EXPERIMENT #1: SIGNAL ANALYSIS

INTRODUCTION:

In this experiment, you will use a spectrum analyzer to get a frequency-domain picture of complex waveforms. In doing so, you will be able to directly verify the theories presented in class. You will build tables consisting of theoretical and measured data, and the interpretation of this data will be central in the laboratory report.

You will use the HP Digital Scope and Spectrum Analyzer. Read Appendix A if you're unfamiliar with the operation of the Spectrum Analyzer option.

Values given for setups in this experiment are only *suggestions*. Use your judgement if a value is inappropriate.

SUGGESTED LABORATORY PROCEDURE

1. Set the Wavetek for a SINE wave output of 2.82 Vpp (1 V RMS), and a frequency of 10 KHz. View this wave on the scope so that you can verify output. Be sure to use a 10:1 probe for the oscilloscope!

2. Set the spectrum analyzer so that you can see ONLY a spectrogram of the above waveform. If the peaks on the displayed spectrum are not high enough , or too high, adjust the Wavetek amplitude to compensate.

   NOTE: The sample rate *of the spectrum analyzer must be set high enough to properly reproduce the sine wave, or incorrect data will be presented on the display. See* Appendix A *if necessary.*

3. Record the spectrogram using units of RMS Volts for the vertical axis.

   NOTE: The HP spectrum analyzer output can be printed directly using ScopeLink. *However, you'll need to convert the HP output (in dBV) to RMS Volts when building your graphs.*

   NOTE: If there is a serious deviation from theory at this point, double-check your settings (especially sample rate!) If the display doesn't make sense, get help!

4. Now change the Wavetek to a square-wave output, and repeat the measurement of the spectral content. Record up to at least the 11th harmonic.

   WARNING: Make sure the sample rate is adequate for at least the 13th harmonic of the fundamental (which should still be 10 KHz.)

5. Change the Wavetek output to a *triangle* and repeat step 4.

REPORT SUMMARY:

a) Theory of operation - explain the significance of the experiment; what are we attempting to demonstrate in this lab? Pay attention to the theory behind the Fourier Series.

b) There is no design method for this experiment.

c) The following graphs are required:

Sine Wave - Measured Spectrogram ; Sine Wave - Theoretical Spectrogram

Square Wave - Measured Spectrogram ; Square Wave - Theoretical Spectrogram

Triangle Wave - Measured Spectrogram; Triangle Wave - Theoretical. Spectrogram

Data tables should accompany the theoretical square and triangle spectrograms; show a sample of each calculation. A good format for the data tables is as follows:

Fourier Analysis - Square Wave 1 Vpk amplitude; 10 KHz frequency				
N	Frequency (KHz)	Bn(theory) - RMS	Bn(measured) RMS	% Difference
1	10	900 mV	980 mV	+ 8.85 %
2	20	0 V	0 V	-
3	30	etc...	etc...	etc...
4	40	...	...	...
5	50	...	...	...
6	60	...	...	...

MAKE SURE ALL GRAPHS AND TABLES ARE TITLED AND ADEQUATELY ANNOTATED (THERE SHOULD BE NO DOUBT ABOUT WHAT DATA IS BEING REPRESENTED).

d) Conclusion. A conclusion is a *summary*. In a conclusion, you should *quantitatively* interpret the data collected during the experiment.