This is because the layer thicknesses occurring in the calculations are nearly equal and are small in comparison with $x_0$, and in this situation, calculations based on the expressions for a homogeneous medium will give satisfactory results.

**LITERATURE CITED**

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**USE OF THE EXPERIMENTAL-ANALYTICAL METHOD TO DETERMINE THE THREE-DIMENSIONAL STRESS-STRAIN STATE OF THE ROOF DURING WORKING OF EAST GERMAN POTASH DEPOSITS**

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The planning and execution of mining operations, particularly when the procedures involve small losses of useful minerals, means that workers in the field of rock mechanics must solve the problem of analyzing the stress-strain state of the rocks to estimate the stability of the underground workings and ensure safe working. This can be done either by measuring the stresses in the field or by analytical methods based on physical and mathematical models and extensive use of computers. The applicability of the analytical solution and the degree of reliability of the results of investigation depend in fact not only on the formal validity of the method employed but also strongly on the extent to which we can take account (both qualitatively and quantitatively) of the geometry and structural characteristics of the mining-out area and rock, the characteristics and behavior of the rocks, and the boundary conditions.

The experimental-analytical method developed in the Institute of Mining, Siberian Branch, Academy of Sciences of the USSR, enables us to determine the three-dimensional stress-strain state of rocks on the basis of the use of elasticity theory for a half space, using the working periphery displacement vector as boundary conditions.

Working in conjunction with the Institute of Mining, Siberian Branch, Academy of Sciences of the USSR, in 1977 the Institute of Safety in Mines (ISM) at Leipzig commenced work on the adoption of the experimental-analytical method and its use for research in the German Democratic Republic.

Brief Review of the Experimental-Analytical Method [1-4]. The calculation procedure involved was obtained from a solution to the problem of the theory of elasticity of the stress-strain state of a half space with given surface displacements on the boundary plane [3, 5].

To a first approximation the mining environment and the geomechanical situation during working of a horizontal sheet deposit at a considerable depth can be represented by the following model: a) The mining-out space formed is a platelike cavity, the height of which is negligible in comparison with the lateral dimensions; b) the extraction working is performed at a great depth, which is such that the influence of the earth's surface on the stress-strain state of the solid rock can be disregarded; c) the solid rock above the mining-out space and the sheet is regarded as a uniform isotropic half-space \((-\infty < x, y < \infty, z > 0\)), loaded at infinity by the initial stressed state of the undisturbed rock in the vicinity of the working. In particular, in absence of data on the tectonic stresses we can assume that

\[
\sigma^0_{ij}(x, y, z) = \begin{pmatrix}
\sigma^0_x & 0 & 0 \\
0 & \sigma^0_y & 0 \\
0 & 0 & \sigma^0_z
\end{pmatrix},
\]

where \(\sigma^0_x = \sigma^0_y = \lambda \gamma H; \sigma^0_z = \gamma H; \lambda = \nu(1-\nu)^{-1};\) d) rocks have elastic properties and are characterized by the Young's modulus \(E\) and Poisson's ratio \(\nu\); e) assume that over the whole roof surface \((x, y, z = 0)\) the horizontal displacements are small \(U(x, y, z = 0) = V(x, y, z = 0) = 0\), and the vertical displacements of the roof \(W(x, y, z = 0)\) correspond to its settling and are measured under natural conditions.

From the known displacement surface in the roof plane \(W = W(x, y, z = 0)\) we can determine [3] the displacement vector components in the solid rock \(U(x, y, z), V(x, y, z),\) and \(W(x, y, z)\) the additional deformations \(\epsilon_{ij}(x, y, z)\) and stresses \(\sigma^{d}_{ij}(x, y, z)\) induced by mining-out work. The stressed state of the solid rock is determined as

\[
\sigma_{ij} = \sigma^d_{ij} + \sigma^0_{ij} \quad (i, j = x, y, z).
\]

In practical calculations by the experimental-analytical method we use the superposition principle, permitting calculation of the change in the mechanical state of the rock during working of a seam. The surface of displacements \(W(x, y, z = 0)\) depends on the shape and size of the mining-out space and is formed from the elements — displacement increments.