UNIVERSITY OF CALIFORNIA RIVERSIDE

DEPARTMENT OF MATHEMATICS

COLLOQUIUM

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"Network Based Inversion"

Abstract: I Present my work on network based methods to reconstruct the parameter of a differential equation inside a body from measurements taken at its surface. Two inverse problems are considered: the electric impedance tomography problem where the conductivity is to be estimated from current voltage measurements at the surface and the problem of estimating the (linear) elastic properties of a body from displacement and force measurements at its surface. These are severely ill-posed problems requiring some form of regularization. Out inversion strategy is to (1) Find a reduced model of the problem that can be recovered from the data, with deliberately few parameters to cope with the ill-posedness. (2) Interpret the reduced model as dicretization of the underlying PDE. (3) Use the interpretation to estimate the unknown parameter in the PDE. For electric impedance tomography the reduced model is a resistor network arising from finite volumes of discretization with the number of parameters (resistors) determined by the quantity and quality of the measurements. We show that the model reduction problem of finding the smallest resistor network (of fixed topology) that can predict meaningful boundary measurements is uniquely solvable for a broad class of measurements. We propose a simple inversion method based on interpretation of the resistors as conductivity averages over the cells of a predetermined grid that is adapted to the measurements. The reconstruction method is well-suited to situations where measurements are only available on a portion of the surface. For inverse linear elasticity problem we outline the results that would be needed for applying this inversion strategy. Here the reduced models are networks of springs and masses. We present a first step towards a network based inversion method for the problem, namely, a complete characterization of the response function of networks of springs and masses.

Monday, March 8th, 2010

Surge 284

4:10-5:00pm

Tea Time at 3:40pm