Variant 10

In the stripes layer are two rows of holes. Determine the total oil production from deposits for the following data:

width changes from 3 km with a step of 100 m;

length changes from 9 km with a step of 200 m;

reservoir permeability coefficient changes from 20 mD with a step of 5 mD ;

layer thickness changes from 12 m with a step of 0.5 m;

coefficient of dynamic viscosity of oil changes from 2 mPa s with a step of 0.05 mPa s;

coefficient of dynamic viscosity of water 1 mPa s;

reservoir pressure changes from 21 MPa with a step of 0.2 MPa;

bottomhole pressure of each rows of wells varies from 19 MPa 18 MPa with a step of 0.2MPa for each row respectively;

distance from the first row of wells changes from oil water contact to 5 km with a step of 200 m;

distance from the oil drainage boundary to oil water contact changes from 2 km with a step of 100 m;

the distance between the first and second rows changes from 700m with a step of 20m;

the distance between the holes in each row changes from 400m, 500 m with a step of 50 m respectively for each series;

radius wells 0,1m.

Problem 4

In the stripes layer are two rows of holes. Determine the total oil production from deposits

Width $B := 3000 + 100 \cdot 9 = 3900$ m

Length $L := 9000 + 200 \cdot 9 = 10800$ m

Reservoir Permeability coefficient $k := (20 + 5 \cdot 9) \cdot 10^{-15} = 6.5 \times 10^{-14}$

Layer Thickness $h := 12 + 0.5 \cdot 9 = 16.5$ m

Coefficient of dynamic viscosity of oil $\mu_o := (2 + 0.05 \cdot 9) \cdot 10^{-3} = 2.45 \times 10^{-3}$ Pa·s

Coefficient of dynamic viscosity of water $\mu_w := 1 \cdot 10^{-3}$ Pa·s

Reservoir pressure $P_r := (21 + 0.2 \cdot 9) \cdot 10^6 = 2.28 \times 10^7$ Pa

Bottomhole pressure $P_{bh.1} := (18 + 0.2 \cdot 9) \cdot 10^6 = 1.98 \times 10^7$ Pa

$P_{bh.2} := (18 + 0.2 \cdot 9) \cdot 10^6 = 1.98 \times 10^7$ Pa

Distance from the first row of wells $L_{w1} := 5000 + 200 \cdot 9 = 6800$ m distance from oil drainage boundary to oil water contact

$$L_{ow} := 2000 + 100 \cdot 9 = 2900 \quad \text{m}$$

distance between the first and second rows $L_{1.2} := 700 + 20 \cdot 9 = 880$ m

distance between the holes in each row

$$\sigma_1 := \frac{(400 + 50 \cdot 9)}{2} = 425 \quad \text{m}$$

$$\sigma_2 := \frac{(500 + 50 \cdot 9)}{2} = 475 \quad \text{m}$$

radius wells $r_w := 0.1$ m

Solution:

