

. 1. ; 2 - ; 3 - ; 4 -

( ) , [2]

$$\rho \left( \frac{\partial U}{\partial t} + U \frac{\partial U}{\partial r} \right) = \frac{\partial \sigma_r}{\partial r} + \frac{\sigma_r - \sigma_\theta}{r}, U = \frac{\partial r}{\partial t}; \quad (1)$$

$$\frac{\partial \rho}{\partial t} + \frac{1}{r} \frac{\partial (r \rho U)}{\partial r} = 0; \quad (2)$$

$$\frac{\partial E}{\partial t} + P \frac{\partial \bar{V}}{\partial t} - \bar{V} (S_r \dot{\epsilon}_r + S_\theta \dot{\epsilon}_\theta + S_z \dot{\epsilon}_z) = 0; \quad (3)$$

$$\sigma_i = S_i - P, \quad (i = r, \theta, z), \quad (4)$$

- ; \$U\$ - ; \$t\$ - ; \$P\$ - ; \$r, \theta, z\$ - ; \$\sigma\_i, S\_i\$ -

; \$\bar{V} = V/V\_0\$, \$V\$, \$V\_0\$ - ,

(3)

$$S_i = 0.$$

$$\dot{\epsilon}_r = \frac{\partial U}{\partial r}, \dot{\epsilon}_\theta = \frac{U}{r}, \dot{\epsilon}_z = 0. \quad (5)$$

[3]:

$$P = A \rho^N + B \rho^{\gamma+1}. \quad (6)$$

$$(6) \rightarrow P_n \quad [4]$$

$$P = P_n \left( \frac{\rho}{\rho_n} \right)^{k_n}, \tag{7}$$

$k_n -$  ) (6)  $\rightarrow P_0$  ( 0 -

$$P = P_0 \left( \frac{\rho}{\rho_0} \right)^{k_0}, \tag{8}$$

$0, k_0 -$   $P = P_0; P_n, \rho_n -$   
(7) (8).

$Q$

$$E = Q + \frac{P_n - P_0}{2} \left( \frac{1}{\rho_0} - \frac{1}{\rho_n} \right). \tag{9}$$

(6) (7)  $, N, \gamma$  (6)  $(\rho_n, \rho_n)$  (6) (8)  $P \rightarrow P_0$   $P_n$   $P_0$   
(6)

$$k_n = \frac{N + B \rho_n^{\gamma+1} (\gamma + 1 - N)}{\rho_n}, \quad \gamma = k_0 - 1,$$

$$Q = \frac{(\rho_n - \rho_0)(V_0 - V_n)}{2} = \frac{P_n - P_0}{\rho_n (N - 1)} + \frac{B \rho_n^\gamma (N - 1 - \gamma)}{\gamma (N - 1)}. \tag{10}$$

$$P_n = \frac{\rho_0 D_n^2}{k_n + 1}, \quad \rho_n = \frac{\rho_0}{k_n} (k_n + 1), \tag{11}$$

$D_n -$  ,  $A, B, N, \gamma$  (6)

(10)–(11)  
( $D_n, k_n, k_0, Q$  0).

[3]

$$\dot{\varepsilon} = \phi(P, \varepsilon) \dot{P} - \frac{\alpha_1 \lambda(P, \varepsilon)}{\eta} \psi(P, \varepsilon). \tag{12}$$

$$\varepsilon+1 = \left[ \frac{\gamma_{SR}(P-P_0)}{\rho_0 c_{SR}^2} + 1 \right]^{-1/\gamma_{SR}} + \left[ \frac{\gamma_S(P_m-P_0)}{\rho_0 c_S^2} + 1 \right]^{-1/\gamma_S} - \left[ \frac{\gamma_{SR}(P_m-P_0)}{\rho_0 c_{SR}^2} + 1 \right]^{-1/\gamma_{SR}}, \quad (13)$$

