NONSTEADY THERMAL STRESSES AT THE EDGES OF HOLES IN BOILER SHELLS

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UDC 539.3:536.21

A method is described by which one can calculate quasisteady thermal stresses around a pipe hole during heating or cooling at a constant rate. It is assumed in the solution of the problem that the neighboring holes, the wall curvature, and the inserted pipe all have an insignificant effect here and that the wall dimensions beyond the radius of the hole are infinite.

The expression which has been obtained for the temperature field by solving the differential equation of heat conduction in cylindrical coordinates r, z is a sum of two terms. The first one (t*) is a function of z only and represents the known solution for an infinitely large plate, the second one (t**) represents the effect of the hole and decreases fast with increasing r. The thermoelasticity problem is solved by expressing the components of the stress field in terms of the thermoelastic displacement potential and the Liav stress function. The stresses due to component (t*) are determined by the approximation method.

The stresses at a surface along which a heat carrier flows can be determined by the formula:

$$\sigma = \sigma_{\rho\to\infty}(1 \pm \rho^{-2}),$$

where $\rho = r/r_0$, r_0 is the radius of the hole, and $\sigma_{\rho\to\infty}$ is the stress at the wall surface without a hole.

The plus sign before the ρ^{-2} term applies to tangential (circumferential) stresses, the minus sign to radial stresses.

Eastern Branch of the F. E. Dzerzhinskii All-Union Institute of Heat Engineering, Chelyabinsk. Translated from Inzhenerno-Fizicheskii Zhurnal, Vol. 20, No. 5, p. 940, May, 1971. Original article submitted April 7, 1970; revision submitted July 28, 1970.