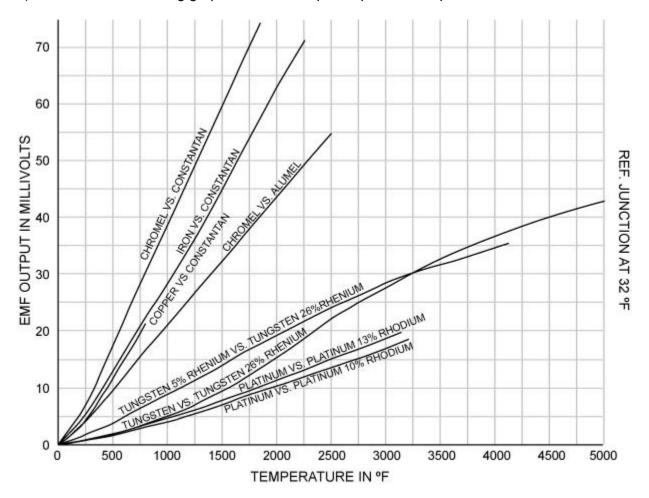
MEEM 5990 Getting Data in the Lab Spring 2016

Homework 03

Due 2016-02-18

- 1) Write a brief description of your interim project (no more than a paragraph) in a text file named "ProjectDescription.txt"
- 2) Consider the following graph of thermocouple outputs vs. temperature



Source: http://www.convectronics.com/TechInfo5.html

- i. Which thermocouple will provide the greatest sensitivity temperature change at 1000 °F?
- ii. What letter type is this thermocouple?

Write your answers in a file named "Problem02.txt"

- 3) Consider two options three options for measuring angular displacement (e.g. of a shaft):
 - a) http://www.alliedelec.com/images/products/datasheets/bm/CLAROSTAT/70152976.pdf
 - b) http://www.mouser.com/ProductDetail/Alpha-Taiwan/RV120F-10-15F- B10K/?qs=sGAEpiMZZMtC25l1F4XBU%2fP0MTCF53RLP9Y2hf6vz4Q%3d
 - i. What type of DAQ (analog input, digital output, counter/timer, etc.) would be best for sensor a?
 - ii. What type of DAQ would be best for sensor b?
 - iii. Besides a DAQ system and the system under test, what else would be necessary to use sensor a?
 - iv. Sensor b?
 - v. If the goal of this measurement was to measure small angle changes from 0-10 degrees, which sensor would be better and why?
- vi. If the goal of this measurement was to measure total angular displacement over several revolutions, which sensor would be better and why?

Write your answers in a text file named "Problem03.txt"

4) Write a VI which calculates the analog input voltage resolution of an Analog Input system.

Inputs:

- Input voltage range maximum
- Unipolar or bipolar? (e.g., from 0 V to 5 V, or from -5 V to 5 V)?
- ADC resolution in bits (e.g. 12, 16, etc.)

Output:

Resolution of ADC in volts

Save the VI as "AIResolution.vi"

5) Billy has a system is known to generate a signal that is composed of a 22.5 kHz signal added to a 100 Hz signal.

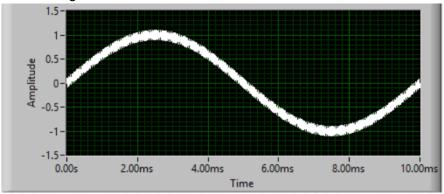


Figure 1: The system output signal

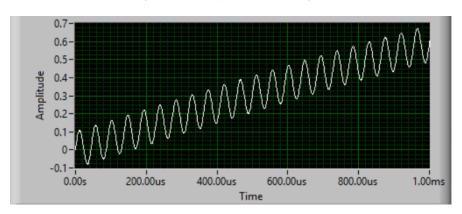


Figure 2: A close-up of the signal. Note the change in the time-axis scale

- i. What sampling speed should Billy use, at a minimum, to fully capture the frequency content of this signal?
- ii. Suppose the Billy considers the 22.5 kHz signal to be noise. What can he do to remove this signal from his data prior to acquiring the signal?
- iii. If Billy has successfully removed the 22.5 kHz "noise" from his signal, now what sampling rate does he need to run in order to capture the 100 Hz component of interest
- iv. Suppose that Billy does nothing to remove the 22.5 kHz signal, and samples his data at 1 kHz. At what frequency will the alias of the high-frequency signal appear?

Write your answers in a text file called "Problem05.txt"