PETE 2060 Fall 2016

Project 2: Flow in a 1-D reservoir (Due on Monday 11/07/2016, 11:55pm)

Consider slight compressible but *constant fluid property* flow in undersaturated reservoir (i.e. pressure remains above bubble point) with no dip and wells represented as mass source/sink. Following governing equation describes such flow in porous media:

$$\varphi \rho c_t \frac{\partial p}{\partial t} = \frac{\partial}{\partial x}\left(\frac{\rho}{\mu} k_{xx} \left(\frac{\partial p}{\partial x}\right)\right) + q$$

Where the fluid density and rock porosity is described as: $\rho = 0.85$ SG and $\varphi = 0.15$

Define the total compressibility as $c_t = 1.2\ microsips$ (c_f = 1 microsips and c_R = 0.2 microsips) and assume that fluid viscosity is constant (= 3 cp) for your problem. All boundaries are no flow (i.e. set transmissibility coefficient to zero). Each grid block has the dimension of 100 ft X 100 ft (assume no variation in the third direction). Initial reservoir pressure MUST be hydrostatic with the first gridblock pressure set as the datum value of 3000 psia. Reference fluid density and rock porosity evaluated at 3000 psia are 0.85 SG and 0.15.

●: Producer Well -- Apply the average grid block pressure of 1500 psia in the grid block# 8 to model the producer well. In other words, q can be set to zero in rest of the grid blocks.

HINT: Convert into consistent units before you discretize the terms in governing equation. All unit conversions and definitions are available in any introductory textbook for petroleum engineering.

P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}
10 mD	10 mD	10 mD	10 mD	10 mD	10 mD	10 mD	10 mD	10mD	10 mD
0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15 ●	0.15	0.15

Task 1: Write a linear algebraic solver for N X N system for the gridblock pressures as unknowns.

Task 2: Determine the transmissibility coefficients for your system and solve it. Present the results (i.e. pressure distribution in the reservoir) at three different time instances of 10, 30, and 90 days by solving the system of equations using time steps of 1, 2, and 3 days respectively.