NUMERICAL ANALYSIS OF NONLINEAR EQUATIONS

Concordia University COMP6361/4-DD Winter 2016

Thursdays 17:45-20:15 H634 (Hall Building)

`http://users.encs.concordia.ca/~doedel/courses/comp-6361/`

Course Description: An introduction to numerical algorithms for nonlinear equations. The emphasis is on numerical analysis, rather than numerical simulation. This course is suitable for scientists and engineers with a practical interest in nonlinear phenomena. Topics include computational aspects of continuation methods, the determination of stationary and periodic solutions, asymptotic stability, bifurcations, transition to chaos, and discretization techniques. Participants can learn how to use the software AUTO to analyze the solution behavior of nonlinear equations, and especially dynamical systems. The underlying algorithms will be described in some detail. The lectures will include computer demonstrations of how AUTO can be used to gain insight into the dynamical behavior of model problems, including, for example, predator-prey models and the celebrated Lorenz equations. Special emphasis will on equations from Celestial Mechanics, with application to space mission design.

Prerequisites: Participants are expected to have taken a course in Numerical Methods. Knowledge of differential equations (especially computational, at an elementary level) will be helpful. Background Lecture Notes will be posted on the COMP6361 web page. Depending on the need, the course may start with a review of the most relevant background material.

Course work: Students are expected to complete four or five assignments that will be practically oriented and involve programming. Together the assignments will amount to a course project. Participants will discuss their progress on the course work with the instructor at regular intervals during the course.

Lecture Notes: Detailed Lecture Notes will be provided on the course web page.

Recommended Reference book: For a comprehensive treatment of relevant theory and related material: Yu. A. Kuznetsov, Elements of Applied Bifurcation Theory, Springer 2004.

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