New Course in Fall 1996

MA581C

Course:	Numerical Methods for Boundary Value Problems in Ordinary Differential Equations
Instructor:	Moody T. Chu, (515-3265 or chu@math.ncsu.edu)
Time:	Tuesday and Thursday, 9:50 - 11:05 AM (3 credit hours)

Boundary value problems (BVPs) in the form of ordinary differential equations (ODEs) occur in many physical applications — Flow in a channel, moisture transport in desiccated soil, seismic ray tracing, epidemiology modeling, mass and energy balance of renal counterflow system, nonlinear elastic beams, optimal harvesting, and the re-entry of a space vehicle are just a few examples. Many BVP formulations originate as partial differential equations can also be reduced by various techniques to the ODE form. This course will offer a comprehensive study of the many important theoretical and practical developments on the numerical methods for BVPs in ODEs.
Perhaps surprisingly, boundary value problems differ substantially from initial value problems. In the past few years our knowledge and understanding of these BVP techniques has increased significantly, among which we shall discuss the following topics:

- Shooting Methods
- Finite Difference Methods
- Galerkin methods
- Collocation Theory
- Eigenvalue Problems
- Singular Perturbation Problems

Examples drawn from a variety of applications will be brought into the course to motivate and illustrate the concepts and techniques. Software packages, such as AUTO, COLSYS(COLNEW), MUS and other library routines will also be introduced and used throughout the course.

This course is suitable for science of engineer students. Students who have a practical orientation or a specific application in mind will be especially benefited. The prerequisite of this course would be a general understanding of the ODEs, either through a course or practices, and background in numerical linear algebra, nonlinear equations, polynomial interpolation and numerical quadrature (MA 529 and 530 will be more than sufficient). Knowledge in programming languages, such as FORTRAN, C or MATLAB, is also required.

* Sign up earlier! For this course to run, a minimum number of enrollment must be met during the pre-registration period.