ResGeo 202 Reservoir Geomechanics
Spring 2017, Stanford Online

Homework 7 – Building a Geomechanical Model
Due 30 May 2017, 07:30 UTC

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

Note that the deadline is in Coordinated Universal Time (UTC). If you want to see the current time in UTC, please google: "Current time in UTC."

Background

In this assignment, you will use a stress polygon diagram ("Zobackogram") similar to the one you built in Homework 6 to construct a geomechanical model for the Barnett Shale data, but using new information below. If your answers to Homework 6 were incorrect, solutions will be posted after it is due that you can use to inform this homework.

Utilize a scientific computing or plotting program such as Microsoft Excel or MATLAB to follow the steps below. **Then, answer the questions on the webpage below this PDF document. There is no need to submit your plots via email.**

Instructions

Part 1: Constraining S_{Hmax} from leak-off tests

Use the values below to construct new stress polygons. Note, however, that the stress polygons we are dealing with in this assignment are for the stress state (in psi) at one specific depth, rather than normalized stress gradient (in psi/ft) over a depth interval in the well, as they were in the previous homework assignment. *Note also that different pore pressure values (corresponding to a slightly lower gradient of 0.53 psi/ft) are used here.*

Leak-off tests (LOTs) have been used to determine the value of S_{hmin} at the two depths given below. Laboratory testing on core samples at the given depths have been used to estimate the value of UCS. Using the parameters below, as well as any others you need from Homework 6, recalculate the constraints on S_{Hmax} at each depth, given the observed lack of tensile failures or borehole breakouts from Homework 6.

Depth (ft)	S_V (psi)	S_{hmin} measurement (psi)	Pore pressure (psi)	UCS (psi)	ΔP_P (psi)
5500	6050	3856	2915	22000	825
7000	7700	7600	3710	28000	1050

a) Make new stress polygons for each depth, using values given above and, where necessary, from Homework 6.
b) Given the S_{hmin} value measured at each depth using a LOT, calculate the range of possible S_{Hmax} values, to the nearest psi.
c) Finally, make a stress polygon at 5500 ft depth for a slightly lower coefficient of friction ($\mu = 0.65$). Use this to plot to understand how changes to the coefficient of friction affect the likelihood that well-oriented faults will be critically stressed under the ambient stress conditions. (If you are not excited about the prospect of generating a third stress polygon, note that you might be able to use your intuition to answer questions about the effect of changing the coefficient of friction.)

Part 2: Answer the questions on the page below

Use the stress polygon plot and the calculations from Part 1 to answer the questions on the webpage below. The answers will be posted after the due date. Numerical entry type responses have only 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.