EAS 8803: SEISMOLOGY II - SPRING 2008

Time and Location: Monday/Wednesday 10:05 am – 11:25 am, ES & T, 1229

Instructor:
Zhigang Peng, ES&T 2256, 404-894-0231, zpeng@gatech.edu

Office Hour: Monday/Wednesday 11:25 am – 12:25 pm (immediately after class)

General description: This is an advanced graduate-level course designed to involve students into seismological research. The topics covered include digital signal processing, seismometers and seismic networks, basic and advanced seismic data processing tools, travel time and synthetic seismogram calculations.

Prerequisite: Seismology EAS 6314 or equivalent

Grading:
40% homework assignment; 30% paper reading and discussion; 30% term paper project.

Required Textbook:
S. Stein and M. Wysession, An Introduction to Seismology, Earthquakes, and Earth Structure, Blackwell Publishing.

Recommended Textbook:
Aki, K. and P. Richards (2002), Quantitative Seismology, Second Edition, University Science Books.
T. Lay and T. C. Wallace (1995), Modern Global Seismology, Academic Press.
Additional material will be either handed out in class or made available on the course website.

Class website: http://geophysics.eas.gatech.edu/people/zpeng/Teaching/EAS8803_S08

Course Outline:

1. Digital Signal Processing
    a. Fourier analysis
    b. Linear systems
    c. Discrete time series and transforms
2. Seismometers, Seismic Networks, and Data Centers
    a. Historical development and the Earth's background noise
    b. The damped harmonic oscillator
    c. Basic types of seismic sensors and digital recording devices
    d. Global and regional seismic networks and data management centers
    a. Instrument response
3. Observational Seismology
    b. Basic data processing tools

   c. Data management
   d. Waveform stacking
   e. Array analysis
4. Theoretical and Computational Seismology
   a. Seismic source and representation theorems
   b. Ray theory and travel time calculation
   c. Theoretical seismogram calculation
   d. Earthquake location and tomography
   e. Scattering
5. Current topics in observational and computational seismology
   a. Spectral-element methods (SEM) and full-waveform tomography
   b. Ambient noise tomography and seismic interferometry
   c. Waveform back projection for imaging earthquake ruptures

Homework assignment: There will be four homework problems, which will involve analysis of selected issues, including analytical calculations, computer simulations, or data analysis. The homework is designed for each student to work by him/herself. The homework will count as 40% of your overall course grade, with each counting 10%.

Paper reading and discussion: In the last part of the class, we will discuss three topics of modern research in the field of observational and computational seismology. You are required to submit (electronically) a 2-page summary after each topic. Paper reading and discussion comprises 30% of your total grade, and is based on 15% of your summary, and 15% of in-class participation.

Term paper project: You are required to write a term paper with any topic related to this course. These can be literature reviews, or research projects involving calculations, data analysis, or theoretical results done in consultation with the instructor. The topic needed to be approved by the instructor before the spring break. Your paper should be written up in journal form with length, figures and referencing in a format suitable for submission to journals like Geophysical Research Letters (GRL). Please check the GRL submission guidance online at www.agu.org/pubs/au_contrib_rev.html. Preliminary version of the final paper should be shown to the instructor for approval at least two weeks beforehand. You will present your term paper in a 15 minute AGU-style talk; a 12 minute presentation with 3 minutes of questions. The project will count as 30% of your overall course grade. Grading for your project will be based on the 15% of the written paper, 10% of presentation, and 5% of participation during the project, and during other's presentations.

Academic honesty: It is expected that all students are aware of their individual responsibilities under the Georgia Tech Academic Honor Code, which will be strictly adhered to in this class. The complete text of the Georgia Tech Academic Honor Code is at http://www.deanofstudents.gatech.edu/integrity/policies/honor_code.html.