University of Toronto
Department of Electrical and Computer Engineering
ECE1647 - Introduction to Nonlinear Control Systems
Fall 2016

Information Sheet

Instructor	**Email Address**	**Office**	**Phone No.**
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Lectures (start Sept 14, 2016): Wednesday 10-1, Room: TBD

Course Outline:

- CHAPTER 1: Mathematical preliminaries
- CHAPTER 2: Introduction to Dynamics
  - Finite dimensional phase flows and vector fields
  - Existence and uniqueness of solutions of ODEs
  - Invariant sets and limit sets
  - The Poincare'-Bendixon theorem
  - Stability of periodic attractors
  - Centre, stable, and unstable manifolds; the stable manifold theorem
  - Elements of structural stability
- CHAPTER 3: Stability theory
  - Stability definitions
  - Direct Lyapunov theorems for autonomous systems
  - LaSalle's invariance principle for autonomous systems
  - Massera and Kurzweil's converse Lyapunov theorems
- CHAPTER 4: Introduction to nonlinear stabilization
  - Control Lyapunov functions
  - Artstein-Sontag Theorem
  - Brockett's necessary conditions
  - Passive systems and passivity-based stabilization

Course Notes:

You'll be able to download the course notes (developed by Prof. Manfredi Maggiore) from the Course Documents section in the University of Toronto web portal. The notes are self-contained and serve as a textbook for this course.

Reference Texts:

If the course notes are not sufficient, you may consider consulting these references:

1. V.I. Arnold, *Ordinary Differential Equations*, MIT Press,1973.
2. J. Guckenheimer, P. Holmes, *Nonlinear Oscillations, Dynamical Systems, and Bifurcation of Vector Fields*, Springer-Verlag, 1983.
3. J.K. Hale, *Ordinary Differential Equations*, Robert E. Krieger Publishing Company, 1980.
4. P. Hartman, *Ordinary Differential Equations*, Second edition, SIAM, 2002.
5. M.W. Hirsch, S. Smale, *Differential Equations, Dynamical Systems, and Linear Algebra*, Academic Press, 1974.
6. Hassan Khalil, *Nonlinear Systems*, Third Edition, Prentice Hall, 2002.