EAS 309 Computer-Aided Analysis For Geosciences
Professor Braile
Two lectures and one lab per week, 3 credits
Two exams and 12 lab assignments

Goals: Develop an understanding of some fundamental statistical and numerical methods that are useful in Geosciences; explore applications of these methods using Matlab computer codes.


Lecture Notes:
I. Getting Started with Matlab
II. The Normal or Gaussian Distribution
III. Statistics of randomly-spaced events (applicable to earthquakes, volcano eruptions, tornadoes, hurricanes, etc.)
IV. Explore the Chi-Square Test with Random Data
V. Matrices and matrix operations
VI. The Method of Least Squares and the Least Squares Straight Line Fit Through Observations
Addendum to Section VI. Least Squares Matlab codes and output
VII. Least Squares II – Matrix Algebra, Higher Order Equations
VIII. Least Squares Straight Line Fit to Non-linear Equations by Transformation
IX. Least Squares and ANOVA
X. Interpolation (1-D and 2-D)
XI. Time Series Analysis -- Sampling Theory and Aliasing
XII. Time Series Analysis -- Convolution and Correlation
XIII. The Fourier Transform -- Theory and Numerical Calculation
XIV. The Fourier Transform -- Numerical Calculations, Gibbs Phenomenon, Smoothing, Truncation and Signal Processing

Lab Assignments:
Lab 1: Getting Started with Matlab
Lab 2: Using Statistics to Analyze a Series of Data Points and Making 2-D Plots
Lab 3: Working with the Chi-Square Test
Lab 4: Matrix Algebra
Lab 5: Least Squares I -- The Least Squares Straight Line Fit and the Correlation Coefficient
Lab 6: Least Squares II -- Least Squares for the Exponential Curve Fit and the Error (Confidence) Bounds on the Predicted Values of y
Lab 7: Least Squares III -- ANOVA for a Least Squares Straight Line Fit and Quadratic Fit
Lab 8: Least Squares IV -- Least Squares Polynomial Fit: Choosing the Best Order of the Polynomial
Lab 9: 1-D and 2-D Interpolation
Lab 10: Time Series Analysis – Sampling, Aliasing, Convolution and Correlation
Lab 11: The Fourier Transform (Using the FFT)
Lab 12: The Fourier Transform (The FFT of real data)