THE USE OF VERTICAL CAVITY TO CONTROL THE BUSY STATE WHEN EXPLOSIVE AND NON-STATIONARY SEISMIC WAVE IMPACTS

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Discusses the use of vertical rectangular cavities to control the busy state during explosive and non-stationary seismic wave influences. For the solution of two-dimensional non-stationary dynamic problem of elasticity theory with initial and boundary conditions we use the method of finite elements in displacements. In works [1–5] is some information on the practical implementation of numerical modeling of non-stationary of stress waves in complex deformable objects using numerical method, algorithm and software.

The calculations were conducted with the following initial data: $H = \Delta x = \Delta y$; $\Delta t = 1{,}393 \cdot 10^{-6}$ c; $E = 3{,}15 \cdot 10^{4}$ МПа; $\nu = 0{,}2$; $\rho = 0{,}255 \cdot 10^4$ кг/м^3; $C_p = 3587$ м/с; $C_s = 2269$ м/с. Solve the system of equations of 59048 unknown.

Consider the task focused on the impact of the blast wave on the free surface of an elastic half-plane with the cavity (ratio of width to height of one to twelve) (fig. 1). At the point F perpendicular to the free surface $ABEFG$ applied concentrated normal stress σ_y (fig. 1), which, when $0 \le n \le 10$ $(n = t / \Delta t)$ changes linearly from 0 to P, and when $10 \le n \le 20$ from P to 0 ($P = \sigma_0$, $\sigma_0 = -0{,}1$ МПа). The boundary conditions for the contour $GHIA$ in $t > 0$ $u = v = \dot{u} = \dot{v} = 0$. The reflected waves from the contour $GHIA$ do not reach to the point when $0 \le n \le 200$. Contour $ABCDEFG$ free of loads, besides the point F, where is applied a concentrated elastic normal stress σ_y. The results of calculations for grid voltages $\bar{\sigma}_k (\bar{\sigma}_k = \sigma_k / |\sigma_0|)$ in time n received at the point $A1$ (fig. 2), located on the free surface of an elastic half-plane: 1 – in the problem without cavity; 2 – in the problem with the cavity (the ratio of width to height of one to twelve).

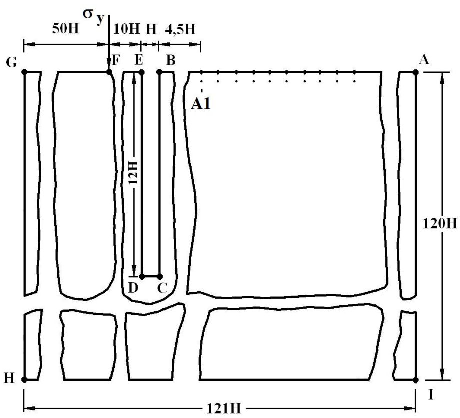

Fig. 1. The problem statement focused on the impact of the blast wave on the free surface of an elastic half-plane with the cavity (ratio of width to height of one to twelve)

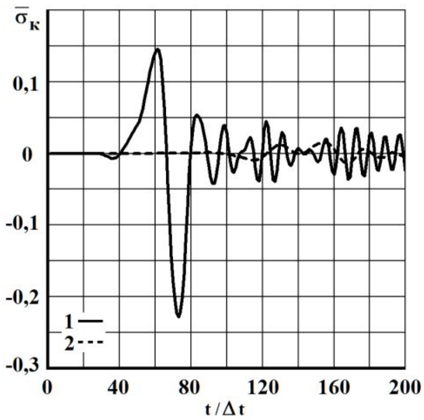

Fig. 2. The change of elastic contour stress $\bar{\sigma}_k$ in time $t / \Delta t$ at the point $A1$: 1 – in the problem without cavity; 2 – in the problem with the cavity (ratio of width to height of one to twelve)

Consider the problem of the influence of flat longitudinal seismic waves parallel free surface elastic half-plane with the cavity (ratio of width to height of one to twelve) (fig. 3). From the point F parallel to the free surface $ABEFG$ applied normal stress σ_x, which, when $0 \le n \le 10$

($n = t/\Delta t$) varies linearly from 0 to P, and when $n \geq 10$ same P ($P = \sigma_0$, $\sigma_0 = 0{,}1$ MПa). The boundary conditions for the contour GHIA in $t > 0$ $u = v = \dot{u} = \dot{v} = 0$. The reflected waves from the contour GHIA do not reach to the point when $0 \leq n \leq 200$. Contour ABCDEFG free from loading, besides the point F. The results of calculations for grid voltages $\bar{\sigma}_k$ ($\bar{\sigma}_k = \sigma_k / |\sigma_0|$) in time n received at the point A1 (fig. 4), located on the free surface of an elastic half-plane.

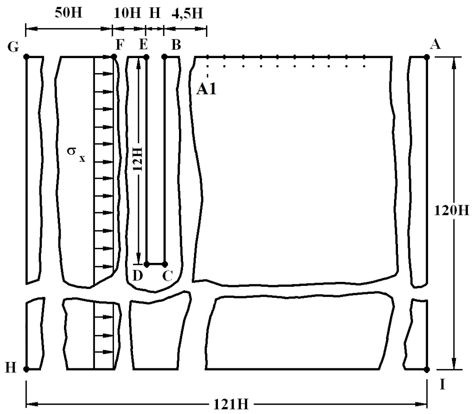

Fig. 3. Statement of the problem on impact of a flat longitudinal seismic waves on an elastic half-plane with the cavity (ratio of width to height of one to twelve)

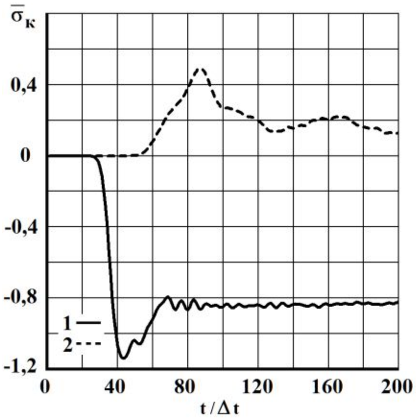

Fig. 4. The change of elastic contour stress $\bar{\sigma}_k$ in time $t/\Delta t$ at the point A1: 1 – in the problem without cavity; 2 – in the problem with the cavity (ratio of width to height of one to twelve)

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