ELG4135: Experiment 1

Design of Oscillators Using OP-AMPS

Objective

To study the operation and characteristic of phase shift and multivibrator oscillators based on op-amps.

Phase Shift Oscillator

The phase shift oscillator produces positive feedback by using an inverting amplifier and adding another 180° of phase shift with the three high-pass filter circuits. It produces this 180° phase shift for only one frequency:

	$f_O = \frac{1}{2\pi\sqrt{6}RC}$	(1)

Procedure

- Design an inverting op-amp circuit with a gain of about 60 (Figure 1).
- Use Equation (1) to design a three-stage RC filter which has a gain of 1/29 and a phase shift of 180^o at a frequency near 1 kHz. Note that R_2 should be greater than R.
- Through the design process, choose values for resistors, capacitors, and supply voltage.
- Apply a signal to the input and observe the signal at point O, as a function of frequency.
- Point A is 180^o out of phase with the input. At what frequency is point O in phase with the input? What is the overall gain from the input to point O, at this frequency?
- Adjust the potentiometer R so that the overall gain to the output terminal shown in Figure 1 at the frequency found in step 1 is about 1. Connect the output to the input. Does the circuit oscillate? Readjust the potentiometer R so that the circuit just barely oscillates.
- Compare the theoretical frequency and the nominal attenuation of 29 in the RC network with the values experimentally obtained. Why should be differences?
- Set the function generator to approximately the same frequency as that at which the circuit oscillates. Apply a very small signal, about 10 mV p-p, to the "sync" input of the oscillator. This will cause the oscillator to synchronize, or lock into the same frequency as the signal generator.
- Over how large a range in frequency can you pull the oscillator so that it remains in synchronization with the signal generator?

Simulation Assignment

Use PSPICE OR MULTISIM to plot the attenuation and phase shift of the RC network you designed for Figure 1 from 100 Hz to 10 kHz. At what frequency is the gain 1/29? At what frequency is the phase shift 180^o?

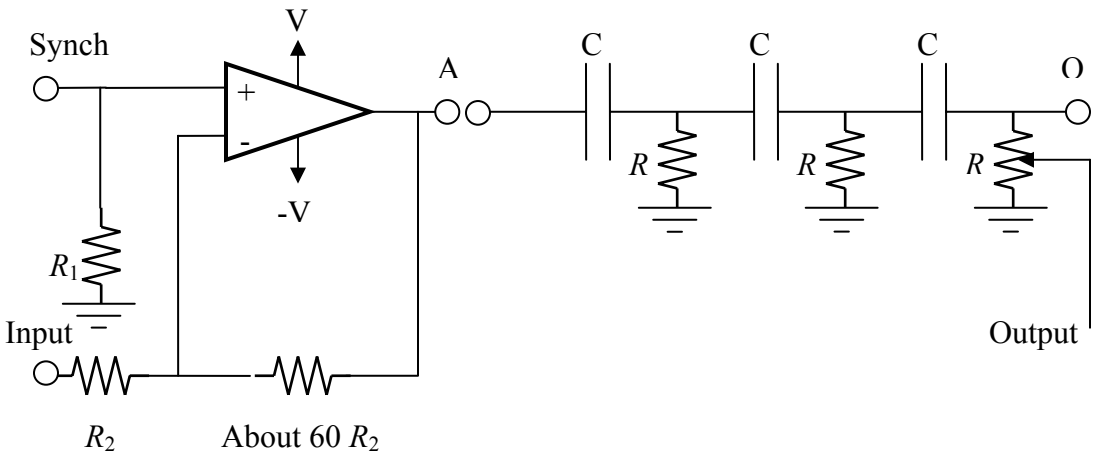

Figure 1

Reference:

Martin Feldman, Electronic Laboratory Manual, Prentice Hall, 2002.