In the circular layer simultaneously has two rows of holes. It is necessary to determine the flow rates of wells each series for the following data:
radius reservoir changes from 8 km with a step of 100m;
oil water contact changes from 5 km with a step of 100 m;
the radius of the first and second rows of wells changes from 3km, 2 km with a step of 100 m;
well radius of 0.1 m;
reservoir permeability coefficient layer changes from 20 mD with a step of 5 mD;
layer thickness varies from 10 m with a step of 0.5 m;
coefficient of dynamic viscosity of oil changes from 2.5 mPa s with a step of 0,05mPa s;
coefficient of dynamic viscosity of water 1mPa s;
reservoir pressure changes from 21 MPa with a step of 0.2 MPa;
bottomhole pressure of each rows of wells changes from 19 MPa. 18 MPa with a step of 0.2 MPa each row respectively;
number of wells in each row changes from 30. 20 with a step of 1 well.

Problem N°5

In the circular layer simultaneously has two rows of holes.it is necessary to determine the flow rates of wells each series for the following data:

Data

Reservoir radius $R_r := 8000 + 9 \cdot 100 = 8900$ m

OWC radius $R_{owc} := 5000 + 100 \cdot 9 = 5900$ m

The radius of the first row $R_1 := 3000 + 100 \cdot 9 = 3900$ m

The radius of the second row $R_2 := 2000 + 100 \cdot 9 = 2900$ m

Formation presssure $P_{res} := (21 + 9 \cdot 0.2) \cdot 10^6 = 2.28 \times 10^7$ Pa

Bottomhole pressure for each rows $P_{bh1} := (19 + 9 \cdot 0.2) \cdot 10^6 = 2.08 \times 10^7$ Pa

$P_{bh2} := (18 + 9 \cdot 0.2) \cdot 10^6 = 1.98 \times 10^7$ Pa

Coefficient of permeabililty $k := (20 + 5 \cdot 9) \cdot 10^{-15} = 6.5 \times 10^{-14}$ m^2

thickness $h := 10 + 9 \cdot 0.5 = 14.5$ m

Coefficients of dynamic viscosity;

$\mu_o := (2.5 + 0.05 \cdot 9) \cdot 10^{-3} = 2.95 \times 10^{-3}$ Pa·s

$\mu_w := 1 \cdot 10^{-3}$ Pa·s

Radius ratio of well

$r_w := 0.1$ m

Number of well in each row

$n_1 := 30 + 1 \cdot 9 = 39$

$n_2 := 20 + 1 \cdot 9 = 29$

Solution:

