Waveform inversion with a data driven estimate of the internal wave

Speaker: Liliana Borcea, University of Michigan

Abstract: We study an inverse problem for the wave equation, concerned with estimating the wave speed from data gathered by an array of sources and receivers that emit probing signals and measure the resulting waves. The typical mathematical formulation of velocity estimation is a nonlinear least squares minimization of the data misfit, over a search velocity space. There are two main impediments to this approach, which manifest as multiple local minima of the objective function: The nonlinearity of the mapping from the velocity to the data, which accounts for multiple scattering effects, and poor knowledge of the kinematics (smooth part of the wave speed) which causes cycle-skipping. We show that the nonlinearity can be mitigated using a data driven estimate of the internal wave field. This leads to improved performance of the inversion for a reasonable initial guess of the kinematics.