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テクニカル　レポート

遠方からの応力や，内圧を受ける場合の，無限弾性体中の円管の変形

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Deformation of Cased Circular Holes by Horizontal Stresses Working at Infinity and Internal Pressure

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Abstract

Crustal deformation is routinely observed with borehole tiltmeters and/or strainmeters.

In most cases a borehole tiltmeter is fixed to the borehole casing by a clamping device. When the borehole is deformed by external stress, the center of the vessel shifts from the original location, and this shift may cause a spurious tilt. To estimate this possible false tilt, we need an analytical method to calculate the deformation of cased boreholes under such conditions.

A borehole strainmeter, regardless of type, is installed into an open borehole with mortar or cement grouting, and we measure the deformation of the cylindrical vessel under the outer stress field. The relation between deformation of a cylinder and the stresses acting at infinity is important in the derivation of strain.

The author treated two-layer models, composed of an inner metal cylinder and outer elastic medium, in his first paper regarding the Sakata-type three-component strainmeter (1981), in which the effects of casings, as well as formulas to express stress and displacement distributions were discussed.

In this paper the method for two-layer models is applied to three-layer models, in which the intermediate grouting strata are considered. Coefficients in the formulas to describe the stress and displacement distributions are obtained by solving the simultaneous equations in the text.

In addition the deformation of a metal cylinder submitted to fluid pressure on the inner surface is treated. The results may be applicable to estimate the effects of atmospheric pressure changes in boreholes that contain water.