

ENGR 4520 / 5520: Sensors & Actuators

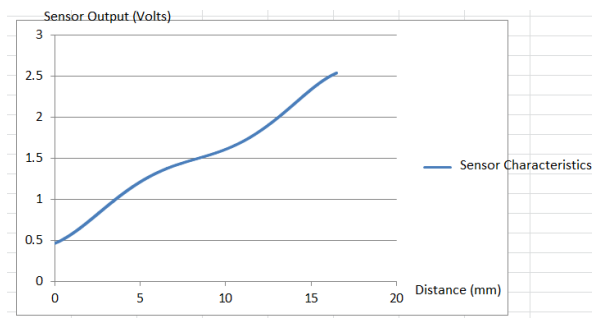
Fall 2015

Term Project

Due Dec 1st 2015

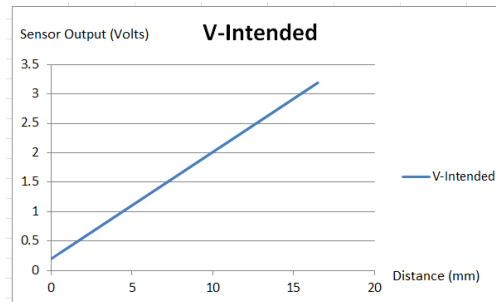
Dr. Abtahi

The attached data is the output of a sensor in volts. The input to this sensor is distance. In this project, you need to analyze the given sensor characteristic, next come up with compensation algorithms (or programs or circuits) to make the characteristic of the sensor close to a desired characteristic, and finally analyze the amended characteristic and make a judgement about the efficiency of your algorithms.



For the given characteristic:

- 1) Sweep distance from 0 to 16 mm and from 16 mm to 0 mm and show the output of the sensor in time domain. Evaluate the sensor output in time domain. The speed of sweep is not of important (one sweep is enough)
- 2) Design a method to measure the resolution of this sensor for any given distance. Depict the resolution vs. distance. Use a pass/fail criterion of 70 micron for resolution and find the violating areas.
- 3) Design a method to determine the symmetric point of the sensor. If it is not possible to determine a point, then determine the interval in which the symmetric point resides. The range shall be as small as possible. (explain about your criterion to determine this range)
- 4) Assume the desired characteristic of this sensor is as follows:



Please note that that rail voltages are 0.2 Volts and 3.1 Volts (to avoid any saturation). Determine the error for each distance from the desired characteristic. Depict error vs. distance on a graph.

- 5) Depict the distribution of resolution and error and determine the following parameters:
 - a. Mean
 - b. Median
 - c. Mode
 - d. Standard Deviation
 - e. Sigma-level for 10 mVolts error
 - f. Sigma-level for 70 microns threshold for resolution
- 6) Design an algorithm (or program or circuit) to shift the symmetric point (or range) of the sensor characteristic to the symmetric point of the desired characteristic
- 7) Design an algorithm (or program or circuit) to change the span of the sensor characteristic to the desired characteristic.
- 8) Use your algorithm (or program or circuit) from both 6 and 7 to generate the compensate sensor characteristic.
- 9) Repeat steps 1, 2, 3, 4 and 5 for the amended sensor characteristic
- 10) Evaluate your algorithms based on all the step above and provide a conclusion