Syllabus for ECE 512 Nonlinear & Adaptive Control (Fall 2024)

Lectures: Monday & Wednesday 2:00 PM - 3:20 PM, Science & Engineering Resource Center Room 205 (SEC-205), Busch Campus

Instructor: Guosong Yang (guosong.yang@rutgers.edu)

Office hours: TBD

Prerequisites: ECE 505 (Linear Control Systems) or consent of instructor. Basic knowledge of real analysis is also expected.

Grading (tentative): homework (40%), midterm exam (30%), final project (30%)

Textbook:

[Kha15] Hassan K. Khalil, *Nonlinear Control*. Pearson, 2015 (Primary)

[Kha02] Hassan K. Khalil, *Nonlinear Systems*, 3rd ed. Prentice Hall, 2002 (Supplement)

Course topics (tentative):

1. Introduction: nonlinear models, nonlinear phenomena, application examples
2. Fundamental properties: existence and uniqueness of solutions, continuous dependence on initial conditions and parameters, comparison principle
3. Stability analysis: Lyapunov stability of autonomous and nonautonomous systems, the invariance principle, converse Lyapunov theorems, perturbation analysis, input-to-state stability
4. Feedback systems: passivity, $\mathcal{L}$-stability, small-gain theorems
5. Feedback stabilization: feedback linearization, backstepping, control Lyapunov functions
6. Advanced topics (time permitting): sliding mode control, Lyapunov redesign, etc.