Time Series and Spectral Analysis

Description: Treatment of discrete sampled data by linear optimum Wiener filtering, minimum error energy deconvolution, autocorrelation and spectral density estimation, discrete Fourier transforms and frequency domain filtering and the Fast Fourier Transform Algorithm. Examples showing applications of time series analysis and spectral analysis in hydrology, geophysics, image processing etc.

Prerequisites: SC/CSE 1540 3.0 or equivalent FORTRAN programming experience; SC/MATH 2015 3.0 and SC/MATH 2270 3.0

Format: Three lecture hours. One term. Three credits.?

Two hour lecture and two hour lab?

EATS4020.03 Q. Cheng

Time Series and Spectral Analysis

Lecture 1 Basic Concept and Notations
Lecture 2 Statistical property of time series
Lecture 3 Z-transformation – convolution
Lecture 4 Wavelets
Lecture 5 Filtering in Spatial domain
Lecture 6 Fourier Transformation
Lecture 7 Filtering in frequency domain
Lecture 8 Decomposition of mixing signals
Lecture 9 Application of spectral analysis in hydrology
Lecture 10 Application in image processing
Lecture 11 Application in geophysical data processing

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Lab. 1 and Assignment 1 (10%) Use excel program to calculate convolution and spatial autocorrelation and cross-correlation

Lab. 2 and Assignment 2 (10%) Moving average and Filtering in time domain

Lab. 3 and Assignment 3 (10%) Fourier transformation

Lab. 4 and Assignment 4 (10%) Filtering infrequency domain for 2D time series – map

Middle term exam (25%)

Term Project (three weeks) (35%)

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Reference Texts:

1. Course notes "The Analysis of Data Sequences in the Time and Frequency Domains" by Dr. D. E. Smylie, provided as PDF
2. "Time Series Analysis and Applications" by Enders A. Robinson, Goose Pond Press, 1981, on reserve in Steacia Library for two hours.
3. "Spectral Analysis and its Applications" Jenkins and Watts, 1968, Holden-Day, on reserve in Steacia Library for two hours.
4. Selected articles to be distributed in class.