
GE-4550

Gravity and Magnetic Interpretation Methods

Curricular Designation: elective

Catalog Description:

Interpretation of gravity and magnetic anomalies based on forward modeling techniques, including space filtering to enhance anomalies of importance. Emphasis will also be given to the design of the gravity/magnetic survey based on cost, implementation, and interpretation methods used.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2004-2005 academic year

Pre-Requisite(s): GE 3040

Textbook and Other Required Materials

Software used: Surfer 8, Oasis montaj viewer with USGS GX modules, Magpick, and USGS Potential Field software

Reference materials: Burger, R. H., Sheehan, A. F. and Jones C. H., *An Introduction to Applied Geophysics*, W. W. Norton and Company, 2006

Blakely, R. J., *Potential Theory in Gravity and Magnetic Applications*, Cambridge Press, 1995

Reeves, C., *Aeromagnetic Surveying: Principles, Practices, and Interpretation*, Geosoft, 2005

Nabighian, M. N., Grauch, V. J. S., Hansen, R. O., LaFehr, T. R., Li, Y., Peirce, J. W., Phillips, J. D. , and Ruder, M. E., , The historical development of the magnetic exploration method. *Geophysics*, **70**, 33ND – 62ND, 2005

Nabighian, M. N., Ander, M. E., Grauch, V. J. S., Hansen, R. O., LaFehr, T. R., Li, Y., Pearson, W. C. , Peirce, J. W., Phillips, J. D. and Ruder M. E., Historical development of the gravity method in exploration, *Geophysics*, **70**, 63ND – 89ND, 2005

Prerequisites by Topic

Fundamentals of Applied and Environmental Geophysics (GE3040)

Course Objectives

Objective 1: to teach the student how to use forward modelling techniques to interpret gravity and magnetic anomalies assuming simple geometric shapes for the causative bodies, how to do more complex 2D gravity modelling, and how to calculate excess mass.

Objective 2: to demonstrate the fundamentals of filtering to enhance gravity and magnetic anomalies

Objective 3: to develop the student's ability to design a gravity/magnetics survey, cost the survey, conduct the survey and interpret results

Topics Covered

I. Review of GE 3040 gravity and magnetic lectures (3 lectures)

II. Mathematics of potential fields (3 lectures)

III. Gravity (9 lectures)

Gravity effects of geometric shapes

Gravity effects of complex shapes (2D and 3D modeling)

Excess mass calculations

Gravity anomaly maps

IV. Magnetism (9 lectures)

Magnetic effects of geometric shapes

Slope/half slope methods

Magnetic effects of complex shapes (2d and 3D modeling)

Magnetic anomaly maps

V. Anomaly separation and enhancement (18 lectures)

Convolution, low and high pass filtering in spatial domain

Fourier series and transforms

Filters in the frequency domain - high pass, low pass, bandpass, notch, and threshold. 1 & 2D power/amplitude spectra, and radial averages

Upward/downward continuation, reduction to the pole, pseudogravity transformation

Wenner and Euler deconvolution