$$c(T)\frac{\partial T}{\partial t}=\frac{\partial}{\partial x}\left(\lambda(T)\frac{\partial T}{\partial x}\right)-\frac{2}{R}\alpha(x)T+k(T)F_0(t)e^{-k(T(x))x}+\frac{2T_0}{R}\alpha(x).$$

$$0\le x\le l$$
$$0\le t\le T$$

$$\begin{cases} t=0; & T(x,0)=T_0\\ x=0, & +\lambda(T(0))\frac{\partial T}{\partial x}=\alpha_0(T(0)-T_0)\\ x=l, & -\lambda(T(l))\frac{\partial T}{\partial x}=\alpha_N(T(l)-T_0).\end{cases}$$

$V \to F_0$

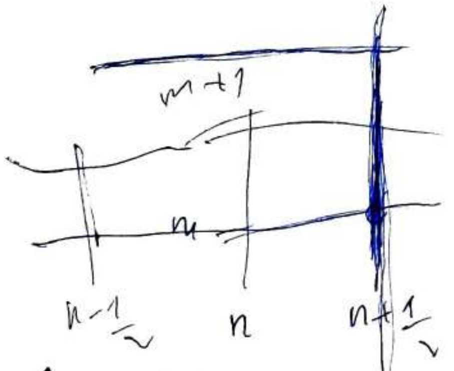
$$\cancel{\left.\frac{\partial u}{\partial t}\right|_{x=x_n}=\frac{y_n^{m+1}-y_n^m}{\tau}}$$

$$\cancel{\left.\frac{\partial u}{\partial x}\right|_{t=t_{m+1}}=\frac{y_{n+1}^{m+1}-y_n^{m+1}}{h}}$$

$$\cancel{\left.\frac{\partial^2 u}{\partial x^2}\right|_{t=t_{m+1}}=\frac{y_{n+1}^{m+1}-2y_n^{m+1}+y_{n-1}^{m+1}}{h^2}=\frac{\hat y_{n+1}-2\hat y_n-\hat y_{n-1}}{h^2}}$$

$$\cancel{\left.\frac{\partial T}{\partial t}\right|_{x=x_n}=\frac{y_n^{m+1}-y_n^m}{\tau}=\frac{\hat y_n-y_n}{\tau}}\qquad \frac{c(T_{m+1})-c(T_m)}{\tau}$$

$$\cancel{\int_{x_{n-\frac12}}^{x_{n+\frac12}}dx\int_{t_m}^{t_{m+1}}c(T)\frac{\partial T}{\partial t}dt=\int_{x_{n-\frac12}}^{x_{n+\frac12}}\int_{t_m}^{t_{m+1}}c(T)\,\partial T=\hat c_n(\hat y}\qquad \hat y-y$$



$$\int_{x_{n-\frac12}}^{x_{n+\frac12}}dx\int_{t_m}^{t_{m+1}}c(T)\frac{\partial T}{\partial t}dt=\int_{x_{n-\frac12}}^{x_{n+\frac12}}\hat c(\hat T-T)\,dx=\hat c_n(\hat y_n-y_n)h$$

$$\int_{t_m}^{t_{m+1}}dt\int_{x_{n-\frac12}}^{x_{n+\frac12}}\left(\frac{\partial}{\partial x}\left(\lambda(T)\frac{\partial T}{\partial x}\right)-\overbrace{\frac{2}{R}\alpha(x)T}^{p(T)T}+k(T)F_0(t)e^{-k(T(x))x}+\frac{2T_0}{R}\alpha(x)\right)dx$$

простo
разностоb

$$=\left\{F=-\lambda(T)\frac{\partial T}{\partial x}\right\}=-\int dt\int\frac{\partial F}{\partial x}dx-\iint\frac{2}{R}\alpha(x)T\,dx\,dt+$$

$$+\iint k(T)F_0(t)e^{-k(T(x))x}dx\,dt+\iint\frac{2T_0}{R}\alpha(x)\,dx\,dt=$$

$$=-\int(F_{n+\frac12}-F_{n-\frac12})dt-\int\frac{2}{R}\alpha_nT_nh\,dt+\int k(T_n)F_0(t)e^{-k(T_n)x_n}h\,dt+$$

$$+\int\frac{2T_0}{R}\alpha_nT_nh\,dt=$$

$$= -\left(\hat{F}_{n+\frac{1}{2}} - \hat{F}_{n+\frac{1}{2}}\right)\tau - \frac{2}{R}\alpha_n T_n h\tau + \cancel{\ldots}$$

$$\cancel{\ldots} + k(T_n)\, F_0(t_n)\, e^{-k(T_n)x_n} h\tau +$$

$$\cancel{\ldots} + \frac{2T_0}{R}\alpha_n T_n h\tau.$$

$$F = -\lambda(T)\frac{\partial T}{\partial x}$$

прош. резуль.

