MATH 552 – Introduction to Dynamical Systems

Outline

2015W T2 (Jan–Apr 2016)

Ideas, methods and applications of dynamical systems and bifurcation theory: differential and difference equations, local bifurcations, perturbation methods, chaos. Prerequisite: two semesters of undergraduate differential equations.

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Web page: `http://www.math.ubc.ca/~nagata/m552/`

Textbook (optional, not required):

- Y. A. Kuznetsov, *Elements of Applied Bifurcation Theory,* Springer, New York (3rd ed. 2004; or 2nd ed. 1998).

Topics:

1. *Linear Dynamical Systems:* Linear vector fields and flows, linear maps, stable, unstable and centre subspaces, Floquet theory.
2. *Nonlinear Dynamical Systems:* Nonlinear vector fields and flows, nonlinear maps, Poincaré maps, linearization, hyperbolicity, stable and unstable manifolds, Hamiltonian systems, Lyapunov functions.
3. *Local Bifurcations:* Fold, Hopf and other local bifurcations, centre manifolds, normal forms.
4. *Global Dynamics:* Homoclinic bifurcations in the plane, Melnikov's method, chaos.

Additional references:

- C. Chicone, *Ordinary Differential Equations with Applications,* Springer, New York (2006).
- J. Guckenheimer & P. Holmes, *Nonlinear Oscillations, Dynamical Systems and Bifurcations of Vector Fields,* Springer, New York (1983).
- J. Hale, *Ordinary Differential Equations,* Krieger, Malabar (1980).
- M. Hirsch, S. Smale & R. Devaney, *Differential Equations, Dynamical Systems and an Introduction to Chaos,* Academic Press, New York (2004).
- J. Meiss, *Differential Dynamical Systems,* SIAM, Philadelphia (2007).
- S. Wiggins, *Introduction to Applied Nonlinear Dynamical Systems and Chaos,* Springer, New York (2003).