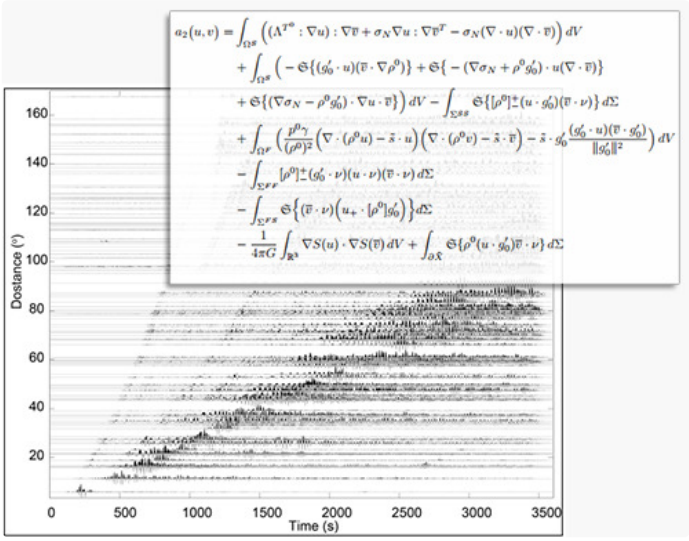
MATH + X Symposium on Seismology and Inverse Problems 2017

MATH + X SYMPOSIUM ON SEISMOLOGY AND INVERSE PROBLEMS

Rice University, January 18-20, 2017

The Department of Computational and Applied Mathematics
The Department of Earth Science
George R. Brown School of Engineering



Venue: BioScience Research Collaborative (BRC) Building, Lecture Hall – Room 280

Online Symposium Registration

Knowing the internal structure of Earth on an extreme range of spatial scales is important for our understanding of natural hazards, the exploitation of natural resources, and the understanding of the evolution of our planet since its formation. Assembling this knowledge is not a trivial task, however. Virtually all of what we know about Earth's deep interior has been inferred from

observations made at the surface, the modeling of presumed geodynamical processes, and high pressure/temperature studies of the behavior of pertinent materials. Seismic waves emitted by earthquakes or man-made (active) sources represent the most direct and precise probes. Developing methods to recover geomaterial properties, including their multi-scale variations, local continuity, anisotropy and microstructures (such as fracture networks) from broadband seismic observations, will lead to a deeper understanding of the coupling of geological and geodynamical processes, (complex) phase boundaries etc. via their interaction with seismic waves and free oscillations.

Seismology is essentially described by an elastic-gravitational system of equations on a (rotating) compact manifold, the coefficients of which represent the properties of geomaterials, in some way coupled to nonlinear friction laws through active faults to incorporate dynamic ruptures. This system generates normal modes and the free wobbles on the one hand, and body and surface (and fluid-solid boundary) waves on the other hand. Extracting different features in the data leads to different classes of inverse problems for the coefficients, namely time-harmonic and hyperbolic inverse boundary value and geometric and spectral ones, jointly with the (time-dependent) inverse source problem. Furthermore, different time windows relative to an (earthquake) origin time emphasize different manifestations (regimes of scattering) of the seismic wavefield with very different sensitivities to the variations in material properties.

The workshop will bring seismologists, mathematicians and computer scientists together, to present the state of the art and emerging directions of research on the one hand and expose key challenges on the other hand, with the goal of bridging seismology, the analysis of inverse problems and machine learning, and data from ever-expanding, modern networks.

Invited Speakers:

Seismology

B. Buffett (UC Berkeley)
M. Campillo (Université Grenoble-Alpes)
T. Dickens (ExxonMobil)
P. Johnson (Los Alamos National Laboratory)
B. Kennett (Australian National University)
T. Lay (UC Santa Cruz)
A. Levander (Rice University)
M. Long (Yale University)
L. Pyrak-Nolte (Purdue University)
V. Tsai (CalTech)
R. van der Hilst (MIT)

Inverse Problems

L. Demanet (MIT)
B. Engquist (UT Austin)
J. Garnier (L'École Polytechnique)
A. Greenleaf (University of Rochester)
J. Ilmavirta (University of Jyväskylä)
M. Lassas (University of Helsinki)
G. Nakamura (Hokkaido University)
L. Oksanen (University College London)
Y. Saad (University of Minnesota)
M. Salo (University of Jyväskylä)
G. Uhlmann (University of Washington)
A. Vasy (Stanford University)
H. Zhou (University of Cambridge)

Symposium Agenda with Abstracts

funded by

SIMONS FOUNDATION
Advancing Research in Basic Science and Mathematics

MATH + X Program

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Organizing committee:

– Maarten de Hoop (Rice University)
– Gunther Uhlmann (University of Washington)
– Robert van der Hilst (MIT)