$$\frac{\partial T}{\partial x} = -\frac{F}{\lambda(T)} \Rightarrow \int_{x_n}^{x_{n+1}} \frac{\partial T}{\partial x}dx = -\int_{x_n}^{x_{n+1}} \frac{F}{\lambda(T)}dx$$

$$y_{n+1} - y_n = -F_{n+\frac{1}{2}} \int_{x_n}^{x_{n+1}} \frac{dx}{\lambda(T)}$$

метод средних.

$$F_{n+\frac{1}{2}} = \varkappa_{n+\frac{1}{2}} \frac{y_n - y_{n+1}}{h} \qquad \varkappa = \frac{h}{\int \frac{dx}{\lambda(T)}}$$

$$\varkappa_{n+\frac{1}{2}} = \frac{\lambda(T_n) + \lambda(T_{n+1})}{2}$$

$$\cancel{\varkappa = \frac{h}{\frac{\frac{1}{\lambda(T_{n+1})} + \frac{1}{\lambda(T_n)}}{2}}}$$

$$\boxed{\begin{aligned} F_{n-\frac{1}{2}} &= \varkappa_{n-\frac{1}{2}} \frac{y_{n-1} - y_n}{h} \\ \varkappa_{n-\frac{1}{2}} &= \frac{\lambda(T_{n-1}) + \lambda(T_n)}{2} \end{aligned}}$$

$$\varkappa = \frac{h}{\frac{1}{\lambda(T_{n+\frac{1}{2}})} \cdot h} =$$

$$F_0 = \alpha_0 (\hat{y}_0 - y_0)$$

$$= \lambda(T_{n+\frac{1}{2}}) =$$

метод средних. $= \dfrac{\lambda(T_n) + \lambda(T_{n+1})}{2}$

Итого:

$$\hat C_n(\hat y_n - y_n)h = \tau\hat\varkappa_{n-\frac12}\frac{\hat y_{n-1}-\hat y_n}{h} - \tau\hat\varkappa_{n+\frac12}\frac{\hat y_n-\hat y_{n+1}}{h} -$$

$$-\frac{2}{R}\alpha_n\hat y_n\tau + k(y_n)F_0(t_n)e^{-k(y_n)x_n}\tau + \frac{2T_0}{R}\alpha_n y_n h\tau$$

Преобразуем к виду:

$$\hat A_n\hat y_{n-1} - \hat B_n\hat y_n + \hat D_n\hat y_{n+1} = -\hat G_n$$

$$\hat A_n = \tau\frac{\hat\varkappa_{n-\frac12}}{h} \qquad \hat D_n = \tau\frac{\hat\varkappa_{n+\frac12}}{h}$$

$$B_n = \hat C_n h + \hat A_n + \hat D_n - \frac{2}{R}\alpha_n\tau$$ ← ! B в формулу с минусом

$$\hat G_n = k(y_n)F_0(t_n)e^{-k(y_n)x_n} + \frac{2T_0}{R}\alpha_n y_n h\tau$$

Краевые условия. Левый край метод трапеций.

$$\cancel{\int_{x_0}^{x_{\frac12}}dx\int_{t_m}^{t_{m+1}}c(T)\frac{\partial T}{\partial t}dt =}$$

q верно.

$$\int_{x_0}^{x_{\frac12}}\hat C(\hat T - T)\,dx = \frac{\hat C_{\frac12}(\hat T_{\frac12}-T_{\frac12}) + \hat C_0(\hat T_0 - T_0)}{2}\cdot\frac{h}{2} = \frac{h}{4}(-\,''\,-)$$

Правая часть: (по времени так же как τ, по x — $\frac{h}{2}$).

$$-(\hat F_{\frac12} - \hat F_0)\tau - \frac{2}{R}\left(\frac{\alpha_{\frac12}T_{\frac12} + \alpha_0 T_0}{2}\right)\frac{h}{2}\tau +$$

$$+\frac{k_{\frac12}F_0(t_m)e^{-k(T_{\frac12})x_{\frac12}} + k_0F_0(t_m)e^{-k(T_0)x_0}}{2}\frac{h}{2}\tau +$$

$$+\frac{2T_0}{R}\frac{\alpha_{\frac12}+\alpha_0}{2}\frac{h}{2}\cdot\frac{y_0+y_1}{2}$$

находим методом пр. р-ов

это упрощение :3

трапеций.

