Waveform inversion of single component seismic data under an isotropic assumption has been proved to be an effective tool for reservoir characterization. With the recent interests in exploring and exploiting the naturally fractured and unconventional hydrocarbon reservoirs, an understanding of the subsurface azimuthal anisotropy has become crucial and attempts have been made in developing methodologies for estimating the subsurface anisotropic properties from single and multicomponent pre-stack seismic waveform data. These isotropic and anisotropic waveform inversions are computationally challenging and require careful implementation of the inversion algorithm in a high-performance parallel computing environment. While these inversions could be applicable to real seismic data at the reservoir scale over geologically simple areas by assuming a locally one-dimensional (1D) structure at each common mid/conversion point (CMP/CCP) location, extending such methodology to complex three dimensional (3D) structures offer new sets of computational challenges. This presentation reviews the current developments in the isotropic and anisotropic waveform inversion methods under 1D assumptions and outlines a practical approach of extending such methodology to complex 3D structures as the future of reservoir characterization.

Dr. Subhashis Mallick received his Ph.D. from the University of Hawaii and is a first-rate computational seismologist, with a strong record of developing new approaches to addressing high-profile problems of interest to industry, including reservoir characterization and 4D seismology. His research interests include time-lapse monitoring of petroleum and CO2 sequestration reservoirs, development of new 3D pre-stack waveform inversion techniques, and seismic anisotropy and rock physics modeling. For more information contact nkalisze@uwyo.edu.