$$c_{SR} - \quad ; \gamma_{SR} - \quad ; P_m - \quad ; \varepsilon_{1m}$$

$\varepsilon_{1m}$ ,

$$\varepsilon_1 = \frac{1}{\alpha_1} \left( \varepsilon - \sum_{i=2}^3 \alpha_i \varepsilon_i \right) = \frac{1}{\alpha_1} \left[ \frac{\dot{V}}{V_0} - \sum_{i=2}^3 B_i (A_i (P - P_0) + 1)^{\frac{-(1+\gamma_i)}{\gamma_i}} \dot{P} \right] = 0. \quad (14)$$

$$(14) \quad \varepsilon_1 = \varepsilon_{1m} \quad P_m :$$

$$P_m = P_0 + \left[ (1 + \varepsilon_{1m})^{-\gamma_S} - 1 \right]. \quad (15)$$

$$\quad , \quad (12). \quad - \quad , \quad \dots \quad :$$

$$S_r = - \left( y_0 + \frac{k_t \cdot P}{1 + \frac{k_t P}{\tau - y_0}} \right);$$

$$S_\theta = -\frac{1}{2} S_r, \quad S_z = \frac{2(1+k_t)}{1+2k_t} P, \quad (16)$$

$$y_0 - \quad ; k_t - \quad , \tau -$$

:

$$U = 0, P = P_n, \rho = \rho_n \quad 0 \leq r \leq r_0,$$

$$U = 0, P = 0, \rho = \rho_1 \quad r_0 < r \leq r_n, \quad (17)$$

$$U = 0, P = \sigma_r = 0 \quad r > r_n,$$

$r_n -$

.

:

$$1) \ll \quad \gg, \quad U = 0;$$

2)

 $\sigma_r$  $U$ 

-

(1)...(17)

« » [5]

6

$$\rho_n = 1000 \text{ ( / }^3; n_0 = 2,71; A = 2.238 \text{ ( / }^3)^{-n_0}, B = 3.685 \cdot 10^5 \text{ ( / }^3)^{-1} \\ r_0 = 0,02$$

$$: r_n = 0,05; 0,075; 0,1$$

$$: \rho_{20} = 1000 \text{ / }^3 ;$$

$$\rho_{30} = 2650 \text{ / }^3 ; c_{20} = 1500 \text{ / } ; c_{30} = 4500 \text{ / } -$$