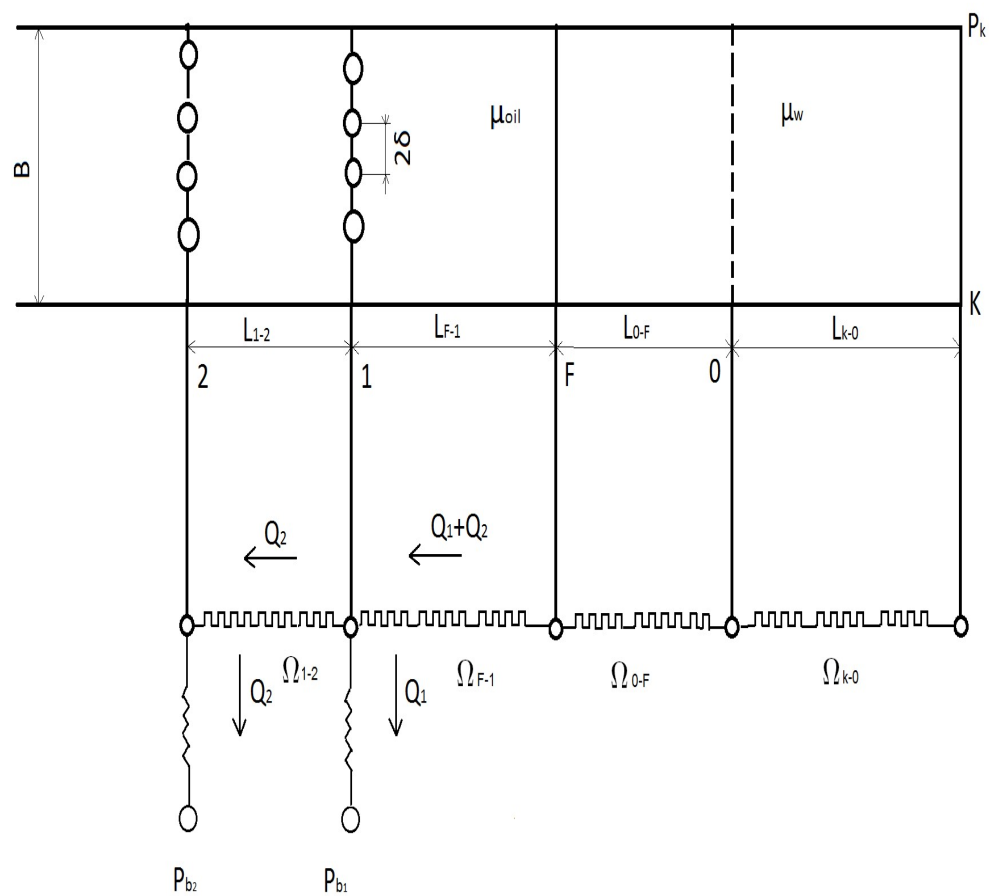

Fig 4 The graph of the stripes layer are two rows of holes.

$$P_r - P_{bh.1} = (Q_1 + Q_2) \cdot (\Omega_{w.1} + \Omega_{d.w}) + Q_1 \cdot W_1$$

$$P_r - P_{bh.2} = (Q_1 + Q_2) \cdot (\Omega_{w.1} + \Omega_{d.w}) + Q_2 \cdot \Omega_{1.2} + Q_2 \cdot W_2$$

$$\Omega_{dw} := \frac{\mu_w \cdot L_{ow}}{B \cdot k \cdot h} \quad (4.1)$$

$$\Omega_{dw} := \frac{1\cdot 10^{-3}\cdot 2900}{3900\cdot 6.5\cdot 10^{-14}\cdot 16.5} = 6.933\times 10^{8} \quad \frac{Pa\cdot s}{m^3}$$

$$\Omega_{w1} := \frac{\mu_o\cdot L_{w1}}{B\cdot k\cdot h} \qquad (4.2)$$

$$\Omega_{w1} := \frac{2.45\cdot 10^{-3}\cdot 6800}{3900\cdot 6.5\cdot 10^{-14}\cdot 16.5} = 3.983\times 10^{9} \quad \frac{Pa\cdot s}{m^3}$$

$$\Omega_{1.2} := \frac{\mu_o\cdot L_{1.2}}{B\cdot k\cdot h} \qquad (4.3)$$

$$\Omega_{1.2} := \frac{2.45\cdot 10^{-3}\cdot 880}{3900\cdot 6.5\cdot 10^{-14}\cdot 16.5} = 5.155\times 10^{8} \quad \frac{Pa\cdot s}{m^3}$$

$$W_1 = \frac{\mu_o\cdot \ln\left(\frac{\sigma_1}{\pi\cdot r_w}\right)}{2\cdot\pi\cdot k\cdot h\cdot n_1} \qquad (4.4)$$

where $n_1 := \frac{B}{2\cdot\sigma_1} = 4.588$ (4.5)

$$W_1 := \frac{2.45\cdot 10^{-3}\cdot \ln\left(\frac{425}{\pi\cdot 0.1}\right)}{2\cdot\pi\cdot 6.5\cdot 10^{-14}\cdot 16.5\cdot 4.588} = 5.713\times 10^{8} \quad \frac{Pa\cdot s}{m^3}$$

$$W_2 := \frac{\mu_o\cdot \ln\left(\frac{\sigma_2}{\pi\cdot r_w}\right)}{2\cdot\pi\cdot k\cdot h\cdot n_2} \qquad n_2 := \frac{B}{2\cdot\sigma_2} = 4.105 \qquad (4.6) \qquad (4.7)$$

$$W_2 := \frac{2.45\cdot 10^{-3}\cdot \ln\left(\frac{475}{\pi\cdot 0.1}\right)}{2\cdot\pi\cdot 6.5\cdot 10^{-14}\cdot 16.5\cdot 4.105} = 6.484\times 10^{8} \quad \frac{Pa\cdot s}{m^3}$$

Given

$Q_1 := 10 \quad Q_2 := 10$

$$P_r - P_{bh.1} = (Q_1 + Q_2)\cdot(\Omega_{w1} + \Omega_{dw}) + Q_1\cdot W_1 \qquad (4.8)$$

$$P_r - P_{bh.2} = (Q_1 + Q_2)\cdot(\Omega_{w1} + \Omega_{dw}) + Q_2\cdot\Omega_{1.2} + Q_2\cdot W_2 \qquad (4.9)$$

$$\text{Find}(Q_1, Q_2) = \begin{pmatrix} 3.977 \times 10^{-4} \\ 1.952 \times 10^{-4} \end{pmatrix} \qquad (4.10)$$

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$$Q_t := Q_1 + Q_2$$

$$Q_t := 3.977\cdot10^{-4} + 1.952\cdot10^{-4} = 5.929 \times 10^{-4} \quad \frac{m^3}{s}$$