Flow Chart for the 1D example

2019년 10월 24일 목요일 오후 10:03

(Cr = 0 in flow simulation because porosity changes are calculated in geomechnical simulation)

① $p_i^{t+\Delta t}$

② $-\alpha \cdot dz \cdot (p_{i+1}^{t+\Delta t} - p_i^t) / E$

③ $\rho_{b,i} = (1-\phi_i^t)\rho_m + \phi_i^t \rho_f$

④ $dz^2 \cdot \rho_{b,i} \cdot g / E$

⑤ $b_i = ② + ④$

⑥ $\begin{bmatrix} -2 & 1 & 0 & \cdots & 0 \\ 1 & -2 & 1 & \cdots & 0 \\ 0 & 1 & -2 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & 1 & -2 \end{bmatrix} \begin{bmatrix} u_1 \\ \vdots \\ u_N \end{bmatrix} = \begin{bmatrix} b_1 \\ \vdots \\ b_N \end{bmatrix}$ $u_{100} = 0$

⑦ $u_1, \ldots, u_N \mid dz_i^{t+\Delta t} = dz_i^t + u_i$

⑧ $V_{b,i}^{t+\Delta t} = dx \cdot dy \cdot (dz_i^{t+\Delta t} + u_i)$

⑨ $C_{b,i} = (1-\phi_i^t) C_{s,i} + \phi_i^t C_{f,i}$, $\alpha_i = 1 - C_{s,i}/C_{b,i}$

⑩ $\Delta S_{m,i}^{t+\Delta t} = \frac{2}{9} \frac{E}{(1-\nu)} (C_b - C_s) \Delta p$ $\Delta p = p_i^{t+\Delta t} - p_i^t$

⑪ $S_{v,i}^{t+\Delta t} = S_{v,i}^t + \Delta S_{m,i}^{t+\Delta t}$

⑫ $\sigma_i^{t+\Delta t} = S_{v,i}^{t+\Delta t} - \alpha p_i^{t+\Delta t}$

⑬ $k_i^{t+\Delta t} = k_i^0 e^{-A(\sigma_i^{t+\Delta t} - \sigma_i^0)}$

⑭ $C_{\phi,i} = C_b(1-\phi_i^t) - C_s$

⑮ $C_{p,i} = \frac{C_{\phi,i}(1-\varepsilon_{v,i}^n) + (C_b - C_s)\phi_i^t}{\phi_i^0}$

⑯ $d\phi_p^* = \phi_i^0 C_{p,i} (p_i^{t+\Delta t} - p_i^t)$

⑰ $d\phi_{sm}^* = -[C_{\phi,i}(1-\varepsilon_v^n) + C_b \phi_i^t] \Delta S_{m,i}^{t+\Delta t}$

⑱ $\phi_i^{*,t+\Delta t} = \phi_i^{*,t} + d\phi_p^* + d\phi^*$

(17) $d\phi^*_{sm} = [\,\phi_{i}(1-\varepsilon_v) + c_b \phi_i\,]\,\Delta \sigma_{m,i}$

(18) $$\phi_i^{*,t+\Delta t} = \phi_i^{*,t} + d\phi^*_p + d\phi^*_{sm}$$

(19) $$\varepsilon_{v,i}^{t+\Delta t} = 1 - \frac{V_{b,i}^{t+\Delta t}}{V_{b,i}^{0}}$$

(20) $$\phi_i^{t+\Delta t} = \frac{\phi_i^{*,t+\Delta t}}{1-\varepsilon_{v,i}^{t+\Delta t}}$$

(21) Update $k_i^{t+\Delta t}$, $\phi_i^{*,t+\Delta t}$ in flow simulation