

William W. Symes

CWP PROJECT REVIEW MEETING

Short Course

Vail Cascade Hotel, Vail Colorado

May 11 2009 ~ 1-5 PM



Velocity Analysis and Waveform Inversion

Velocity analysis concerns kinematics of seismic waves, and relies on a division of the earth structure model into velocity (macro-model, kinematic) and reflectivity (micro-model, dynamic) components. Often interactive in the past, velocity analysis has become highly automated and is one of the standard steps in the processing stream.

Waveform inversion is the contemporary name for model-driven data fitting, in which parameters of a physical model are adjusted to best-fit waveform data. Recent years have seen a great deal of interest in the possible use of waveform inversion, which does not depend on artificial subdivision by scale of earth structure, and can accommodate virtually any rock physics. Despite these potential advantages, the technique is still very experimental: its computational cost is high, and intrinsic obstacles to successful implementation remain.

This short course will sketch a common framework within which to understand velocity analysis and waveform inversion, and suggest some ways to leverage the capabilities and understanding developed for velocity analysis to overcome some of the remaining obstacles to effective waveform inversion.

William W. Symes is the Noah Harding Professor in Computational and Applied Mathematics at Rice University in Houston. He received his degrees in Mathematics from the University of California at Berkeley (BA 1971) and Harvard University (PhD 1975). Before joining the Rice Faculty in 1983, he taught at Michigan State University. He has held visiting positions at the Universities of British Columbia, Wisconsin, and Minnesota, and at Stanford University, Cornell University and the Université de Paris IX. His research spans a variety of topics in applied and numerical mathematics and scientific computing, with inverse problems for wave propagation as the major focus. To support investigation of such problems in an industrial context, he founded The Rice Inversion Project in 1992. This University-industry research consortium is sponsored by a number of firms in the oil and gas industry.