

• • • • •

, -

$$c = (x)_{x^2} \quad (1)$$

$$- \quad ; c - \quad ; - \quad ; - \quad -$$

$$; x - \quad ; \tau - \quad . \quad (1)$$

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[1]. -

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(1). -

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(1). -

[2]. -

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, -

80...90 % [3].

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, -

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(1)

(1).

(1)

$$x \cdot q$$

$$q = - \quad x, \quad (2)$$

q

$$c$$

$$-q_x$$

$$xc = -q_x.$$

$$q_{x^2}$$

(2),

(1),

$$x \cdot x.$$

$$2 \quad x \quad 2$$

$$\theta_2 = \theta_1 + (c\rho)^{-1} \int_{\tau_1}^{\tau_2} \theta'_i d\tau. \quad (3)$$

$$U = U(x,),$$

(1),

(1)

$$U(x,)$$

(3)

(1).

(1)

$$U(x,),$$

(1),

$$x.$$

(1).

= ().

(2)

$$q_x = - \dots \quad (4)$$

$$q_x = -c \\ q_x = - \dots \\ = \text{const},$$

$$= a \dots, a = /c . \quad (5)$$

$$x \quad (4) \quad q_x,$$

x.

$$(1), (4) \quad (5) \quad U(x,)$$

$$(1) \quad (5).$$

$$U(x,) \\ (5)$$

$$x \quad x$$

$$x \quad x \quad x.$$

$$(5).$$

$$(5) \quad U(x,).$$

$$U(x,) \\ (1) \quad (5),$$

$$(2)$$

$$(4) \quad (5).$$

$$(5) \quad U(x,),$$

$$U(x,)$$

$$(1),$$

$$(5),$$

$$[4].$$

$$(1).$$

$$U(x,)$$

$$a \quad b$$

$$a \quad b$$

$$2,$$

$$(3).$$

$$T_s - T_0 = \frac{2R}{T_m - T_0} + C_r(T_m^4 - T_s^4)/(T_m - T_s), \quad (6)$$

/($^2 \cdot \text{K}$); $C_r =$, /($^2 \cdot \text{K}^4$);

$$T = 14 + 0,0038(T - 273) + 0,72 \cdot 10^{-5}(T - 273)^2, \quad /(\cdot), T > 273 \text{ K}. \quad (7)$$

$$(3) \quad \text{Fo} = a/R^2; \text{Fo} < 0,4 \quad (5)$$

$$(T_m - T_s) = T_x(R,) [2]:$$

$$U_a = A_m \text{erfc} W_1 - A_n \exp(-W_2 + W_3^2) \text{erfc}(W_1 + W_3); \quad (8)$$

$$W_1 = (R + h_m x) \sqrt{a\tau}; \quad W_2 = H(R + h_m x); \quad H = a/;$$

$$W_3 = H \sqrt{a\tau}; \quad h_{m1} = -1; \quad h_{m2} = 1.$$

$$A_m = A_n \frac{T_s - T_0}{T_m - T_0}, \quad (8)$$

$$T = T_0 + \frac{A_m}{A_n} (T_m - T_0) \text{erfc}(W_1 + W_3) - \frac{A_m}{A_n} \text{erfc} W_1 + \exp(-W_2 + W_3^2) \text{erfc}(W_1 + W_3) - \text{erfc} W_1, \quad (1),$$

$$\text{Fo} > 0,4$$

$$U_{a1} = A_m \cos(h_n x/R) \exp(-h_n^2 \text{Fo}), \quad (9)$$

$$(5),$$

$$[2].$$

$$(T_m - T_s) = \frac{A_m}{A_n} \frac{h_n}{\text{Bi}} \text{ctg} h_n = h_n/\text{Bi} \quad (\text{Bi} = HR) [5].$$

$$T(x,)$$

$$[6, 7].$$

	0	2	4	6	8
T	887	887,5	888	890	892
	10	12	14	16	18
T	894	897	901	905	910

$$(8) \quad (9)$$

$$(3).$$

(1).

(3)

$$U = U(x, \dots)$$

[5].

$$U(x, \dots)$$

$$c = (r_h) r + r/r \quad (10)$$

$$= 0, \quad = h, \quad h = 273 \text{ K} \quad (11)$$

R:

$$r = R, \quad = s, \quad (12)$$

$$R - \quad , \quad ; \quad h - \quad , \text{ K}; \quad s - \quad , \text{ K}.$$

$$q_1 = - \quad (r_h, \dots)$$

$$r(r_h, \dots) d = L d, \quad (13)$$

$$L - \quad , \quad / \quad ; \quad - \quad , \quad ; \quad r_h - \quad - \quad , \quad r_h = R - \quad , \quad . \quad d \quad d$$

r_h (10)...(13).

$$dq_1 = \frac{L d}{R}, \quad (13),$$

$$U_c = 0 \quad (= U_c). \quad dq_1, \quad (r_h, \dots),$$

$$dq_1,$$

:

$$U_c = h - (h - 1) \ln(r/r_h) / \ln(R/r_h), \quad \theta_1 = (A - h - s)U(R, r), \quad (14)$$

$$A - \dots; U(R, r) - \dots, \quad r = R. \quad (14)$$

$$(\dots)_r + \dots/r = 0, \quad (10)$$

$$= 0.$$

(10) [4]:

$$U(R, r) = B_n J_0(h_n(r - r_h)/R) W_1; \quad W_1 = \exp(-h_n^2 Fo), \quad (15)$$

$$J_0(h_n r/R) - \dots; \quad Fo = a/R^2 - \dots; \quad (12), \quad h_n \quad [5]: \quad h_1 = 2,4048; h_2 = 5,5201; h_3 = 8,6537; h_4 = 11,7915; h_5 = 14,9309. \quad (14) \quad (15)$$

$$= U_c + AU(R, r), \quad (16)$$

1 (14)

R:

$$Vc(\dots) = 2 RA (U_c)_x(R, r); \quad V = W; \quad W = (R^2 - r_h^2) \quad (17)$$

(16)

$$dv = 2 rzdr \quad (z = 1):$$

$$\theta_m = \theta_s + (\theta_h - \theta_s) V^{-1} \int_{r_h}^R 2\pi r \theta dr. \quad (18)$$

(14)...(16) (18)

$$m = s + (h - 1)[R^2 - W/(2 \ln(R/r_h))]W^{-1} + D_n(1 - s)W_1, \quad (19)$$

$$D_n = 4 J_1[h_n(R - r_h)/R] / h_n^2 J_1(h_n).$$

(10)...(13)

(16),

(10)

(14)

(15)

. 2.

$$= 2,2 / (\dots); \quad = 916,8 / ^3; \quad L = 332,4 / ; \quad = 2,04 / (\dots \cdot K).$$

(13)

i-1

i - i-1.

(10)...(13)

	5	10	15	20	25
	1,25	4,75	10,23	17,39	25,87
	30	35	40	45	50
	35,22	45,14	54,93	64,10	76,90

[4, 5].

[5].

$$R_n c = (r)_r + R_n.$$

R_n .

[6, 7].

1. ... // ... (...) . - 2004. - 4.
2. ... // ... - 1991. - 7. - .27.
3., 1982.
4., 1964.
5., 1967.
6. ... // ... - 1992. - 1. - .62.

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