140 Helpsheet

Software

GDSLAB

Understanding K0 test control

1. Introduction

Some GDS users have encountered difficulties when performing K0 tests, usually due to not having the correct specimen conditions for a K0 test and not having a full understanding of how the software works to control the K0 test.

This helpsheet tries to illustrate how the software controls the K0 test by using a very simple example test, which shows how the test is controlled by the software without the complexity of how the system behaves with a soil sample in place.

2. Understanding the K0 test control

Below are a couple of simple tests that can be carried out without a sample or the cell top in place, and with the valves to the cell pressure (CP) and back pressure (BP) controllers closed off. Only the lower chamber controller will be connected to the lower chamber so that you can see what the axial displacement is doing.

Both these example tests will show exactly what the software is doing during a K0 test and should make it very clear whether or not your system is functioning correctly.

Simple test using the Hall Effect for control of K0 condition

Remove the radial Hall Effect (HE) chip and magnet from the calliper and connect them up to the data acquisition system with the magnet in the correct place over the chip and flat on the table. Set the CP to 100kPa and the BP to 50kPa and zero both the axial displacement and the radial hall effect chip. Setup a K0 test module to ramp the CP from 100-125kPa in 15 minutes. In the termination conditions set Selected K0 Ramp Reaches Target and Hold Pressures at End of Test. Start the test stage running and plot axial displacement and the radial hall effect on one graph and CP and BP on another graph.

The behaviour that you should see is:

- that the BP remains constant throughout the test

- that the CP performs the requested ramp

- you should see that the axial displacement remains constant whilst the radial hall effect value remains within 3 microns of the start value. If the value is greater than 3 microns away from the target then the axial displacement will change. If you pull the magnet a very small amount away from the HE chip so that the HE reading is negative (sample diameter increasing) then the axial displacement should decrease, if you push the magnet a very small amount towards the HE chip so that the HE reading is positive (sample diameter decreasing) then the axial displacement should increase.

- after the test time is up the test should stop logging and controlling the test.

- if you quickly open then close the CP valve the pressure should drop then return to 125kPa.

- if you quickly open then close the BP valve the pressure should drop then return to 50kPa.

Simple test using Back Volume for control of K0 condition

Set the CP to 100kPa and the BP to 50kPa and zero the axial displacement, the back volume and the lower chamber volume. Setup a K0 test module to ramp the CP from 100-125kPa in 15 minutes. In the termination conditions set Selected K0 Ramp Reaches Target and Hold Pressures at End of Test. Start the test stage running and plot axial displacement on one graph, back volume and lower chamber volume on the second graph and CP and BP on the third graph.

The behaviour that you should see is:

- that the BP remains constant throughout the test

- that the CP performs the requested ramp

- open the Object Display. Set the Back pressure to 100kPa (you may need to press Set Target a few times for the controller to respond). The BP should increase for a couple of seconds then the test will take control of the BP controller and bring the pressure back down to 50kPa. You should see that the lower chamber controller moves the piston down to compensate for the increase in volume in the sample. As the BP returns to 50kPa the piston will move back to the original displacement value.

- if you set a BP of 0kPa from the Object Display then the BP should decrease for a couple of seconds and then return to 50kPa. You should see that the lower chamber controller moves the piston up to compensate for the decrease in volume in the sample. As the BP returns to 50kPa the piston will move back to the original displacement value.

- take a coin and place it in between the end of the displacement transducer and the arm of the cell. You should see that the lower chamber controller moves the piston down to set the displacement reading back to the original value. When you take away the coin the lower chamber controller will move he piston up to that the displacement value again goes back to the original reading.

- after the test time is up the test should stop logging and controlling the test.

- if you quickly open then close the CP valve the pressure should drop then return to 125kPa.

- if you quickly open then close the BP valve the pressure should drop then return to 50kPa.

As long as your system is behaving as described above for radial hall effect control and back volume control then the software and the hardware are functioning correctly.

3. Things to Note when carrying out a K0 Test

- It is very important to make sure that the sample is in equilibrium before starting the K0 test i.e. fully saturated and consolidated with no excess pore water pressure.

- The K0 test needs to be carried out at a rate that is slow enough for the sample to drain.

- If you are starting the K0 test from low stresses then it is necessary to use extension topcaps, as at low deviator stresses the sample will not respond to the system trying to increase the height of the sample without the use of the extension topcap.