4.9.3: Procedure

1. In order to measure the magnitude of the impedance across frequency, it is desirable to drive the loudspeaker with a fixed current source. By measuring the voltage across the loudspeaker with an oscilloscope, the magnitude of impedance can be calculated by using a variant of Ohm's law: Z = V/I. A current source may be approximated by placing a large resistor in series with the function generator. If the resistance value is many times greater than the loudspeaker impedance, the loudspeaker may be ignored to a first approximation. Therefore, virtually all of the generator voltage drops across the series resistor, producing a constant current. For this exercise, a 1 k ohm value will suffice. For all measurements, simply place a 1 k ohm resistor in series with the generator and the loudspeaker under test. Using a 10 volt signal from the generator, the approximate current value will be 10 milliamps.

2. Hook up the woofer between the resistor and ground. Make sure that the woofer is magnet-side down, with the cone facing up, and unobstructed.

3. First, find the resonant frequency. To do this, set the output of the generator (i.e., before the resistor) to approximately 100 Hz, sine wave, and 10 volts peak. Now move the oscilloscope probe so that it is across the loudspeaker. Sweep the generator frequency until an amplitude peak is found at the loudspeaker. Note this frequency and amplitude in Table 1. This is called the free-air resonance, or f_s. Compute the impedance and enter it in the table ($Z=V_{loudspeaker}$/10 milliamps).

4. For the remaining frequencies in Table 1, determine the amplitude at the loudspeaker and compute the impedance.

5. Swap the woofer with the general purpose loudspeaker and repeat steps 3 and 4 using Table 2.

6. Plot the magnitude of each device on semi-log graph paper.