

## 径向分层TI孔隙介质井孔中激发的模式波的数值研究

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**摘要** 横向各向同性介质是地层中普遍存在的一种各向异性介质.本文对径向分层TI孔隙介质包围井孔中激发的斯通利波和弯曲波的传播特性进行了理论计算,发现模式波在低频时更多的是反应原状地层的信息,而随着频率的增加侵入带参数逐渐起控制作用;Biot理论描述的地层衰减比速度更容易受井壁附近地层参数的影响.利用灵敏度曲线定量研究了不同频率下地层各个参数对相速度和衰减系数的贡献大小,主要结果显示模式波的衰减受水平渗透率影响明显,而垂直渗透率的变化对模式波几乎无影响;斯通利波对水平传播的横波速度比弯曲波的灵敏度高.从单极子和偶极子声源在井孔中激发的全波波形也可发现,声波测井仪器较宽的声源频带和合适的源距设置有利于对不同径向深度上的地层声学参数进行成像.

**关键词** [径向分层](#) [TI孔隙地层](#) [灵敏度](#) [频散曲线](#) [探测深度](#)

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A numerical study on the mode waves excited by multipole sources in the fluid-filled borehole in radially layered transversely isotropic porous medium

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**Abstract** The propagating properties of the mode waves excited by multipole sources in a fluid-filled borehole embedded in radially layered transversely isotropic porous formation are investigated. The results show that the propagating characteristics of the mode waves are determined mostly by the virgin formation in the low frequency band, and with the frequency increasing the characteristics of the mode waves are controlled by the invaded zone gradually. In the Biot theory the attenuation is easier to be affected by the formation around the borehole wall than the velocity. The frequency-dependent sensitivity coefficients with respect to the parameters of the radial layers are computed quantitatively. Comparing the horizontal permeability with the vertical permeability, the horizontal mobility plays the predominant role over the entire frequency range. The Stoneley wave is more sensitive to the velocity of the horizontally propagating SH wave than the flexural wave. The results of the work also show that the acoustic logging tool with broadband and distributed receiver array is advantageous to image the acoustic parameters at different radial depths.

**Key words** [Radial layer](#); [Transversely isotropic porous formation](#); [Sensitivity](#); [Dispersion curve](#); [Detecting depth](#)

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