ResGeo 202 Reservoir Geomechanics
Spring 2017, Stanford Online

Homework 1 – Calculating Overburden Stress, S_V
Due Tuesday 18 April 2017, 07:30 (AM) UTC

Please direct any questions to the Piazza discussion forum on the course website

Note that the deadline is in Coordinated Universal Time (UTC): **Tuesday 18 April at 07:30 UTC**, which is the early morning of Tuesday 18 April at 00:30 in Pacific time. If you want to see the current time in UTC, please google: "Current time in UTC."

Background

In this assignment, you will be calculating the vertical stress, S_V, and the formation porosity, ϕ, for two different data sets, one from the Barnett Shale, Texas, and the other from an offshore well in the Gulf of Mexico (GOM). Both these data sets will also be used in future homework assignments and can be downloaded by clicking the right tab on the top of this page.

Utilize a scientific computing or plotting program such as Microsoft Excel, MATLAB, or R to follow the steps below. Then, **answer the questions on the page below.**

Instructions

Part 1: Compute the overburden stress and overburden gradients

a. *Plot density vs. depth for each dataset*. It is conventional to put depth on an inverted *y*-axis and density on the *x*-axis. Notice that the density measurements are not continuous to the surface. For the Barnett data, assume a density of 1.9 g/cc for sediments at the Earth's surface to the first measurement point. For the GOM data, since the well is offshore, use a density of 1.0 g/cc from the surface to the sea floor (1000 ft) and a density of 1.8 g/cc for the shallowest seafloor sediments from 1001 ft to the start of the log.

b. *Divide the density profiles into 5 blocks*. By considering the variations of density in each profile, designate 5 blocks representing sections of approximately constant density. Compute the average density in each block and plot blocked density vs. depth for each dataset.

c. *Calculate the overburden stress*. Calculate and plot the overburden stress for each data set using both the continuous and blocked density profiles. On the same plots, show the pore pressure for each well assuming that it is hydrostatic (1.0

g/cc pore fluid density). Use 9.80 m/s^2 or 32.17 ft/s^2 to approximate *g*, the acceleration due to gravity, and convert units to calculate stress in PSI.

d. *Calculate the overburden gradient (overburden stress normalized by depth in PSI/ft)*. Calculate and plot the overburden gradient for each data set using the continuous log data (not the blocked data).

Part 2: Compute porosity from density logs

a. *Compute porosity assuming complete saturation and hydrostatic pore pressure:*

$$\rho_{log} = (1-\phi)\rho_{matrix} + \phi\rho_{fluid}$$

where ρ_{log} is the log density, ϕ is the porosity, ρ_{matrix} is the density of the sedimentary reservoir rock (use 2.7 g/cc), and ρ_{fluid} is density of the pore fluid (use 1.0 g/cc).

b. *Plot porosity vs. depth for each dataset*. Calculate and plot the porosity for each data set using both the continuous and blocked density profiles.

Part 3: Answer the questions on the page below

Use the plots and calculations from Parts 1 and 2 to answer the questions on the page below. The answers will be posted a day after it is due. Numerical entry-type responses have a range of acceptable values and are graded electronically, so please adhere to the value of constants given here to prevent misgrading of your submissions. We will specify the units that we want the answer in, so please do not write units in the answer; just write the number.