

HW#8 (With more description)**Assigned: Thursday, October 22, 2009****Due: Thursday, November 5, 2009**

This problem involves calculating the P/z vs G_p performance for a naturally fractured gas reservoir.

The required properties are listed at the end. Please use a correlation to calculate $\frac{1}{z} \frac{\partial z}{\partial P}$. Use

$\Delta t = 100 \text{ days}$; run until \bar{P} is close to P_w .

Assuming pseudo-steady state conditions, with no external influx, P/z vs G_p is a straight line. This line goes between $(G_p, P/z) = (0, P_i/z_i)$ and $(VR \cdot \phi \cdot (1 - S_w) / B_{gi}, 0)$.

Computational steps:

- 1) Calculate the properties which do not change with time (r_e , r_o , WI, etc)
- 2) Calculate $q_g B_g = -WI(\bar{P} - P_w)$
- 3) Calculate $\tau_g = \frac{q_g B_g}{\pi r_e^2 \Delta z}$
- 4) Calculate $\frac{\partial P_m}{\partial t}$ (not an expanded form) from $\tau_g = \phi_m C_{Tm} \frac{\partial P_m}{\partial t}$
- 5) Calculate $P_f - P_m$ (not an expanded form) from $\sigma k_m \lambda_{gm} (P_f - P_m) = \tau_g$
- 6) Update $G_p^{new} = G_p^{old} + \Delta G_p$; $\Delta G_p = q_g \Delta t$
- 7) Go back to step 2 for a new \bar{P} computed from P/z vs G_p straight line

Submit:

- a) Plot and table of P/z vs G_p
- b) Plot and table of P/z vs time
- c) Plot and table of q_g vs time
- d) Plot and table of G_p vs time
- e) Plot and table of $\frac{\partial P_m}{\partial t}$ vs time
- f) Plot and table of $P_f - P_m$ vs time

Data:

- $P_i = 5000 \text{ psi}$
- $T = 180 \text{ F}$
- $P_{wf} = 1000 \text{ psi}$
- $k_f = 1000 \text{ md}$
- $\phi_f = 10^{-4}$
- $k_m = 3 \cdot 10^{-3} \text{ md}$
- $\phi_m = 0.1$
- Well spacing: 40 acre
- $r_w = 0.25 \text{ ft}$
- $\Delta z = 30 \text{ ft}$
- $\gamma_g = 0.6$ to air
- $s = 2$
- $L_x = L_y = 20 \text{ feet}$
- $L_z = 30 \text{ feet}$
- $\mu_g = 0.02$
- $k_{rgf}^* = 1$
- $k_{rgm}^* = 0.6$
- $S_{wm} = 0.30$
- $S_{wf} = 0.05$
- $C_{\phi,m} = 3 \cdot 10^{-6} \text{ psi}^{-1}$
- $C_{\phi,f} = 5 \cdot 10^{-6} \text{ psi}^{-1}$
- $C_w = 3 \cdot 10^{-6}$