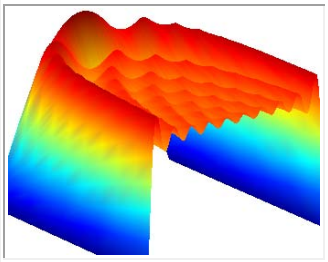
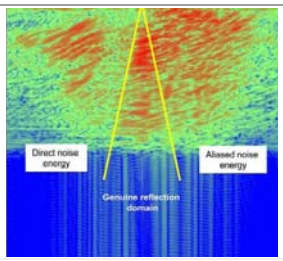


**GEOPHYS 389**

# Seismic Data Processing

**Syllabus – Spring 2014**

*Instructor:* **Dr. Kelly Liu**

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Meeting time: Mondays and Wednesdays 3-3:50 pm
Classroom: McNutt 210
Office Hours: by appointments

**Catalog Description**
Introduction to seismic data processing. Topics to be covered include statics corrections, filtering, velocity analysis, deconvolution, stacking and migration. Prerequisites: Geophys 270, 377, or Geophys 385.

**Course Objectives**
GEOPHYS 389: Seismic Data Processing is a course designed to provide students with theoretical background and practical experience of digital seismic data processing and analysis.

**Course Grading**
Homework and exams will be based on lecture materials.

- Homework: 150 points
- Exam 1: 100 points
- Exam 2: 100 points
- Final exam: 150 points

***A: 450-500 points; B: 400-449; C: 350-399; D: 300-349; F: 0-299 points.***

**Class Policies:**

- In order to make up a missed exam, you need to notify me about your absence *before* the exam. In addition, you need to present me with sufficient evidence to justify your absence.
- Late works will be accepted with reduced points, with a 20% reduction each additional day.
- Assignments must be completed independently. While discussions and collaborations during class time are encouraged, homework problems must be solved independently.

**Reference books:**

- Seismic Data Processing by Yilmaz
- Exploration Seismology by Sheriff and Geldart
- Digital Signal Processing by Oppenheim and Schafer

**Tentative Course Schedule**

| **Date** | **Content** |
|---|---|
| Week 1 - Jan. 22 | Introduction and Logistics |
| Week 2 – Jan. 27&29 | Digital recording and processing; Basic concepts; Dynamic range<br>Storage capacity; Discrete time sequence; Z-transform |
| Week 3 – Feb. 3&5 | Linear system; Filtering system |
| Week 4 – Feb. 10&12 | Discrete convolution; Wave parameters |
| Week 5 - Feb. 17&19 | Discrete Fourier transform; Delta function; Boxcar; Fourier transform properties<br>**Exam 1** |
| Week 6 - Feb. 24&26 | FFT; The sampling theorem; Frequency alias; Nyquist frequency; Interpolating; Low-pass, high-pass, band-pass filters; Notch |
| Week 7 – March 3&5 | Moving average; Gibbs effect; Spectral analysis |
| Week 8 – March 10&12 | Zero Phase; Linear phase shift |
| Week 9 – March 17&19 | Auto correlation; Cross correlation; Correlation coefficient; Vibroseis analysis |
| March 15-March 24-28 | *Spring Break* |
| Week 10 – March 31&April 2 | Convolution; Phase considerations (minimum; maximum; zero phases) |
| Week 11 - April 7&9 | Deconvolution; Inverse filter; Wiener filtering (least-square)<br>**Exam 2** |
| Week 12 - April 14&16 | Statics Corrections |
| Week 13 - April 21&23 | Stacking; Slant stacking; Complex-trace analysis; Hilbert transform (instantaneous frequency; instantaneous phase); Velocity analysis |
| Week 14 – April 28&30 | Migration |
| Week 15 – May 5&7 | 2D Fourier transform*; f-k* domain |
| ***Final Exam*** | ***Comprehensive Final Exam-TBA*** |

**How to get a good grade**

- Come to lectures
- Memorizing through understanding
- Do homework and labs individually
- Questions? Ask