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频率域2.5-D井间波形层析成像及其实际应用

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摘要 从频率域3-D声波波动方程出发，结合井间观测方式的特点，基于Tarantola广义反演理论，提出了一种频率域2.5-D井间波形层析成像方法.数值模型试验结果表明：该方法对薄层厚度的分辨能力能达到约主频波长的1/4，且分辨率显著高于走时层析成像，尤其垂直分辨率有实质改善.模拟资料的抗噪试验表明：在信噪比为0.8的情况下，随机噪声对波形层析成像的影响较小；而相干噪声对全波形层析成像的影响显著，特别是初至波附近的强振幅干扰影响更为严重.井间实际资料的试处理结果表明：波形层析成像能很好地刻画井间介质的分布情况与储层连通性，对于油藏开发阶段的方案实施具有指导意义.

关键词 频率域 3-D声波波动方程 井间观测方式 广义反演 波形层析成像 分辨率 噪声

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The 2.5-D cross-well waveform tomography in the frequent domain and its practical application

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Abstract Based on the 3-D acoustic equation and Tarantola′s generalized inversion theorem, taking into consideration the character of cross-well survey, a 2.5-D cross-well waveform tomography method in the frequency domain is presented here. The experimental results of the numeric models show that this method can achieve a resolution for the thin horizontal layers up to 1/4 of the dominant frequency wave length, and its resolution is obviously higher than the travel-time tomography, especially the vertical resolution is substantially improved. The anti-noise tests with synthetic data show that the random noise affects slightly the quality of the waveform tomography in the case of *N/S*=0.8, but the coherent noise affects greatly, especially the strong amplitude disturbance near the first-arrival has a serious effect. The waveform inversion result of practical data shows that the waveform tomography can depict the distribution of the cross-well medium′s property and the reservoir connectivity, and is of importance for oil development.

Key words Frequency domain 3-D acoustic wave equation Cross-well survey Generalized inversion Waveform tomography Resolution Noise

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