~~Преобразуем к виду:~~ $T_{\frac{1}{2}} = y_{\frac{1}{2}}$ $T_0 = y_0$

$$\hat{F}_{\frac{1}{2}} = \hat{\varkappa}_{\frac{1}{2}} \frac{\hat{y}_0 - \hat{y}_1}{h} \qquad y_{\frac{1}{2}} = \frac{y_0 + y_1}{2}$$

$$\hat{F}_0 = \hat{F} = F(t_{m+1})$$

$F_N = \alpha_0 \hat{y}_N - \alpha_0 T_0$

Преобразуем к виду. $-\hat{F}_0 = \alpha_0 (\hat{y}_0 - T_0)$

$$\hat{K}_0 \hat{y}_0 + \hat{M}_0 \hat{y}_1 = \hat{P}_0$$

$\hat{F}_0 = \alpha_0 \hat{y}_0 + \alpha_0 T_0$

~~Правая~~ Левая

$$\left(\hat{c}_{\frac{1}{2}} \left(\frac{\hat{y}_1 + \hat{y}_0}{2} - \frac{y_1 + y_0}{2} \right) + \hat{c}_0 (\hat{y}_0 - y_0) \right) \cdot \frac{h}{4} =$$

$$= \left(\frac{\hat{c}_0 + \hat{c}_1}{2} \cdot \frac{1}{2} \left(\hat{y}_1 + \hat{y}_0 - y_1 - y_0 \right) + \hat{c}_0 (\hat{y}_0 - y_0) \right) \frac{h}{4} =$$

$$= \left((\hat{c}_0 + \hat{c}_1)(\hat{y}_1 + \hat{y}_0 - y_1 - y_0) + 4\hat{c}_0 (\hat{y}_0 - y_0) \right) \frac{h}{16} =$$

$$= \left((\hat{c}_0 + \hat{c}_1)\hat{y}_1 + (\hat{c}_0 + \hat{c}_1)\hat{y}_0 - (\hat{c}_0 + \hat{c}_1) y_1 - (\hat{c}_0 + \hat{c}_1) y_0 + \right.$$

$$\left. + 4\hat{c}_0 \hat{y}_0 - 4\hat{c}_0 y_0 \right) \frac{h}{16} =$$

$$\cancel{= \left((\hat{c}_0 + \hat{c}_1)\hat{y}_1 + (2\hat{c}_0 + \hat{c}_1)\hat{y}_0 - (\hat{c}_0 + \hat{c}_1) y_1 - (2\hat{c}_0 + \hat{c}_1) y_0 \right) \frac{h}{16}}$$

$\frac{\alpha_0 + \alpha_1}{2} + \alpha_0 = \frac{3\alpha_0 + \alpha_1}{2}$

~~Левая~~ Правая

$-\alpha_0 \hat{y}_0 + T_0 \alpha_0$

$$\hat{F}\tau - \hat{\varkappa}_{\frac{1}{2}} \frac{\hat{y}_0 - \hat{y}_1}{h} \tau - \frac{\tau h}{2R} \left(\frac{\alpha_0 + \alpha_1}{2} \cdot \frac{\hat{y}_0 + \hat{y}_1}{2} + \alpha_0 \hat{y}_0 \right) +$$

$$+ F_0(t_m) \left(\frac{k_0 + k_1}{2} e^{-\frac{k_0 + k_1}{2} \frac{x_0 + x_1}{2}} + k_0 e^{-k_0 x_0} \right) \frac{h\tau}{4} +$$

$$+ \frac{2T_0}{R} \frac{\frac{\alpha_0 + \alpha_1}{2} + \alpha_0}{2} \frac{h}{2}$$

$$\hat{k}_0 = (3\hat{c}_0 + \hat{c}_1)\frac{h}{16} + \frac{\varkappa_{\frac{1}{2}}}{h}\tau + \frac{3\alpha_0+\alpha_1}{2\cdot 2}\cdot\frac{\tau h}{2R} + \alpha_0\tau$$

5 или

$$\hat{M}_0 \sim \frac{h}{16}(\hat{c}_0 + \hat{c}_1) - \frac{\hat{\varkappa}_{\frac{1}{2}}}{h}\tau + \frac{\tau h}{2R}\frac{\alpha_0+\alpha_1}{4}.$$

$$\hat{P}_0 \sim +\alpha_0 T_0\tau + F_0(t_m)\left(\frac{k_0+k_1}{2}e^{-\frac{k_0+k_1}{2}\cdot\frac{x_0+x_1}{2}} + k_0 e^{-k_0x_0}\right)\frac{h\tau}{4} +$$

$$+ \frac{\varrho T_0}{R}\frac{3\alpha_0+\alpha_1}{4}\frac{h}{2} +$$

$$+ (\hat{c}_0 + \hat{c}_1)(y_1+y_0)\frac{h}{16} + \hat{c}_0 y_0\frac{h}{4}$$

Правое аналогично.

$\varphi = 10$

$\frac{x}{20} = 10$

$x = 200$