ME 360: FUNDAMENTALS OF SIGNAL PROCESSING, INSTRUMENTATION AND CONTROL

Laboratory No. 2
Signal Conditioning and Analog-to-digital Signal Conversion Issues Data Sheet

5.2 SINE WAVE RECONSTRUCTION (20 PTS)

Qualitative Observations

In the table below, sketch the original and reconstructed waveforms at the frequencies, 100 Hz, 500 Hz, 975Hz, 1000 Hz and 1200 Hz. For each frequency, compare the base tones in the original and reconstructed signals, indicate whether aliasing is occurring, and describe the observed effects that support your finding.

Frequency Regime	Waveform Comparison Sketches	Base Tone Comparisons
100 Hz		
500 Hz		
975 Hz		
1000 Hz		
1200 Hz		

5.2 SINE WAVE RECONSTRUCTION (CONTINUED) (20 PTS)

Quantitative Data

f [Hz]	f_s [Hz]	f_r [Hz]	$s = f_s / f$	$S_{apparent}$	Aliasing? (yes/no)	Max Error [V]
100	1000					
250	1000					
500	1000					
975	1000					
1000	1000					
1200	1000					

f   = frequency of original waveform as seen on display of function generator [Hz]
f_s = analog-to-digital sampling rate (fixed at 1000 samples per second) [Hz]
f_r = frequency of reconstructed waveform as measured by oscilloscope (Channel 2) [Hz]
s   = f_s / f = actual samples / period of original waveform
$s_{apparent}$ = count of the number of samples / period; *turn off Channel 1 when making this measurement*
Max Error   = worst-case error (absolute value) between original and reconstructed waveform [V]
                = max $[V_{original}(t) - V_{reconstructed}(t)]$
                = maximum difference between the original and reconstructed waveforms at the same instant of time

5.3 QUANTIZATION ERROR IN RAMP OUTPUT (20 PTS)

Ramp Output Measurements

Scaling	D/A Converter Resolution [mV]						DC Offset [mV]
	Step 1	Step 2	Step 3	Step 4	Step 5	Average	
2 mV / div							

Compute the percentage error of the measured vs expected digital-to-analog converter (DAC) resolution.

Explain what the Actual Analog Input plot shows. (Hint: how does the computer see this input?)

5.4 THERMOCOUPLE TEMPERATURE MEASUREMENT (10 PTS)

Instrument	T_{ref} [°F]	T_{ref} [°C]	V_{TC} [mV]	T_{meas} [°C]	T_{meas} [°F]
DMM					

Calculations: