Nonlinear inverse scattering and velocity analysis

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Abstract

Migration velocity analysis ("MVA") can be viewed as a solution method for the linearized ("Born") inverse scattering problem, in its reflection seismic incarnation. MVA is limited by the single scattering assumption - for example, it misinterprets multiply scattered waves – but it is capable of making large changes in the model, and moving estimated locations of scatterers by many wavelengths. The salient features of MVA is its use of an extended (nonphysical) scattering model. Nonlinear least squares inversion ("NLS"), on the other hand, incorporates whatever details of wave physics are built into its underlying modelling engine. However success appears to require that the initial estimate of wave velocity (in an iterative solution method) be "accurate to within a wavelength", i.e. have kinematic properties very close to that of the optimal model.

This talk will describe a nonlinear extended scattering model and a related optimization formulation of inverse scattering. I will present the results of some preliminary numerical explorations, which suggest that this approach may combine the global nature of MVA with the capacity of NLS to accommodate nonlinear wave phenomena.