01/29/2025

Wednesday, January 29, 2025 1:00 PM

$$\frac{p_{i-1}^{n+1} - 2p_i^{n+1} + p_{i+1}^{n+1}}{\Delta x^2} = \frac{\phi \mu C_t}{0.00633k} \frac{p_i^{n+1} - p_i^n}{\Delta t}$$

$$\Rightarrow p_{i-1}^{n+1} - 2p_i^{n+1} + p_{i+1}^{n+1} = \frac{\phi \mu C_t}{0.00633k} \frac{\Delta x^2}{\Delta t} \left(p_i^{n+1} - p_i^n\right)$$

$$\Rightarrow p_{i-1}^{n+1} - \left[2 + \frac{\phi \mu C_t}{0.00633k} \frac{\Delta x^2}{\Delta t}\right] p_i^{n+1} + p_{i+1}^{n+1} = -\frac{\phi \mu C_t}{0.00633k} \frac{\Delta x^2}{\Delta t} p_i^n$$

b_constant

$$-p_{i-1}^{n+1} + \left[2 + \frac{\phi \mu C_t}{0.00633k} \frac{\Delta x^2}{\Delta t}\right] p_i^{n+1} - p_{i+1}^{n+1} = \frac{\phi \mu C_t}{0.00633k} \frac{\Delta x^2}{\Delta t} p_i^n$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -1 & D & -1 & 0 & 0 \\ 0 & -1 & D & -1 & 0 \\ 0 & 0 & -1 & D & -1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} p_1^{n+1} \\ p_2^{n+1} \\ p_3^{n+1} \\ p_4^{n+1} \\ p_5^{n+1} \end{pmatrix} = \begin{pmatrix} 1000 \\ b\_constant \times p_2^n \\ b\_constant \times p_3^n \\ b\_constant \times p_4^n \\ 500 \end{pmatrix}$$

$$\Rightarrow \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -1 & D & -1 & 0 & 0 \\ 0 & -1 & D & -1 & 0 \\ 0 & 0 & -1 & D & -1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} p_1^1 \\ p_2^1 \\ p_3^1 \\ p_4^1 \\ p_5^1 \end{pmatrix} = \begin{pmatrix} 1000 \\ b\_constant \times p_2^0 \\ b\_constant \times p_3^0 \\ b\_constant \times p_4^0 \\ 500 \end{pmatrix}$$

$$A \cdot p^1 = b. \Rightarrow p^1 = A^{-1} \cdot b$$

$$\Rightarrow A \cdot p^2 = b$$

↑ D should be used.

$\Rightarrow (-1) \cdot P^{n} = b$

$P^{n}$ should be used.

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ -1 & D & -1 & 0 & 0 \\ 0 & -1 & D & -1 & 0 \\ 0 & 0 & -1 & D & -1 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} P_1^2 \\ P_2^2 \\ P_3^2 \\ P_4^2 \\ P_5^2 \end{pmatrix} = \begin{pmatrix} 1000 \\ b\_constant \times P_2^1 \\ b\_constant \times P_3^1 \\ b\_constant \times P_4^1 \\ 500 \end{pmatrix}$$

* 1 st assignment : by Feb 7 th, 2025. (Friday. 11:59 pm)

$\phi = 0.2$, $\mu = 0.7$ cp, $C_t = 10^{-5} \frac{1}{psia}$, $K = 10$ md.

$\Delta x = 10$ ft, $\Delta t = 0.01$ day.

$nx = 30$. t-final = 5 days.

(1) Change your code built today into efficient code for larger & longer time problem.

sytem

↓ for.

↓ While.

(2) Solve for $nx = 30$, t-f = 5 days.

plot for every time interval you want.

ex) 0.01, 0.05, 0.1 days, 0.5, 1, 2, 3, 4.5 days.