



THE UNIVERSITY OF CHICAGO

COMPUTATIONAL AND APPLIED MATHEMATICS COLLOQUIUM

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Reduced Order Model for Active Array Data Processing in Inverse Scattering

THURSDAY, March 7, 2019, at 4:00 PM
Jones 226, 5747 South Ellis Avenue

ABSTRACT

I will discuss an inverse problem for the wave equation, where an array of sensors probes an unknown, heterogeneous medium with pulses and measures the scattered waves. The goal in inversion is to determine from these measurements scattering structures in the medium, modeled mathematically by a reflectivity function. Most imaging methods assume a linear mapping between the unknown reflectivity and the array data. The linearization, known as the Born (single scattering) approximation is not accurate in strongly scattering media, so the reconstruction of the reflectivity may be poor. We show that it is possible to remove the multiple scattering (nonlinear) effects from the data using a reduced order model (ROM). The ROM is defined by an orthogonal projection of the wave propagator operator on the subspace spanned by the time snapshots of the solution of the wave equation. The snapshots are known only at the sensor locations, which is enough information to construct the ROM. The main result discussed in the talk is a novel, linear-algebraic algorithm that uses the ROM to map the data to its Born approximation. I will discuss how it applies to imaging with sound, electromagnetic and elastic waves.

Organizers:

Daniel Sanz-Alonso, Department of Statistics, sanzalonso@uchicago.edu
CAM Colloquium URL: <https://cam.uchicago.edu/seminars/colloq/index.shtml>.

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