The oscillation frequency, \( f_0 \), for the oscillators to be designed is the experimenter’s birthday (sans year) in kHz for birthdays prior to July and the birthday divided by two for birthdays from July to December. For instance, if the experimenter was born on May 24 the critical frequency is 5.24 kHz and if the experimenter was born on December 13 the critical frequency is 12.13/2 = 6.065 kHz. The peak value for the output sine wave for each of the oscillators is to be 5 V; a diode limiter circuit is used to set the output level.

1. Design a Wien bridge oscillator.
2. Design a phase shift oscillator.
3. Design a quadrature oscillator.

Simulate each of the circuits designed above with National Instruments (Multisim). The appropriate analysis is transient. The time interval should be large enough to display several cycles of the waveform so the frequency of oscillation can be determined. Use an appropriate model for the op amp; the ideal op amp won’t suffice.

Plot the Bode plots of the open loop circuits from a frequency a decade below \( f_0 \) to a decade above using Multisim. Make the same plots with either Mathcad or Matlab.

Each of these oscillators will be built in lab.