ELECTROMECHANICAL ANALYSIS LAB
EMET 3424_70
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LAB#5

STATIC WEIGHT SCALE CALIBRATION

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LAB OBJECTIVE

The objective of this laboratory experiment is to gain experience and practice working with electrical devices that are used to evaluate mechanical devices. We will see how we can find distributed weight though a frame. We will use two load cells. In doing so, we will understand the device and it uses.

The equipment used in this lab is listed but limited to this list.

- Measuring Scale; Dillion & Company, Inc.; California, USA; Range A: 0-50 lb.; Serial #2: 3219; Serial #5: 3222
- Load Cell; W.C. Dillon & Company, Inc.; California, USA; Code: AISLO3IE-RT; Capacity: 50 lb.; Serial #2: 3212; Serial #3: 3213
- Setup Board; William Laidlaw Manufacturers; Belmont, NY; Type: AGT; No: 67001
- Setup Frame Arm's
- Calibrated Mass's

STATIC WEIGHT SCALE CALIBRATION

THEORY

A load cell is classified as a force transducer. This device converts force or weight into an electrical signal. Multiple strain gages are connected to create the four legs of a Wheatstone-bridge configuration. When an input voltage is applied to the bridge, the output becomes a voltage proportional to the force on the cell. This output can be amplified and processed by conventional electrical instrumentation. This process is done inside the measuring scale.

FIGURE 1: BLOCK DIAGRAM FOR STATIC WEIGHT SCALE CALIBRATION

To find the scale factor for each sensor we use the slope equation. This equitation is a rise over run or calibrated result over raw data.

FIGURE 3: SLOPE EQUATION

Using a general equation, scale factor times raw data we can derive the equations to find calibrated result for each sensor.

FIGURE 4: CALIBRATED RESULT EQUATION

$$\mathrm{SCalibratedResult} := \mathrm{ScaleFactor} \cdot \mathrm{RawData}$$

We find the percent error by finding the difference of calibrated result and true value divided by full-scale value.

FIGURE 5: PERCENT ERROR EQUATION

$$\%\mathrm{Error} := \frac{\mathrm{CalibratedResult} - \mathrm{TrueValue}}{\mathrm{FullScaleValue}} \cdot 100$$

SCHEMATIC

FIGURE 6: MECHANICALSETUP

PROCEDURE / DATA COLLECTION

CALCULATIONS

$\varepsilon Ma(ccw) = 0$

$Mass := 16$

$Dis := \frac{12}{12}$

$TotalDis := \frac{20}{12}$

$Angle := 140$

$AngleConv := Angle \cdot \left(\frac{\pi}{180}\right)$

$$Ta := \frac{(-Mass) \cdot \left(\frac{2}{12}\right)}{(\cos(AngleConv))}$$

*

$Ta = 3.481$

$\varepsilon Mb(ccw) = 0$

$Tb := Ta \cdot \sin\left[90 \cdot \left(\frac{\pi}{180}\right)\right]$

$Tb = 3.481$

RESULTS SUMMARY

DISCUSSION

We can visual see that the shaft encoder has a much greater sensitivity then the rotational potentiometer. The slightest change in the vernier dial will change the output of our encoder. We can as see from our percent error graph; the shaft encoder is more accurate then the rotational potentiometer. The rotational potentiometer has a percent error 5% where the shaft encoder's percent error is less the 1% error. The advantages of the shaft encoder are that is it very accurate and sensitive. Although it disadvantage is that it contain complicated circuitry and may not always be available. It also has an output that must be converted to interpret. The advantage of the rotational potentiometer is that it very potable and has an output that can directly be interpreted. Although its disadvantage is that, its accuracy and sensitivity are less superior to the shaft encoder.