

MATH 550: METHODS OF ASYMPTOTIC ANALYSIS: FALL TERM 2013

Course Outline

This is a basic graduate course in asymptotic and perturbation methods in applied mathematics. It provides the foundation for the more advanced courses Math 551 and Math 556, and many of the techniques studied in this course can be used in various areas of applications (fluids, math biology, etc.). The topics of the course are:

- asymptotic expansions, regular perturbation theory, eigenvalue perturbation theory, elementary bifurcation theory.
- asymptotic evaluation of integrals, including Laplace's method and the method of stationary phase for oscillatory integrals.
- Singular perturbation methods and boundary layer theory, with applications drawn from fluid mechanics, heat transfer, and math biology.
- Local analysis and the method of dominant balance for ODE's and WKB theory for ODE's.
- Introduction to multiple time scale expansions and nonlinear oscillations.

One key goal is to apply the theory developed to a wide range of application areas in the sciences. I will provide some written notes for the course. There is no official text for the course.

Prerequisites

Math 400 (PDE) and Applied Complex analysis (Math 301 or Math 305) or equivalent is desirable.

References

- Bender, C. M., Orszag, S. A. : Advanced Mathematical Methods for Scientists and Engineers
- Hinch, E.: Perturbation Methods
- Copson, E.: Asymptotic Expansions
- deBruijn, N.: Asymptotic Methods in Analysis
- Erdelyi, A.: Asymptotic Expansions
- Murray, J.: Asymptotic Analysis
- Olver, F.: Asymptotics and Special Functions
- Sirovich, L.: Techniques in Asymptotic Analysis

Evaluation

There will be (roughly) seven homework assignments worth 60% of your grade and a take-home final exam worth 40% of your grade.

Instructor

Instructor Michael Ward 822-8571, Math Annex 1217.