Enačbe za single phase model

1 Polnjenje

1.1 1. Robni pogoj

$$\frac{h}{\Delta z}(T_f - T_0) - \frac{k}{\Delta z^2}(T_0 - T_1) = \frac{1}{2}\rho c_p \frac{T_0 - T_0^{k-1}}{\Delta t} - G c_p^f \frac{T_f - T_1}{2\Delta z}$$

Razčlenjeno

$$(2k\Delta t + 2h\Delta z\Delta t + \rho c_p \Delta z^2)T_0 + (-2k\Delta t - G c_p^f \Delta z \Delta t)T_1 =$$
$$= \rho c_p \Delta z^2 T_0^{k-1} + (2h\Delta z\Delta t + G c_p^f \Delta z \Delta t)T_f$$

1.2 Vmesne enačbe

$$k\frac{T_{i-1} - 2T_i + T_{i+1}}{\Delta z^2} = \rho c_p \frac{T_i - T_i^{k-1}}{\Delta t} - G c_p^f \frac{T_{i-1} - T_{i+1}}{2\Delta z}$$

Razčlenjeno

$$(-2k\Delta t - G c_p^f \Delta z \Delta t)T_{i-1} + (4k\Delta t + 2\rho c_p \Delta z^2)T_i +$$
$$+(-2k\Delta t + G c_p^f \Delta z \Delta t)T_{i+1} = 2\rho c_p \Delta z^2 T_i^{k-1}$$

1.3 2. Robni pogoj

$$\frac{k}{\Delta z^2}(T_{M-2} - T_{M-1}) = \frac{1}{2}\rho c_p \frac{T_{M-1} - T_{M-1}^{k-1}}{\Delta t} - G c_p^f \frac{T_{M-2} - T_{M-1}}{\Delta z}$$

Razčlenjeno

$$(-2k\Delta t - 2G c_p^f \Delta z \Delta t)T_{M-2} + (2k\Delta t + \rho c_p^f \Delta z^2 + 2G c_p^f \Delta z \Delta t)T_{M-1} =$$
$$= \rho c_p \Delta z^2 T_{M-1}^{k-1}$$

2 Hranjenje

2.1 1. Robni pogoj

$$\frac{4k}{\Delta r^2}(T_1 - T_0) = \rho c_p \frac{T_0 - T_0^{k-1}}{\Delta t}$$

Razčlenjeno

$$(4k\Delta t + \rho c_p \Delta r^2)T_0 - 4k\Delta t T_1 = \rho c_p \Delta r^2 T_0^{k-1}$$

2.2 Vmesne enačbe brez točke na meji med hranilnikom in izolacijo

$$k\left(\frac{1}{r\Delta j}\frac{T_{j+1} - T_{j-1}}{2\Delta r} + \frac{T_{j+1} - 2T_j + T_{j-1}}{\Delta r^2}\right) = \rho c_p \frac{T_j - T_j^{k-1}}{\Delta t}$$

Razčlenjeno

$$(-k\Delta t - 2k\Delta t j)T_{j-1} + (4k\Delta t j + 2\rho c_p \Delta r^2 j)T_j + (k\Delta t - 2k\Delta t j)T_{j+1} =$$
$$= 2\rho c_p \Delta r^2 j T_j^{k-1}$$

2.3 Točka na meji

$$K = (N_{hr} - \tfrac{3}{2})\rho_{hr} c_{hr} + (N_{hr} - \tfrac{1}{2})\rho_{iz} c_{iz}$$

$$\frac{1}{2\Delta r^2 (N_{hr}-1)}(k_{hr}(T_{hr-2} - T_{hr-1}) + k_{iz}(T_{hr-1} - T_{hr})) + \frac{k_{hr}}{\Delta r^2}(T_{hr-2} - T_{hr-1}) -$$
$$-\frac{k_{iz}}{\Delta r^2}(T_{hr-1} - T_{hr}) = \frac{K}{2(N_{hr}-1)}\frac{T_{hr-1} - T_{hr-1}^{k-1}}{\Delta t}$$

Razčlenjeno

$$K1 = k_{hr}\Delta t - k_{iz}\Delta t + 2(N_{hr} - 1)k_{hr}\Delta t + 2(N_{hr} - 1)k_{iz}\Delta t + K\Delta r^2$$

$$(-k_{hr}\Delta t - 2(N_{hr} - 1)k_{hr}\Delta t)T_{hr-2} + K1 T_{hr-1} + (k_{iz}\Delta t - 2(N_{hr} - 1)k_{iz}\Delta t)T_{hr} =$$
$$K\Delta r^2 T_{hr-1}^{k-1}$$

2.4 Točka na robu

$$\frac{h_{ok}}{\Delta r(N_M-1)}(T_{ok}-T_{M-1})+\frac{k_{iz}}{\Delta r^2}(T_{M-2}-T_{M-1})-\frac{h_{ok}}{\Delta r}(T_{M-1}-T_{ok})=$$

$$\rho_{iz}c_{iz}\frac{T_{M-1}-T_{M-1}^{k-1}}{2\Delta t}$$

Razčlenjeno

$$K=2h_{ok}\Delta r\Delta t$$

$$-2k_{iz}\Delta t(N_M-1)T_{M-2}+(K+2k_{iz}\Delta t(N_M-1)+K(N_M-1)+$$
$$\rho_{iz}c_{iz}\Delta r^2(N_M-1))T_{M-1}=$$
$$(K(N_M-1)+K)T_{ok}+\rho_{iz}c_{iz}\Delta r^2(N_M-1)T_{M-1}^{k-1}$$

3 Praznjenje

3.1 1. Robni pogoj

$$\frac{k}{\Delta z^2}(T_1 - T_0) = \frac{\rho c_p}{2\Delta t}(T_0 - T_0^{k-1}) - \frac{G c_p^f}{\Delta z}(T_1 - T_0)$$

Razčlenjeno

$$(2k\Delta t + \rho c_p \Delta z^2 + 2G c_p^f \Delta z \Delta t)T_0 + (-2k\Delta t - 2G c_p^f \Delta z \Delta t)T_1 = \rho c_p \Delta z^2 T_0^{k-1}$$

3.2 Vmesne enačbe

$$\frac{k}{\Delta z^2}(T_{i-1} - 2T_i + T_{i+1}) = \frac{\rho c_p}{\Delta t}(T_i - T_i^{k-1}) - \frac{G c_p^f}{2\Delta z}(T_{i+1} - T_{i-1})$$

Razčlenjeno

$$(-2k\Delta t + G c_p^f \Delta z \Delta t)T_{i-1} + (4k\Delta t + 2\rho c_p \Delta z^2)T_i +$$
$$+(-2k\Delta t - G c_p^f \Delta z \Delta t)T_{i+1} = 2\rho c_p \Delta z^2 T_i^{k-1}$$

3.3 2. Robni pogoj

$$\frac{k}{\Delta z^2}(T_{M-2} - T_{M-1}) - \frac{h}{\Delta z}(T_{M-1} - T_{ok}) = \frac{1}{2}\rho c_p \frac{T_{M-1} - T_{M-1}^{k-1}}{\Delta t} - G c_p^f \frac{T_{M-1} - T_{M-2}}{\Delta z}$$

Razčlenjeno

$$(-2k\Delta t + G c_p^f \Delta z \Delta t)T_{M-2} + (2k\Delta t + 2h\Delta z \Delta t + \rho c_p \Delta z^2)T_{M-1} =$$
$$= \rho c_p \Delta z^2 T_{M-1}^{k-1} + (2h\Delta z \Delta t + G c_p^f \Delta z \Delta t)T_{ok}$$