MEEN 2210 Electromechanical Engineering Systems Spring 2011

Studio Exercises Week #3

- **Time Response and Frequency Response of a Voltage Divider**
  - **Never measure before you predict!**
  - For a voltage divider with two 1 KΩ resistors, predict the output voltage to a square wave and a sine wave. Include amplitude, frequency, and phase shift in your prediction.
  - Build the voltage divider on the breadboard with a function generator square-wave input and two 1KΩ resistors. Measure the output voltage with the oscilloscope. Compare the measurement to the prediction including amplitude, frequency, and phase shift.
  - Perform the same experiment with an input sine wave from the function generator.
  - State your observations regarding the relationship between the input and output frequencies, amplitudes, and phase shifts of the square wave and sine wave signals.

- **Time Response and Frequency Response of a RC Circuit**
  - **Never measure before you predict!**
  - For an RC circuit with a 15 KΩ resistor and a 0.01 μF capacitor, predict the output voltage first to a square wave and then to a sine wave. For the square wave input, determine the required frequency of the input square wave so the RC circuit response achieves steady state. For the sine wave input, determine the bandwidth of the RC circuit and set the input sine wave to that frequency.
  - Build the RC circuit on the breadboard with a function generator square-wave input. Measure the output voltage with the oscilloscope. Use the oscilloscope cursors to identify the RC circuit time constant and steady-state gain.
  - Now input a sine wave from the function generator at the bandwidth frequency. Measure the output frequency, amplitude, and phase shift and compare these to your predictions. Increase the sine wave frequency. What do you observe in amplitude and phase shift? Decrease the frequency. What do you observe in amplitude and phase shift?