Minicurso

Computational solutions of Nonlinear Inverse Problems

Samuli Siltanen,

University of Helsinki.

Abstract

This course introduces mathematical inverse problems arising from various practical measurements. Application areas include medical imaging, underground prospecting, nondestructive testing and speech signal inversion. Special emphasis is reserved for nonlinear inverse problems related to partial differential equation (PDE) coefficient recovery. The key example is Electrical Impedance Tomography (EIT), whose mathematical model is the infamous Calderon Problem. The central methodology for noise-robust inversion is nonlinear Fourier transform based on exponentially behaving Complex Geometric Optics (CGO) solutions. Presented are several different computational inversion methods making use of CGO solutions, including the regularized D-bar method. Numerical computation of CGO solutions is explained for Schrodinger and Beltrami equations, and the Matlab codes will be made available for participants. Most of the course material follows the book Mueller-Siltanen: "Linear and nonlinear inverse problems with practical applications," SIAM 2012. See http://wiki.helsinki.fi/display/mathstatHenkilokunta/Inverse+Problems+Book+Page for free Matlab resources.