ResGeo 202 Reservoir Geomechanics
Spring 2017, Stanford Online

Homework 5 – Analyzing Fractures from FMI Image Logs
Due 16 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 analyze natural fracture data generated from an FMI image log interpretation in a vertical well from the Barnett shale. This image log has been processed using the software GMI•Imager, in which fractures were picked as abrupt contrasts in the electrical resistivity image of the borehole wall. The interpreted fracture data from the image log can be downloaded by clicking the link on the top of the page.

For this homework assignment, you will need to create stereoenets and rose diagrams. There are many such programs available, but this applet from VisibleGeology (http://app.visiblegeology.com/stereonetApp.html) may be helpful for making stereonet, histogram, and rose plots. Alternatively, Professor Rick Allmendinger's (Cornell) website (http://www.geo.cornell.edu/geology/faculty/RWA/programs/stereonet.html) provides a free stereonet program that works on multiple platforms, and MATLAB has built-in histogram and rose diagram plotting functions.

Then, answer the questions on the webpage below this PDF document. There is no need to upload or send us your figures. You only need to provide answers in multiple-choice form in the webpage below.

Instructions

Part 1: Dominant fracture orientations
Plot the fracture orientations with two conventions in a lower hemisphere stereographic projection and on a rose diagram. First, plot the fracture orientations using strike and dip as poles to planes ("poles") in stereographic projection (on a stereonet) and then plot the fracture orientations using dip direction on a rose diagram. Note that dip direction is 90 degrees to the right of strike direction ("right-hand rule").

Part 2: Fracture apertures
Plot the fracture apertures on a histogram. Plot the fracture apertures on a histogram using 20 evenly spaced bins. Are most fracture apertures greater than or less than 8 mm?

Also make a plot with fracture dip on the horizontal axis and depth on the vertical axis. If possible, color each point by its aperture. Can you pick a depth with several fractures with shallow dips and possibly large apertures that may actually be bedding planes misinterpreted as natural fractures?

Part 3: Fracture clustering with depth

Plot the fracture count with depth on a histogram. Plot the fracture count on a histogram using 20 evenly spaced bins in depth. Which ~200-foot interval has the most fractures?

Also make a plot with fracture strike on the horizontal axis and aperture on the vertical axis. Compare fractures with apertures greater than 8 mm to those with 4–8 mm aperture and those with less than 4 mm aperture. Which group has the most fractures striking approximately north?

Part 4: Answer the multiple-choice questions on the page below

Use the plots from Parts 1–3 to answer the multiple-choice questions on the page below. The answers will be visible shortly after the homework is due.