$$P = P_0$$

$$; \gamma_2 = 7, \gamma_3 = 4 -$$

$$\rho_0 = 1890 \text{ / }^3 -$$

$$, \rho_0 c_S^2 = 3 \cdot 10^7 , \rho_0 c_D^2 = 3,67 \cdot 10^9 ,$$

$$\rho_0 c_{SR}^2 = 3,8 \cdot 10^9 -$$

$$; \gamma_S = 4, \gamma_D = 7, \gamma_{SR} = 8 -$$

$$; \gamma_1 = 0,05; \gamma_2 = 0,15; \gamma_3 = 0,8 ,$$

$$= 2000 . ;$$

$$N = 20 \% .$$

$$\rho_0 = \rho_{30} = 1077 \text{ / }^3 ; c_{30} = 1600 \text{ / } -$$

$$P = P_0 ;$$

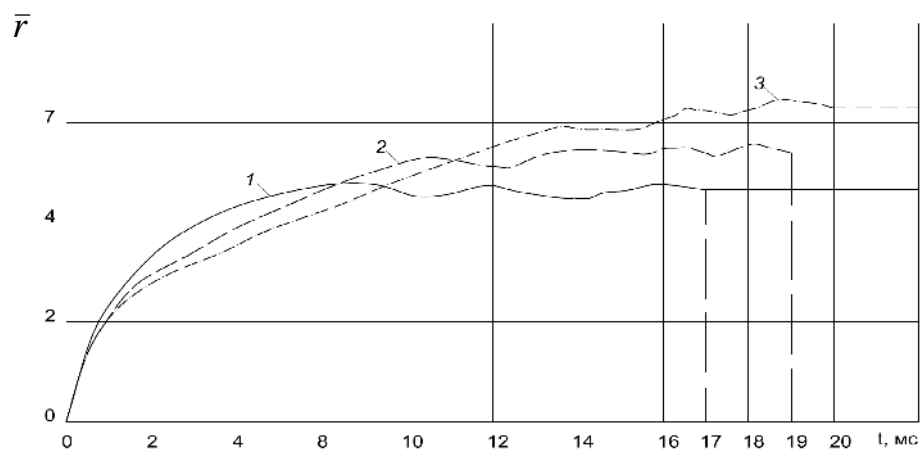
$$\gamma_3 = 4; \rho_0 c_S^2 = 1,23 \cdot 10^7 ; \rho_0 c_D^2 = 1,17 \cdot 10^9 ; \rho_0 c_{SR}^2 = 0,8 \cdot 10^9 -$$

$$; \gamma_S = 4; \gamma_D = 7; \gamma_{SR} = 8 -$$

$$; \gamma = 12 . -$$

$$; N = 0 \% -$$

. 2

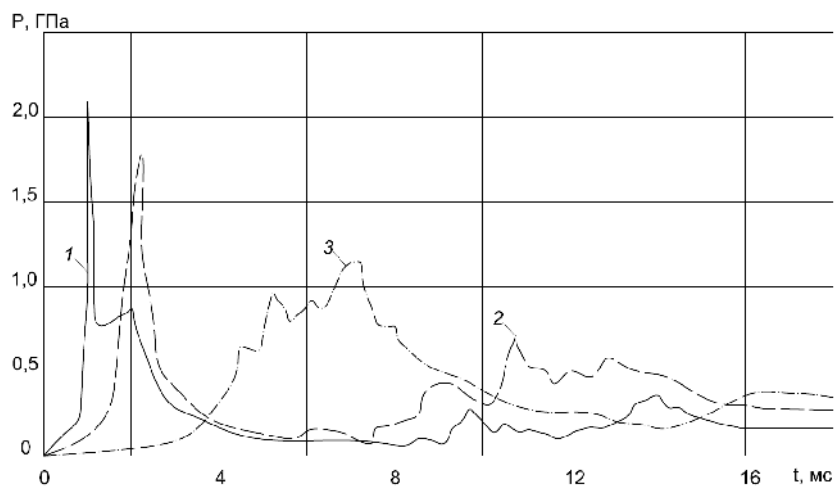


. 2. ; 1, 2, 3 –  
0,05, 0,75 0,01

15, 17 20

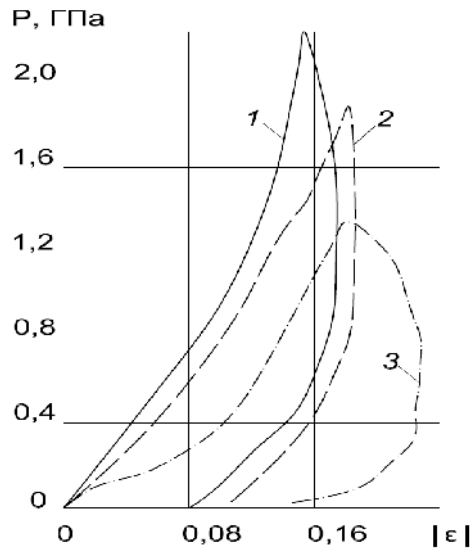
. 3

. 2.



. 3. : 1, 2, 3 – 0,05; 0,75 0,01

. 4



. 4.

: 1, 2, 3 -  
0,05; 0,75 0,01

1)

2)

3)

29 %;

0,05 ,

0,1 ,  
0,1

;

4)

1. . . . / . . . , . . . , . . . , . . . -  
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5.12.2012 .

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