GEOS 6395 (SEISMIC MODELING)

(Spring 2006)

This course is a survey of the theory, implementation, and applications of the major algorithms for the computation of synthetic seismograms. Topics include asymptotic ray theory, spectral and slowness methods, finite-differences, finite elements, pseudo-spectral methods, Kirchhoff, and boundary element methods. Special topics include visco-elasticity, scattering, and anisotropy.

There is no required text for the course; the material will be drawn from the published literature (see hand-out list). A useful compilation of papers is the book

'Numerical modeling of seismic wave propagation'
Edited by K.R. Kelly and K.J. Marfurt
Society of Exploration Geophysicists
Geophysical Reprint Series No. 13
1990
ISBN 1-56080-011-9

Grades will be based on 3 quizzes (15% each) and a term project (55%).

Quizzes are not cumulative; each will cover only material covered since the previous quiz.

Class notes and examples of previous exams will be available for sign-out from the instructor.

TERM PROJECT

The term project is on any topic of your choice related to seismic modeling. It should involve the production and use of software for synthetic seismograms to solve a problem or investigate a phenomenon. It should demonstrate your understanding of the technique(s) you have chosen to use. THIS IS A TERM PROJECT, NOT A WEEKEND PROJECT; grading will reflect an assumption that three months work are involved. GPR modeling may be substituted for seismic for those doing a GPR thesis or dissertation. If you are not sure whether what you want to do fits the requirements, check with the instructor before you start.

The format for the term project report is like a research paper (consult your favorite research journal for examples).

CONTACT INFORMATION

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Office Hours: 9:30 a.m. to 5:00 p.m. monday to friday; other times by mutual arrangement

APPROXIMATE SCHEDULE OF TOPICS

Jan 10 Intro, ray tracing, variable definitions

Jan 17 Asymptotic ray theory

Jan 24 Geometrical spreading, caustics, refl & trans coeffs

Jan 31 S/R directivity, Q, intro to integral methods

Feb 07 Disk ray theory, WKBJ

Feb 14 Quiz # 1, Cagniard-de Hoop

Feb 21 Reflectivity, Q

Feb 28 Finite-differences, Pseudo-spectral & F-K methods

Mar 07 no class (spring break)

Mar 14 One-way wave equation, absorbing boundary conditions

Mar 21 10 Quiz # 2

Mar 28 Finite-elements

Apr 04 Visco-elastic modeling, scattering

Apr 11 3-D modeling (acoustic, elastic, anisotropic)

Apr 18 Kirchhoff boundary integral

Apr 25 Quiz # 3