Variant 10

Determine the coefficient oil extraction which is achieved due to the elastic drive while
thickness changes from 8 m with a step of 0.5 m;
open porosity ratio changes from 15% with a step of 0.5%;
oil saturation changes from 0.4 with a step of 0.01;
compressibility factor of oil changes from $2.1\cdot10^{-9}$ Pa^{-1} with a step of $0.05\cdot10^{-9}$ Pa^{-1};
compressibility factor of rocks changes from $2.4\cdot10^{-10}$ Pa^{-1} with a step of $0.05\cdot10^{-10}$ Pa^{-1};
compressibility factor of water changes from $3.1\cdot10^{-10}$ Pa^{-1} with a step of $0.05\cdot10^{-10}$ $Pa^{-1;}$
initial reservoir pressure changes from 40 MPa with a step of 0.2 MPa;
saturation pressure of oil gas changes from 30 MPa with a step of 0.2 MPa;
saturation coefficient layer bound water of 0.22;
radius boundary changes from 1000 m with a step of 50 m.

Problem 1

$n := 10$

Data

Thickness $h := 8 + 0.5\cdot9$

$h = 12.5$ m

Porosity $m := 15 + 0.5\cdot9$

$m = 19.5$

$m := 0.195$ %

Oil saturation $So := 0.4 + 0.01\cdot9$

$So = 0.49$

Compressibility factor $\beta o := 2.1\cdot10^{-9} + 0.05\cdot10^{-9}\cdot9$

$\beta o = 2.55\times10^{-9}$ Pa^{-1}

Compressibility Rock

$\beta r := 2.4\cdot10^{-10} + 0.05\cdot10^{-10}\cdot9$

$\beta r = 2.85\times10^{-10}$ Pa^{-1}

Compressibility water

$\beta w := 3.1\cdot10^{-10} + 0.05\cdot10^{-10}\cdot9$

$\beta w = 3.55\times10^{-10}$ Pa^{-1}

Initial reservoir pressure $Pinres := (40 + 0.2\cdot9)\cdot10^{6}$

$Pinres = 4.18 \times 10^7$ Pa

Saturation pressure of il gas $Ps := (30 + 0.2 \cdot 9) \cdot 10^6$

$Ps = 3.18 \times 10^7$ Pa

Saturation coefficient layer bound water $Sw := 0.22$

Radius boundary $Rb := 1000 + 50 \cdot 9$

$Rb = 1.45 \times 10^3$ m

solution

The oil coefficient of oil extraction is determine by:

$$\eta := \frac{Voil}{Vres}$$

Compressiblity factor

$\beta := \beta o \cdot So + \beta w \cdot Sw$

$\beta = 1.328 \times 10^{-9}$

$V := \pi \cdot Rb^2 \cdot h$ explicit, ALL $\rightarrow \pi \cdot (1000 + 50 \cdot 9)^2 \cdot (8 + 0.5 \cdot 9) = 8.256 \times 10^7$ m3

$\Delta P := Pinres - Ps$ explicit, ALL $= (40 + 0.2 \cdot 9) \cdot 10^6 - (30 + 0.2 \cdot 9) \cdot 10^6 = 1 \times 10^7$ m3

$Voil := (V \cdot \Delta P \cdot \beta)$ explicit, ALL $\rightarrow 82564981.927156746 \cdot 10000000 \cdot \left[(2.1 \cdot 10^{-9} + 0.05 \cdot 10^{-9} \cdot 9) \cdot (0.4 + 0.01 \cdot 9) + (3.1 \cdot 10^{-1} \right.$

$Vres := \pi \cdot Rb^2 \cdot h \cdot m \cdot So$ explicit, ALL $\rightarrow \pi \cdot (1000 + 50 \cdot 9)^2 \cdot (8 + 0.5 \cdot 9) \cdot 0.195 \cdot (0.4 + 0.01 \cdot 9) = 7.889 \times 10^6$ m3

$$\eta := \frac{Voil}{Vres} \text{ explicit, ALL } = \frac{1096132.7000649332}{7889084.023139827} = 0.139$$

$^{0} + 0.05 \cdot 10^{-10} \cdot 9) \cdot 0.22\Big] = 1.096 \times 10\,\mathrm{m3}$