

**MECH-7930 Advanced Nonlinear Systems Analysis  
2008/2009**

***Instructor:***

Dr. Christine Q. Wu, EITC E1-414

***Objective:***

To provide an advanced background in nonlinear analysis by presenting the fundamental results of modern nonlinear analysis and demonstrating their use and implications in the design of nonlinear control systems.

***References:***

1. Hilborn, R.C., 2004, *Chaos and Nonlinear Dynamics* (Oxford University Press).
2. Lyapunov, A. M., 1892, The general problem of the stability of motion (Translated by Fuller, A.T.) *International Journal of Control*, 52, 531-773; also (London: Taylor & Francis, 1992).
3. Hahn, W., 1963, *Theory and Application of Lyapunov's Direct Method* (Englewood Cliffs, NJ: Prentice Hall).
4. Filippov, A. F., 1988, *Differential Equations with Discontinuous Right Hand Sides* (Boston, MA: Kluwer).
5. Research papers

***Topics:***

- Prelude: Dynamics in State Space: One and Two Dimensions
- Lyapunov's stability theory (Lyapunov's stability analysis and control)
- non-smooth systems analysis (Filippov's solution analysis and stability analysis)
- concept of Lyapunov exponents for stability analysis

***Format:***

Weekly meeting

***Evaluation:***

Assignments	50%
Project	50%