

ME556 Laboratory Experiment #5 Calibration of a 3-Axis Force Transducer

(The following will be more fully described on the DVD):

The transducer may be mounted using 4 bolts directly to a wall plate in a pillar located in MEB 123. The transducer may be mounted with the arm pointing down (i.e., the Y-direction pointing down), or with the arm pointing towards the glass shelves (i.e., the Z-direction pointing down). The same set of bolt holes also allows for pointing the arm at an approximately 30° angle (this orientation is used in the final part of this experiment). The transducer can also be mounted to a right-angle bracket, which is in turn mounted to the wall bracket. In this case the X-direction is pointing down.

Procedures:

As per directions on the DVD, the force transducer is connected to the Strain-Smart system (see attached Strain-Smart operation procedure), and measurements are obtained with the transducer in 4 different orientations.

Record the data you collect in the tables on the following page.

Measurements obtained in the first three orientations are used to calibrate the device, while measurements in the fourth configuration are to be compared with values predicted via use of a calibration matrix, defined below.

Also determine the calibration matrix for the transducer following the guidelines given on Lab#5 discussion file. Do this using a spreadsheet so that you can also invert the matrix and allow convenient use of the calibration data. That is, you should be able to insert the three strain readings obtained by applying any load vector to the transducer and have the components of the load vector displayed in the spreadsheet. Now put in the strains found for the approximately 30° load and check to see if the transducer output agrees with this known load vector.

Submit this page with your data along with a print out of your spreadsheet showing the results found for the angled load.

ME556 Lab #5:

Name: _____ Date: _____

Calibration data:

	Strain in X-dir ($\mu\epsilon$)	Strain in Y-dir ($\mu\epsilon$)	Strain in Z-dir ($\mu\epsilon$)
80 lb. load in X-dir			
80 lb. load in Y-dir			
80 lb. load in Z-dir			

Test load data:

80 lb. load at ____°	Strain in X-dir ($\mu\epsilon$)	Strain in Y-dir ($\mu\epsilon$)	Strain in Z-dir ($\mu\epsilon$)

Strain Smart System Operation

This system will record the calibration data for the 3-axis Force Transducer

Follow the steps below to record your data:

1. Open the **ME556 data** folder on the desktop. Create a new folder for your data storage (unless you already have one there).
2. Double-click on the “**Strain Smart**” icon on the Desktop.
3. From the Front Panel, select **OPEN** from the drop-down **FILE** menu.
4. Answer **NO** to the prompt to save the file.
5. Select the file: C:\Program Files\Measurement Group\Projects\ ME556 Three Axis Transducer.5K1
6. With the file loaded click on the **DATA** tab.
7. From the **SCAN SESSION** window, right-click on **3 axis transducer**, and choose **Duplicate Scan Session**.
8. A new scan session will be created. Right-click on the new session and **rename** it as appropriate (e.g., Lab5_axis 1 in the name).
9. Check that the **ONLINE** indicator in the lower left corner of the screen is lit green. If it is red (offline), click once on **ONLINE**.
10. The support arm should already be in the x-axis position. If not, remove the tray and re-mount it to the wall bracket as shown in Lab-5 setup.pdf (on the desktop). Note that the x-axis orientation requires use of the intermediate angle-bracket.
11. Verify that the top of the arm is horizontal using the digital level before fully tightening the screws.
12. Hang the load tray on the end of the support arm. Next, we will balance the strain gage bridges.
13. Click on the **ZERO/CAL** icon from the top of the screen. (Then click on **ZERO** icon to get to the zero assignment window, if needed)
14. All 3 bridges should be highlighted blue. If not, select **All Assignments** from the **FILTER** menu.
15. Click on **ZERO** button. When the zeroing sequence has completed with no warnings, close the window.
16. Click on the **Arm** Icon, then click on the **Start** button. The **scanning** window will come up.
17. (Note: this step is only necessary for the initial scan session. Once opened, the display window remains open until closed). Click on the **DISPLAY** icon in the lower right corner of the **scanning** window. Select **Other Online Displays** **3 axis transducer**. Answer **CONTINUE** if prompted for a disk. The display window will come up.
18. Carefully place two weights on the tray (80 lbs).
19. Wait till the oscillations become small.
20. In the **scanning** window, click on the **Record** button once. Wait 1-2 seconds to collect 10-20 scans, and then click **Record** again to stop recording scans. Make a note of which channel has the largest strain reading, this channel will correspond

to the x-axis. Click **Stop** to end the scan session.

21. Click on the main window. Answer **YES** when prompted to save your data (unless you plan to discard it and repeat the session).

22. Answer **YES** when prompted to duplicate scan session.

23. **Rename** the new session (e.g., Lab 5_axis 2 in the name).

24. Remove the weights and the tray from the support arm. Remove the intermediate angle-bracket, and re-mount the arm in to the y-axis position.

25. Repeat steps 11-22 for the y-axis. Repeat again for the z-axis and the 27.5° reading.

26. **To Reduce and save your data**, highlight the scan session to be reduced (e.g., Lab5_axis 1). Note: be sure you are in the **Scan Session** window, not the **Reduce Data** window.

27. Click on the **REDUCE** icon at the top of the screen. **The Data Reduction Wizard** will open.

28. Click **NEXT** to exit the first window (unless you wish to change your file name).

29. In the second window, you will choose your file path:

a. Un-check the box next to **MS Excel [*.xls]**, this will clear the path.

b. Re-check the box. A file dialog box will open that will allow you to save the file in the folder you created: **Desktop\ME556 data\Your Folder**. If you forgot to create a folder, you can do it now by choosing the New Folder icon at the top-right of the dialog box.

30. Choose **NEXT** till you reach **STEP 5**

31. In Step 5 window, verify that the **Strain** boxes are checked for each channel. Click on **NEXT** button.

32. In the final window click **REDUCE**.

33. Repeat these steps (25-31) to reduce the other three scan sessions.

34. The MS Excel files should now appear in your folder on the desktop.

35. Open your Excel files to ensure that data is saved before leaving.

36. Close the system. Click on the drop down menu **FILE** and then click on **EXIT**.

Answer **NO** to the prompt screen which asks if you want to save changes. Close the Strain-Smart Online Display window (it might be minimized on the screen).

37. Do not disconnect the transducer from the strain smart system.

38. Remove all the weights from the tray and place on the table.

39. Be a good sport! Re-mount the support arm in the x-axis position for the next user!

Contact Bill Kuykendall if you need help with the lab equipment:

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