AE6705 Lab 5: Analog-to-Digital Conversion

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October 7, 2024

1. Temperature plot and time to transition from one steady state to another:

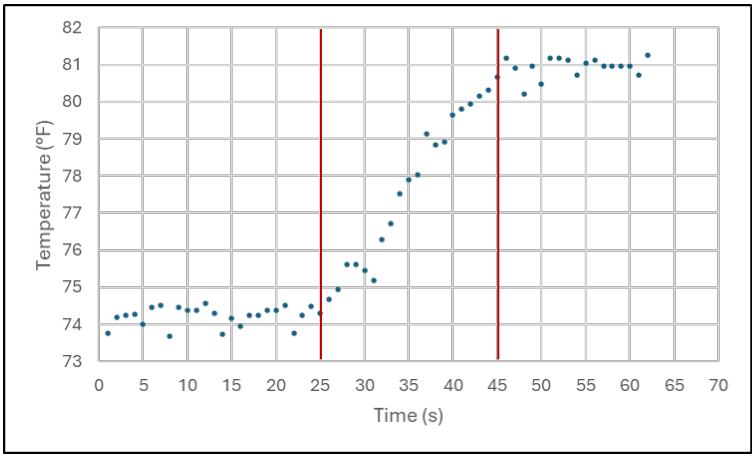

Figure 1: Temperature Plot

It takes about $\boxed{\text{20 seconds}}$ for the sensor to transition from the first stead-state to the second.

2. Calculate the resolution used in this lab in units of mV and in corresponding units of temperature. The op-amp is tuned such that $150°F$ maps to $3.3V$, and $0°F$ maps to $0V$, meaning that the temperature sensor needs to be be scaled to output $22mV/°F$ The temperature sensor has a $10.0mV/°F$ output voltage, so the op-amp needs to be tuned to have a gain of 2.2.

$$\text{res\_voltage} = \frac{mV_{max} - mV_{min}}{2^12} = \frac{3300 - 0}{4096} = \boxed{0.805 \text{ mV}}$$
$$\text{res\_temp} = \frac{T_{max} - T_{min}}{2^12} = \frac{150 - 0}{4096} = \boxed{0.0366\ °F}$$

3. An ADC is configured with 14 bits output. The output is scaled to 0V to 5V corresponding to the angular velocity of a motor from 0 to 100 rad/s. Calculate the voltage input to the ADC and output of the ADC if the angular velocity of the machine is 65 rad/s.

$$\frac{5V}{100\ rad/s} = 0.05\frac{V}{rad/s}$$
$$\text{voltage output} = 0.05 \times 65 = \boxed{3.25V}$$
$$\text{ADC output} = 3.25 \times \frac{2^{14}}{5} \approx \boxed{10650}$$