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# Fracture prediction using pre-stack multi-component seismic data

Mengqi Li (1), Jun Lu (1), Ying Shi (2), and Yun Wang (3)

(1) School of Energy Resources, China University of Geosciences (Beijing), China (leemq0111@163.com), (2) Department of Mathematical Sciences, Tsinghua University, China, (3) School of Geophysics and Information Technology, China University of Geosciences (Beijing), China

Split PS1- and PS2-waves of multi-component seismic data are usually used in petroleum exploration to predict the fracture development. However, the resolution of seismic data is not high enough to identify the fractures developed in thin beds such as coal seams and thin shale beds. To solve this problem, we propose an approach to derive fracture parameters using Alford rotation and joint PP- and PS1-wave AVO inversion. Compared with pre-stack seismic data, post-stack seismic data have a relatively higher signal-to-noise ratio. Therefore, we scan post-stack R- and T-components to derive fracture azimuths using Alford rotation. Due to the wavefield mixing of post-stack data, PS1- and PS2-waves can hardly be separated thoroughly based on post-stack Alford rotation. Therefore, we only use the azimuths derived from post-stack R- and T-components to rotate pre-stack R- and T-component records, which are then migrated to be PS1- and PS2-wave sections. Then, we extracted the time delays between PS1- and PS2-events of the target stratum; combined with the PS1-wave interlayer travel-time derived from joint PP- and PS1-wave AVO inversion, we derived the anisotropy parameter $\gamma$. This approach has been applied to the Huainan coalfield in eastern China, producing reliable prediction results of the fracture development in a coal seam with the average thickness of 4.4 m.