Strip deposit is developed by one row of wells under water drive. Determine the flow rates of the row wells for data:
width of deposit 2500 m,
length 6000 m,
the distance between drainage boundary and WOC - 400 m with a step of 50 m.
the distance between the initial and the current position of the WOC 200 m with a step of 50 m.
the distance between current position of the WOC and the first row of wells – 5400 m with a step of 50 m.
the number of wells in the first row 16 with a step of 1.
the formation pressure 24 MPa with a step of 0.5 MPa,
bottom-hole pressures in the first row 19 MPa with a step of 0.5 MPa,
coefficient of permeability 18 D with a step of 5 mD,
thickness 19 m,
the coefficient of dynamic viscosity oil and water 2.5 mPa·s and 1.2 mPa·s, respectively,
reduce radius of wells 10 cm.
bound water saturation of 0.17;
residual oil saturation of 0.28.

Problem 7

Width , m $B := 2500$ m

Length , m $L := 6000$ m

Distance between the oil drainage boundary to WOC, m $L_{ow} := 400 + 50 \cdot 9 = 850$ m

Distance between the initial and current position of the WOC, m $L_{wf} := 200 + 50 \cdot 9 = 650$ m

Distance between the current position of WOC and the first row of wells, m $L_{w1} := 5400 + 50 \cdot 9 = 5.85 \times 10^{3}$ m

Number of wells in the first row $n := 16 + 9 \cdot 1 = 25$

Reservoir Permeability, m2 $k := (18000 + 5 \cdot 9) \cdot 10^{-15} = 1.805 \times 10^{-11}$ m^2

Formation or reservoir Pressure, Pa $P_r := (24 + 0.5 \cdot 9) \cdot 10^{6} = 2.85 \times 10^{7}$ Pa

Bottom hole Pressure, Pa $P_b := (19 + 0.5 \cdot 9) \cdot 10^{6} = 2.35 \times 10^{7}$ Pa

Layer Thickness, m $h := 19 \quad m$

Coefficient of Dynamic Viscosity of Oil, Pa.s $\mu_o := 2.5 \cdot 10^{-3} \quad Pa \cdot s$

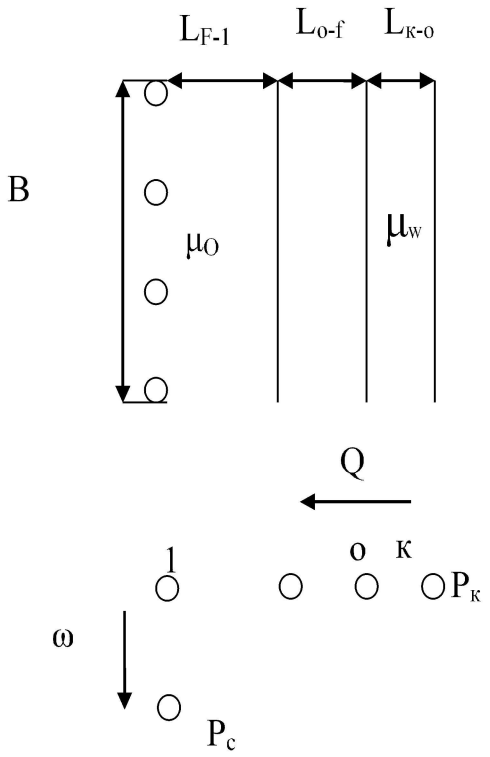
Coefficient of Dynamic Viscosity of Water, Pa.s $\mu_w := 1.2 \cdot 10^{-3} \quad Pa \cdot s$

Radius Wells, m $r_w := 0.1 \quad m$

Residual oil saturation $S_{ro} := 0.28$

Saturation of bound water $S_{bw} := 0.17$

Solution



$$\Omega_{dw} := \frac{\mu_w \cdot L_{ow}}{B \cdot k \cdot h} \quad \text{..... (7.1)}$$

$$\Omega_{dw} := \frac{1.2\cdot10^{-3}\cdot850}{2500\cdot1.805\cdot10^{-11}\cdot19} = 1.19\times10^{6} \quad \frac{Pa\cdot s}{m^3}$$

$$\Omega_{w1} := \frac{\mu_o\cdot L_{w1}}{B\cdot k\cdot h} \quad \text{..... (7.2)}$$

$$\Omega_{w1} := \frac{2.5\cdot10^{-3}\cdot5.85\cdot10^{3}}{2500\cdot1.805\cdot10^{-11}\cdot19} = 1.706\times10^{7} \quad \frac{Pa\cdot s}{m^3}$$

$$\Omega_{wf} := \frac{\mu_o\cdot L_{wf}}{B\cdot k\cdot h} \quad \text{..... (7.3)}$$

$$\Omega_{wf} := \frac{2.5\cdot10^{-3}\cdot650}{2500\cdot1.803\cdot10^{-11}\cdot19} = 1.897\times10^{6} \quad \frac{Pa\cdot s}{m^3}$$

$$\sigma := \frac{B}{2\cdot n} \quad \text{..... (7.4)}$$

$$\sigma := \frac{2500}{2\cdot25} = 50$$

$$\omega_1 = \frac{\mu_o\cdot\ln\left(\frac{\sigma}{\pi\cdot r_w}\right)}{2\cdot\pi\cdot k\cdot h\cdot n} \quad \text{..... (7.5)}$$

$$\omega_1 := \frac{2.5\cdot10^{-3}\cdot\ln\left(\frac{50}{\pi\cdot0.1}\right)}{2\cdot\pi\cdot1.805\cdot10^{-11}\cdot19\cdot25} = 2.353\times10^{5} \quad \frac{Pa\cdot s}{m^3}$$

$$Z_f := 0.18$$

$$\alpha := \frac{\mu_w}{\mu_o}\cdot\left(1.7 + 8Z_f + 25\cdot Z_f^{\,2}\right) \qquad \text{..... (7.6)}$$

$$\alpha := \frac{1.2}{2.5}\cdot\left[1.7 + 8\cdot 0.18 + 25\cdot(0.18)^2\right] = 1.896$$

$$P_r - P_b = Q\cdot\left(\Omega_{d.w} + \Omega_{w.f}\cdot\alpha + \Omega_{w1} + \omega_1\right) \qquad \text{..... (7.7)}$$

$$Q := \frac{P_r - P_b}{\left(\Omega_{dw} + \Omega_{wf}\cdot\alpha + \Omega_{w1} + \omega_1\right)} \qquad \text{..... (7.8)}$$

$$Q := \frac{2.85\cdot 10^7 - 2.35\cdot 10^7}{\left(1.19\cdot 10^6 + 1.817\cdot 10^6\cdot 1.896 + 1.706\cdot 10^7 + 2.353\cdot 10^5\right)} = 0.228 \quad \frac{m^3}{s}$$

Conclusion

I applied Kirchhoff during my calculations I found the flow rates of the row wells (Q=0,228 m3/s) that affirmate the strip deposit is developed by one row of wells under water drive