SPECIAL TOPICS COURSE

Inverse Modeling in the Geosciences and Engineering

Instructor: Juan Restrepo

Demand for scientists with skills in estimation, data assimilation, and inverse modeling is presently very high. Inverse modeling appears in a multitude of problems: from blending data and models, to making economic forecasts and weather forecasts, to improving tomographic methods in seismic and medical work, to a variety of remote sensing problems.

In this course we will cover the basics of inverse modeling, including least squares, singular value decomposition methods, variational assimilation, Kalman-Bucy methods, ensemble and particle methods, techniques for nonlinear and/or non-Gaussian statistics. The course is by necessity eminently practical and it involves some computation. We will use a variety of books, including Andrew Bennett's "Inverse Modeling of the Ocean and Atmosphere. " However, we will consult journal papers, mostly.

The course pre-requisites are: linear algebra and advanced calculus, a basic course in probability theory. The course audience is beginning graduate students in math, engineering, geosciences, and physics.

Course work: one project, one midterm, five homework assignments. The work involves requires some computer programming.