 Proceedings of ICCES'08, pp.1453-1453

Cased hole flexural modes in anisotropic formations

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Summary

Based on the perturbation method, for flexural wave in cased hole in anisotropic formation, the alteration in the phase velocity caused by the differences in elastic constants between anisotropic formation of interest and a reference, or unperturbed isotropic formation is obtained. Assuming the cased hole is well bonded, the Thomson-Haskell transfer matrix method is applied to calculate the dispersion relation of flexural wave in cased hole in unperturbed isotropic formation. Both the cases of a fast and slow formation are considered where the symmetry axis of a transversely isotropic (TI) formation makes an angle with the cased hole axis, the dispersion of the phase velocity of the flexural mode in cased holes is studied. The corresponding dispersion curves of flexural wave in open hole are presented simultaneously for comparison. The computational results indicate that because of the influence of the casing, the flexural wave dispersion curves in cased hole in both fast and slow TI formations all almost tend toward an identical Stoneley wave velocity at higher frequency. The casing and the cement affect the form as well as the cut-off frequency of flexural wave dispersion curves more greatly in slow TI formation than in fast TI formation. At a frequency high enough, the flexural and the Stoneley waves reach the appropriate Scholte wave velocity in both the open hole and cased hole situation.