

## Geophysical Data Processing

### Course description:

This course will provide background knowledge and practical skills of digital data analysis for Geophysicists. The focus is on the principles and practicality of the most common signal analysis methods, including sampling, Fourier method, filtering, deconvolution, data fitting, seismic subsurface imaging, and tomography. Though seismology is often taken as example, most of the analytic tools are of general purpose. Case examples will be drawn from all disciplines of geophysics.

### Who Should Take this Course?

Students in geophysics and employees of the petroleum industry, particularly processors and interpreters who deals with data processing issues, as well as anyone who is interested in learning geophysical data processing.

### Course outline:

This course will be delivered following a set of class notes by Dr. H. Zhou titled “Geophysical Signal Analysis”. The chapters are: 1. Geophysical Data: Geophysical data acquisition, processing, and interpretation • Sampled time series, sampling rate, and aliasing • Digital data processing sequence • Gain control • Phase considerations and Hilbert Transform; 2. Discrete Fourier Analysis: • Fourier Transform • Discrete Fourier Transform • Fast Fourier Transform • Spectrum analysis; 3. Statistical Analysis of Geophysical Data: • Noise, random variables and distribution • Correlation and convolution • Central Limit Theorem • Confidence Estimation • Basics of Geostatistics; 4. Digital Filters: • Filtering of digital data • F-k filtering • Types of filters: pole-zero representation • Geophysical models for filtering • Inverse filtering; 5. Deconvolution: • Predictive deconvolution • Frequency domain deconvolution • Adaptive deconvolution • Minimum entropy deconvolution; 6. Data Fitting and Model Inversion: • Forward modeling • Regression and degree of freedom • Least squares fitting • Matrix decompositions • Generalized inverse; 7. Applications of Geophysical Data Processing: Seismic migration • Tau-p transform • Seismic tomography • Topics chosen by students.