X030994

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Department of Electrical Engineering

Experiment No.________Signal, Pulse, and Function Generators

INTRODUCTION

Generally, electronic devices are designed to receive certain types of signals, perform some operation on them, and output the results. In order to test the device, signals of the proper type are needed. For example, the frequency response of an audio amplifier would be checked using a sinusoidal signal with frequencies in the audio range. A digital device would most likely use a pulse or square-wave signal for testing. There are generators on the market today that produce a wide variety of signals. The purpose of this experiment is to introduce the student to several types of such generators and illustrate their use in a testing environment.

PRELIMINARY

P-1. Ramp signals are used in the time bases of X-Y recorders to provide the horizontal sweep of the plotting arm. Generally, only calibrated sweep-rates are provided with no provision for in-between settings. However, other sweep-rates can be provided by applying a ramp signal of the proper magnitude and frequency to the X-input of the X-Y recorder.

Assume the X-setting of an X-Y recorder is on 0.2 volts/cm. Determine the magnitude and frequency of a ramp signal that will cause the plotting arm to sweep 18 centimeters at a 0.36 cm/sec sweep rate.

Magnitude = __________volts; Frequency = _____________Hertz.

P-2. A circuit has been designed to receive a 100 Hertz, +5-0 volt pulse and output the average value of the pulse. What must the duty cycle of the input pulse be in order to have an output of 1 volt DC (average)?

Duty Cycle = _______________%

P-3. The output of an amplifier can be expressed mathematically as follows for a sinusoidal input.

Magnitude: $Vout = \frac{Vin}{\sqrt{1+(6.28f)^2}}$

Phase: $\theta = -\mathrm{atan}(6.28f)$

where, f, is frequency in Hertz.

Assuming that Vout = 0.707 volts and Θ = -45 degrees, what is the magnitude of the input signal?

Vin = ___________________volts.

(INSTRUCTOR'S SIGNATURE__________________________DATE___________)

PROCEDURE

L-1. Review the operation manual of the given Sinusoidal Signal Generator.

L-2. Using the given Sinusoidal Signal Generator and an oscilloscope, apply and MAINTAIN a +10-10 volt signal to the input of the circuit in Figure 1. Vary the frequency of the generator until the voltage across the capacitor is +7-7 volts. Record this frequency (which is called the “break” or “bandpass” frequency of the circuit).

L-3. Review the operation manual of the given Function Generator.

L-4. Using the given Function Generator and an oscilloscope, apply a +10-10 volt triangular-wave signal to the input of the circuit in Figure 2. Vary the frequency of the input signal until the signal across the resistor looks like a square-wave. Record the frequency and the waveform.

L-5. Using the given Function Generator and an oscilloscope, apply a +10-10 volt ramp-wave signal to the input of the circuit in Figure 2. Observe and record the signal across the resistor (the circuit is basically differentiating the input signal).

L-6. Still using the given Function Generator with a +10-10 volt triangular-wave output, observe and record the open-circuit output of the Function Generator as the DC offset is varied from a maximum negative value to a maximum positive value. Adjust the triangular-wave magnitude and the DC offset so that +10+5 volts is showing.

L-7. Take time to become familiar with other features of the Function Generator.

L-8. Review the operation manual for the given Pulse Generator.

L-9. Using the given Pulse Generator and an oscilloscope, apply a +10-0 volt, 50 percent duty-cycle pulse signal to the input of the circuit in Figure 1. Vary the frequency of the input signal until the maximum voltage across the capacitor just reaches approximately +10 volts. Adjust the oscilloscope until a good measurement of the rise-time of the signal across the capacitor can be obtained. Record the rise-time.

L-10. Continue Procedure L-9 above, varying the width of the input pulse from minimum to maximum and noting what happens to the signal across the capacitor (the narrower the pulse, the higher the frequency content of the pulse; thus, the magnitude of output signal will become smaller. The signal becomes more distorted because the harmonic frequencies making up the pulse are being phase-shifted by the circuit).

L-11. Take time to become familiar with other features of the Pulse Generator.

<u>REPORT</u>

R-1. Tabulate the results of Procedures L-2, L-4, and L-9.

R-2. Discuss the results of Procedures L-5, L-6, and L-10.

R-3. Discuss other applications for which the generators in the experiment might be useful.

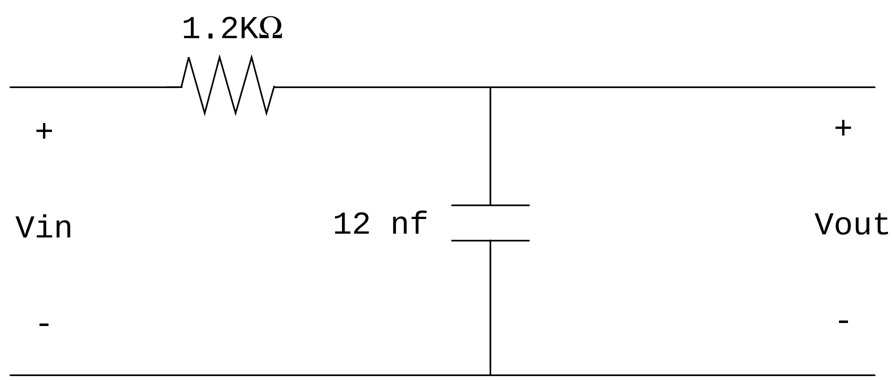

Figure 1.

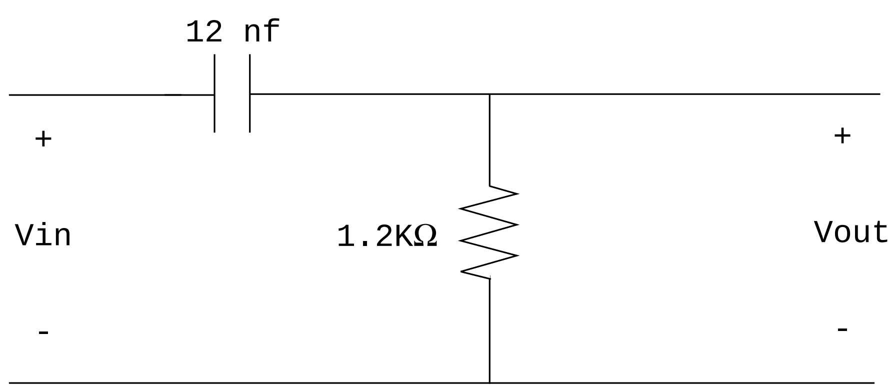

Figure 2.