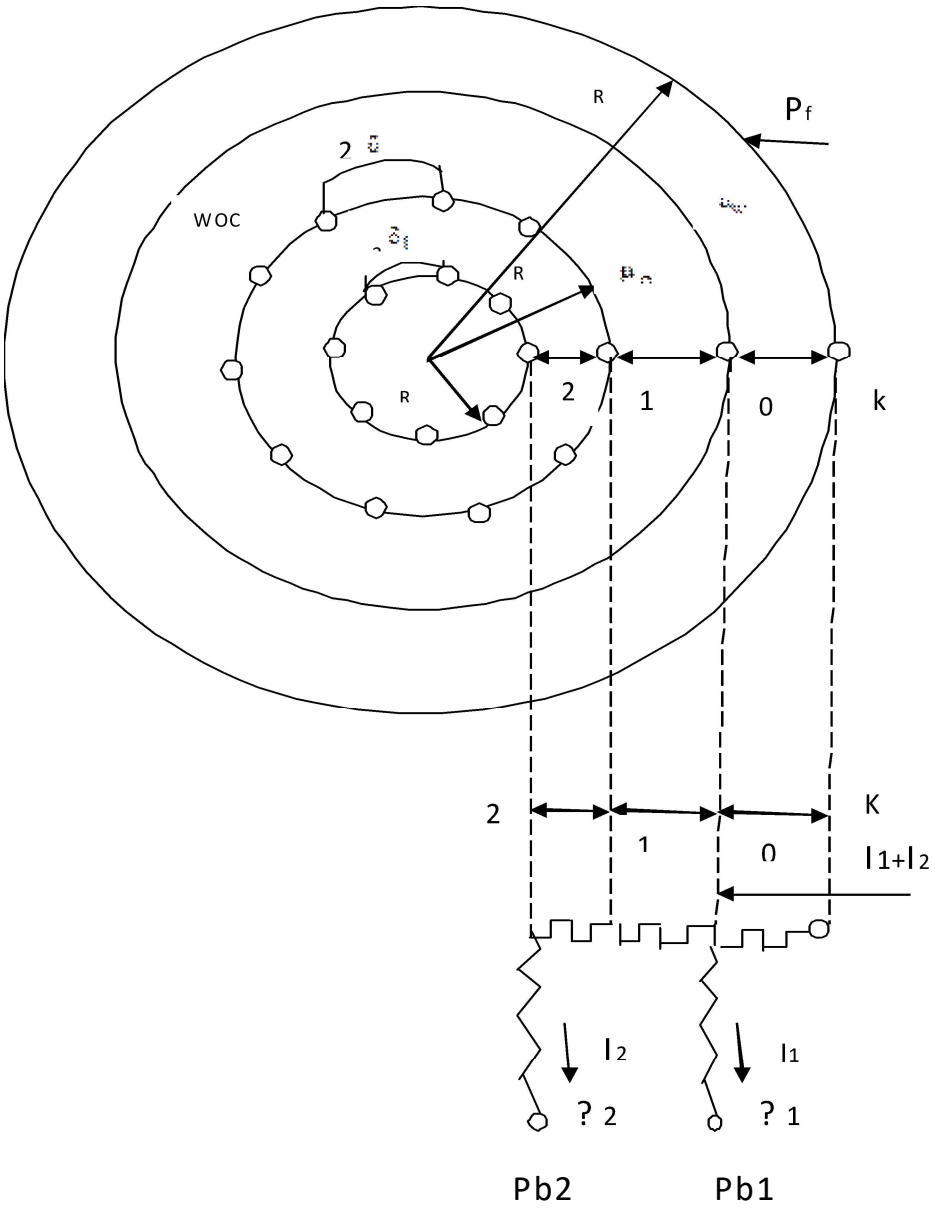

Fig5. The circular layer simultaneously has two rows of holes.

$$P_{res} - P_{b1} = \left(Q_1 + Q_2\right) \cdot \left(\Omega_{w1} + \Omega_{dw}\right) + Q_1 \cdot W_1$$

$$P_{res} - P_{b2} = \left(Q_1 + Q_2\right)\cdot\left(\Omega_{w1} + \Omega_{dw}\right) + Q_2\cdot\left(W_2 + \Omega_{12}\right)$$

Determination of unknown parameters

$$\Omega_{dw} := \frac{\mu_w \cdot \ln\left(\frac{R_r}{R_{owc}}\right)}{2\cdot\pi\cdot k\cdot h} \qquad (5.1)$$

$$\Omega_{dw} := \frac{1\cdot10^{-3}\cdot\ln\left(\frac{8900}{5900}\right)}{2\cdot\pi\cdot6.5\cdot10^{-14}\cdot14.5} = 6.942\times10^{7} \quad Pa\cdot\frac{s}{m^3}$$

$$\Omega_{w1} := \frac{\mu_o \cdot \ln\left(\frac{R_{owc}}{R_1}\right)}{2\cdot\pi k\cdot h} \qquad (5.2)$$

$$\Omega_{w1} := \frac{2.95\cdot10^{-3}\cdot\ln\left(\frac{5900}{3900}\right)}{2\cdot\pi\cdot\left(6.5\cdot10^{-14}\right)\cdot14.5} = 2.062\times10^{8} \quad Pa\cdot\frac{s}{m^3}$$

$$\Omega_{1.2} := \frac{\mu_o \cdot \ln\left(\frac{R_1}{R_2}\right)}{2\cdot\pi k\cdot h} \qquad (5.3)$$

$$\Omega_{1.2} := \frac{2.95\cdot10^{-3}\cdot\ln\left(\frac{3900}{2900}\right)}{2\cdot\pi\cdot\left(6.5\cdot10^{-14}\right)\cdot14.5} = 1.476\times10^{8} \quad Pa\cdot\frac{s}{m^3}$$

$$W_1 := \frac{\mu_o \cdot \ln\left(\frac{\sigma_1}{\pi\cdot r_w}\right)}{2\cdot\pi\cdot k\cdot h\cdot n_1} \quad \text{Where} \quad \sigma_1 := \frac{\pi\cdot R_1}{n_1} = \frac{\pi\cdot3900}{39} = 314.159 \qquad (5.4)\ (5.5)$$

$$W_1 := \frac{2.95\cdot10^{-3}\cdot\ln\left(\frac{314.159}{\pi\cdot0.1}\right)}{2\cdot\pi\cdot\left(6.5\cdot10^{-14}\right)\cdot14.5\cdot39} = 8.823\times10^{7} \quad Pa\cdot\frac{s}{m^3}$$

$$W_2 := \frac{\mu_o \cdot \ln\left(\frac{\sigma_2}{\pi\cdot r_w}\right)}{2\cdot\pi\cdot k\cdot h\cdot n_2} \quad \text{Where} \quad \sigma_2 := \frac{\pi\cdot R_2}{n_2} = \frac{\pi\cdot2900}{29} = 314.159 \qquad (5.6)\ (5.7)$$

$$W_2 := \frac{2.95 \cdot 10^{-3} \cdot \ln\left(\frac{314.159}{\pi \cdot 0.1}\right)}{2 \cdot \pi \cdot \left(6.5 \cdot 10^{-14}\right) \cdot 14.5 \cdot 29} = 1.187 \times 10^{8} \quad Pa \cdot \frac{s}{m^3}$$

Given

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

$$P_{res} - P_{bh1} = \left(Q_1 + Q_2\right) \cdot \left(\Omega_{w1} + \Omega_{dw}\right) + Q_1 \cdot W_1 \tag{5.8}$$

$$P_{res} - P_{bh2} = \left(Q_1 + Q_2\right) \cdot \left(\Omega_{w1} + \Omega_{dw}\right) + Q_2 \cdot \left(W_2 + \Omega_{1.2}\right) \tag{5.9}$$

$$\text{Find}\left(Q_1, Q_2\right) = \begin{pmatrix} 0.002 \\ 0.004 \end{pmatrix}$$

(5.4)