Experiment 1 Sensors (continued)
Linear Variable Differential Transformer (LVDT) Position Transducer
January 24-26, 2017

Introduction: Linear variable differential transformers (LVDT) convert position of a soft iron core into an electrical signal. The circuit diagram in Figure 1 shows that the LVDT consists of a transformer with a primary coil P coupled to two secondary windings S. The identically wound secondary coils are positioned on the same linear axis as the primary but are symmetrically displaced from each other above and below the mid-span of the primary's axis. Motion of the soft iron core through the LVDT changes the magnetic coupling between the primary input and each of secondary outputs. The differential size of the secondary outputs can be used to monitor the linear displacement of the core.

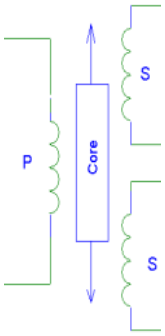

Figure 1. Linear variable differential transformer (LVDT).

For measurement convenience, the LVDT sinusoidal output can be rectified and conditioned using the circuit of Figure 2 to provide a DC output.

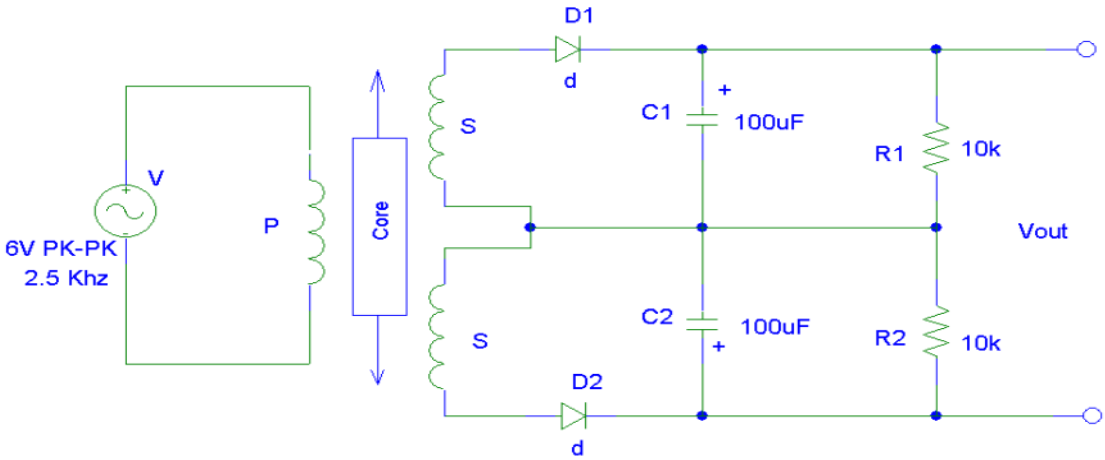

Figure 2. Demodulator circuit used to condition LVDT output.

Procedure:
1. The LVDT primary leads have two colors on each wire. Use a continuity check to determine the pairing of the secondary leads. Supply a 2.5 kHz, 6 v_{pp} sinusoidal signal to the LVDT primary side with the yellow/black lead at ground. With the oscilloscope set to display both channels 1 and 2 versus time, feed the primary input to channel 1 and use channel 2 to monitor one pair of secondary outputs as the iron core is moved through the LVDT. Orient the LVDT axis vertical with the lead wires on the top side and determine the location(top or bottom) of the secondary windings and also secondary lead polarity needed for the input and output signal to be in phase. Repeat this process for the other pair of secondary outputs.
2. Build the demodulator circuit shown in Figure 2 and show your instructor how the LVDT position sensor

output displayed on the oscilloscope varies with core position.
3. Calibrate the LVDT output using the micrometer stand to vary core position and the digital multi-meter to measure the DC output. The calibration should range from approximately one-half inch below to one-half inch above the mid-span of the LVDT.

Required:

a. Copy of Figure 1 with the color of each wire identified.
b. The LVDT calibration table (Output Voltage versus Core Position) Include the LVDT serial number in the Table Title.
c. A graph of the LVDT calibration data.
d. Select and graph the linear response subset of the LVDT calibration data. Use this graph to determine the linear equation that relates output voltage to core position.
e. Determine the sensitivity of the LVDT.