THE UNIVERSITY OF WESTERN ONTARIO
London Ontario

Department of Applied Mathematics

AM 9524B Compution of Dynamical Systems and Applications

(Winter 2016-2017)

- Time & Place: Thursday 1:30-4:30 pm, Room MC 15B. (First meeting: Jan. 5, 2017)
- Instructor: Pei Yu
- Office: MC 283, Ext: 88783, E-mail: pyu@uwo.ca

1. Course Outline

This course provides the students with a combination of symbolic and numerical computational methods for nonlinear systems. as well as applications to physical and biological problems. The nonlinear systems discussed in this course includes those described by *map, ordinary* differential equations and *partial* differential equations. Topics covered include stability and bifurcation, Hopf bifurcation, limit cycles, Bogdanov-Takens bifurcation and homoclinic/heteroclinic bifurcations, center manifold theory and normal form theory, perturbation methods and Melinikov's method.

(1) Brief review of basic concepts in differential equations and dynamical systems.

(2) Stability of equilibria: stability and asymptotic stability, classifications, nonlinear sinks, limit sets, Lyapunov's theorem, autonomous systems, gradient systems, Hamiltonian systems, and applications.

(3) Periodic attractors: asymptotic stability of closed orbits, discrete dynamical systems, stability and closed orbits, Poincare maps, and applications.

(4) Bifurcation theory, perturbation methods and melnikov function method, Hopf bifurcation, Bogdanov-Takens bifurcation, homclinic/heteroclinic bifurcation, center manifold and normal form theories.

(5) Computation methods: symbolic computations for center manifolds and normal forms, limit cycles and Hilbert's 16th problem, numerical bifurcation method.

(6) Applications of dynamical analysis to physical and biological problems, with demostration of using software packages.

2. Text

None. Notes will be available in .pdf format. A list of the pertinent reference literature will be provided.

3. Course Evaluation

(a) Assignments (once every two weeks): 40%
(b) Project (presentation and report/paper): 60%