rd edition, 2002

Grading: Homework: 30 points, Midterm: 30 points, Final: 40 points

Homework: Weekly homework sets will be assigned. 20% penalty for each session late. Submission will not be accepted if more than two sessions late.

Midterm and final dates:

March 14, Wednesday: Midterm (in class)

May 8, Tuesday: Final (take-home; details to be announced)

Tentative Course Outline:

- *Fundamental Properties of Nonlinear Systems:* Nonlinear phenomena and examples, planar systems, bifurcations, existence and uniqueness theorems.
- *Lyapunov Stability Theory:* Lyapunov's direct and indirect methods. Lyapunov-based feedback stabilization examples, including backstepping and adaptive control.
- *Robustness Analysis:* Input-to-state stability. Using level sets for reachability bounds and safety certification.
- *Computational Methods:* Sum-of-squares techniques and semidefinite programming relaxations for stability and robustness analysis.
- *Differential Geometric Tools for Nonlinear Control:* Basics concepts in differential geometry, feedback linearization, and design examples.
- *Sliding Mode Control:* stabilization and tracking.