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TITLE: (6) Contact problem for a many-layer base

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TEXT: The base is assumed to consist of an arbitrary number of layers having different elastic properties, each with constant thickness. It is also assumed that no gaps are formed between the layers during deformation, the deformation is plane, the displacements are equal to zero at infinity, the state of loading is symmetrical with respect to the x axis, the stress functions and their derivatives up to the fourth order satisfy the conditions of existence of Fourier's sine and cosine transformations. Recurrence formulas are given which make it possible to solve the basic problems of the theory of elasticity for bases consisting of any number of layers, if two image functions for one of these layers can be found. The authors consider the case when the lowest layer is placed on a rigid

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surface and a symmetrical die acts on the top layer. The image function $\alpha(p)$ for the top layer is sought in the form

$$\alpha(p) = \frac{1}{1p^2}\int_0^a \chi(t) J_0(pt)\,dt \qquad (2.5)$$

J_0 denoting the cylindrical function of the first kind. The problem is reduced to a Fredholm integral equation

$$\chi(x) = \frac{E}{2(1-\nu^2)}\left[y'(0+x)\int_0^{\frac{\pi}{2}} y''(x \sin\gamma)\,d\gamma\right] + \int_0^a \chi(t)K(x,t)\,dt \qquad (2.11)$$

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where y(x) is a function determining the shape of the die, and

$$K(x,t) = x \int_0^{\infty} p\varphi(p) J_0(px) J_0(pt)\,dp \qquad (2.12)$$

$$\varphi(p) = 1 - \frac{A(p)}{1} \qquad (2.8)$$

$$\beta_1 = \alpha_1 pA(p) \qquad (1.6)$$

/ Abstracter's note: 1 not defined, probably Eq. (2.6) in which the left hand side is missing. / The image functions α and β were defined by the authors in a previous paper (Prykładna mekhanika, v. 8, 1962, no. 2), 2a is the maximum width of the die. When the layer thickness tends to ∞ one obtains the solution for a half-plane

/ Abstracter's note: The meaning in which the authors use this term is not clear. / Eq. (2.11) is reduced to a form suitable for numerical computation. Tables of auxiliary coefficients which do not depend on the shape of the die are given for the case of a layer placed on a half-plane and on a rigid base. The method of computation is described and the results quoted for the two above cases, the die being round and the contact segment four times as large as the layer thickness. The forces P have the form $P = m\pi Ea^2/(1-\nu^2)R$. The radius of the die R is assumed to be sufficiently large. The coefficient m is equal to 0.21 for a layer on a half-plane and to 0.51 for a layer on a rigid base. There are 2 tables and 1 figure.

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