

Reservoarfluider og Strømning

Reservoir Fluids and Flow
Course TPG 4145

Homework Problem 4

Handed Out: April 3, 2017

Due Date: April 10, 2017

Hand in on ItsLearning as a single Excel file.

File Naming: Problem-3- LastName.xls

Based on Tables 1 and 2, complete the following:

- For an oil phase with “composition” given by $R_s=263 \text{ Sm}^3/\text{Sm}^3$, give the bubblepoint pressure, the saturated oil FVF and saturated oil viscosity. For the same oil, give the oil FVF, oil viscosity and (calculated) oil density at reservoir pressure of 350 bara.
- For a gas phase with “composition” given by $R_v=0.00054632 \text{ Sm}^3/\text{Sm}^3$, give the dewpoint pressure, the saturated gas FVF and saturated gas viscosity. For the same gas, give the gas FVF, gas viscosity, and (calculated) gas density at reservoir pressure of 300 bara.
- Calculate the total initial surface oil in place N and the total initial surface gas in place G . Include the surface oil from the reservoir oil N_o , the surface oil from the reservoir gas N_g , the surface gas from the reservoir oil G_o and the surface gas from the reservoir gas G_g . Assume black-oil PVT properties evaluated at the GOC conditions can be used to estimate the initial in-place volumes.
- Plot (versus pressure) all saturated black-oil PVT properties, and *only* the undersaturated properties for the gas and the oil at initial GOC. Plot all six properties, one figure for each property (plot $1/B_{gd}$, not B_{gd}).

TABLE 1 - RESERVOIR DESCRIPTION

Reservoir Gas Hydrocarbon Pore Volume, $\text{HCPV}_g, \text{m}^3$	10^8
Reservoir Oil Hydrocarbon Pore Volume, $\text{HCPV}_o, \text{m}^3$	10^9
Initial Reservoir Pressure at Gas-Oil Contact, bara	300
Reservoir Temperature, $^\circ\text{C}$	140
Surface Oil Molecular Weight, kg/kmol	160

TABLE 2 – ECL100 BLACK-OIL PVT TABLES (SI UNITS)

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-- ECLIPSE 100 PVT DATA SET : OIL PROPERTIES (CVD)
-- METRIC units
-- Reservoir Temperature (C) =      140.00
-- ECLIPSE 100 DENSITY data
-- Surface Densities of Oil, Water, and Gas (kg/m3)
DENSITY
  777.00898    1000.00000      0.95723 /

-- Separator Conditions:
--   Tsp(C)      Psp(bara)
-----
--       65.00      70.00
--       25.00      35.00
--       15.56      1.01
-----
--Solution      Oil      Oil FVF      Oil
-- GOR, Rs      Pressure    Bo      Viscosity
-- Sm3/Sm3      bara      m3/Sm3      cp
-----
PVT0
  66.713      100.000      1.35311      0.18464
              150.000      1.32385      0.20991
              200.000      1.30050      0.23477
              275.000      1.27279      0.27143
              350.000      1.25097      0.30740
              400.000      1.23874      0.33098
              450.000      1.22794      0.35425
              500.000      1.21831      0.37720 /

  107.763      150.000      1.48868      0.14978
              200.000      1.45288      0.16965
              275.000      1.41208      0.19916
              350.000      1.38104      0.22842
              400.000      1.36399      0.24778
              450.000      1.34913      0.26701
              500.000      1.33600      0.28611 /

  157.637      200.000      1.64962      0.12357
              275.000      1.58822      0.14677
              350.000      1.54342      0.16995
              400.000      1.51942      0.18541
              450.000      1.49879      0.20086
              500.000      1.48080      0.21631 /

  262.880      275.000      1.98826      0.09338
              350.000      1.90472      0.10888
              400.000      1.86205      0.11929
              450.000      1.82637      0.12978
              500.000      1.79595      0.14034 /

  314.708      300.009      2.15842      0.08431
              350.000      2.09141      0.09317
              400.000      2.03765      0.10208
              450.000      1.99324      0.11106
              500.000      1.95573      0.12013 /

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-----
-- ECLIPSE 100 PVT DATA SET : WET GAS PROPERTIES (CVD)
-- METRIC units
-- Reservoir Temperature (C) =      140.00

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-- ECLIPSE 100 DENSITY data
-- Surface Densities of Oil, Water, and Gas (kg/m3)
DENSITY
  777.00898    1000.00000    0.95723 /

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-- Separator Conditions:
--   Tsp(C)    Psp(bara)
--   -----
--   65.00     70.00
--   25.00     35.00
--   15.56     1.01

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-----
--   Gas      Solution   Gas FVF      Gas
--Pressure   OGR, Rv    Bgd        Viscosity
--  bara     Sm3/Sm3    m3/Sm3     cp
-----
PVTG
100.000  0.00018568  0.013343  0.015872
          0.00000000  0.013343  0.015872 /
150.001  0.00022684  0.008834  0.018420
          0.00018568  0.008787  0.018384
          0.00000000  0.008787  0.018384 /
200.001  0.00031310  0.006750  0.022131
          0.00022684  0.006740  0.021541
          0.00018568  0.006701  0.021475
          0.00000000  0.006701  0.021475 /
275.001  0.00054632  0.005300  0.030401
          0.00031310  0.005234  0.027328
          0.00022684  0.005201  0.026438
          0.00018568  0.005166  0.026339
          0.00000000  0.005166  0.026339 /
300.011  0.00067340  0.005062  0.034241
          0.00054632  0.005012  0.032258
          0.00031310  0.004924  0.028971
          0.00022684  0.004885  0.028006
          0.00018568  0.004852  0.027899
          0.00000000  0.004852  0.027899 /
350.002  0.00067340  0.004649  0.037898
          0.00054632  0.004580  0.035722
          0.00031310  0.004457  0.032071
          0.00022684  0.004409  0.030983
          0.00018568  0.004378  0.030862
          0.00000000  0.004378  0.030862 /
400.002  0.00067340  0.004352  0.041291
          0.00054632  0.004269  0.038927
          0.00031310  0.004124  0.034948
          0.00022684  0.004069  0.033754
          0.00018568  0.004039  0.033620
          0.00000000  0.004039  0.033620 /

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