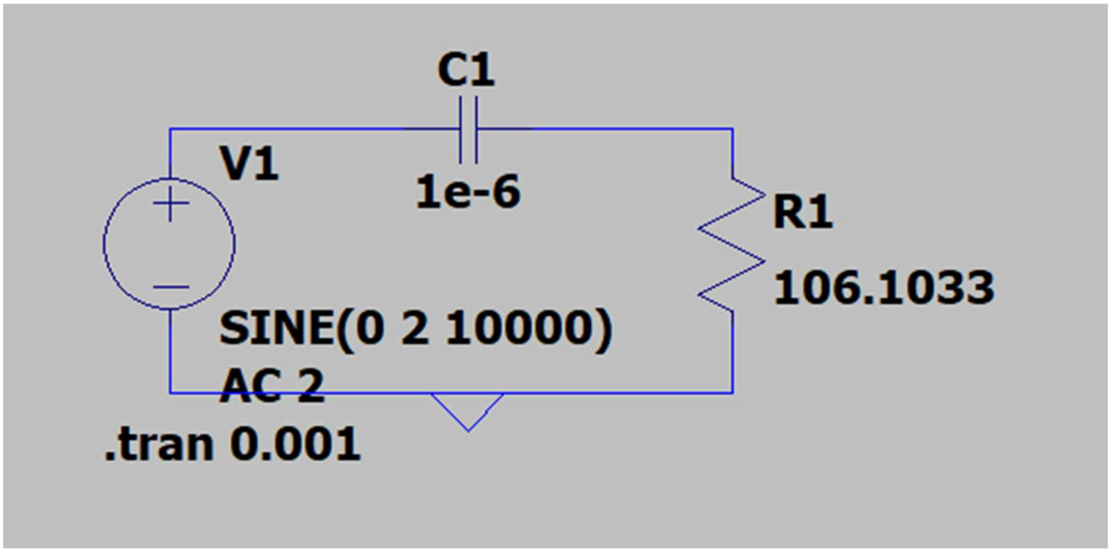
High Pass Filter(RC):

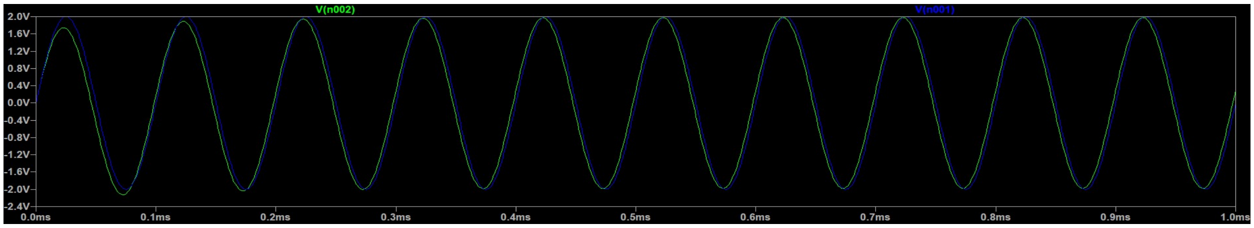
An RC high-pass filter uses a capacitor and a resistor to allow high-frequency components of a signal to pass while attenuating low-frequency and DC components. The capacitor presents high reactance at low frequencies, effectively blocking slow-varying and constant signals, while at higher frequencies its reactance decreases, allowing the signal to pass to the output. The frequency at which the filter begins to significantly attenuate the input is called the cutoff frequency and is determined by the values of the resistor and capacitor. Above this cutoff frequency, the output closely follows the input, whereas below it the output magnitude is reduced. The output voltage in an RC high-pass filter is taken across the resistor.



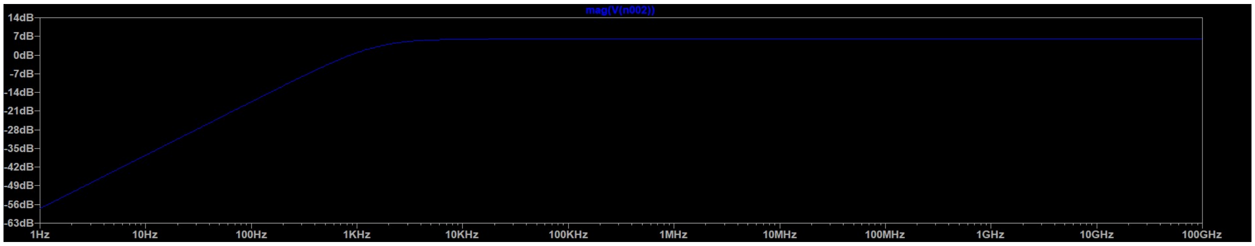
Cutoff frequency: It is the frequency at which the output voltage magnitude rises to 70.7% of the input voltage or when the gain is -3dB of the max value.

$$f = \frac{1}{2\pi RC} = \frac{1}{2\pi \times 106.1033 \times 10^{-6}} = 1kHz$$

Simulation Waveform:

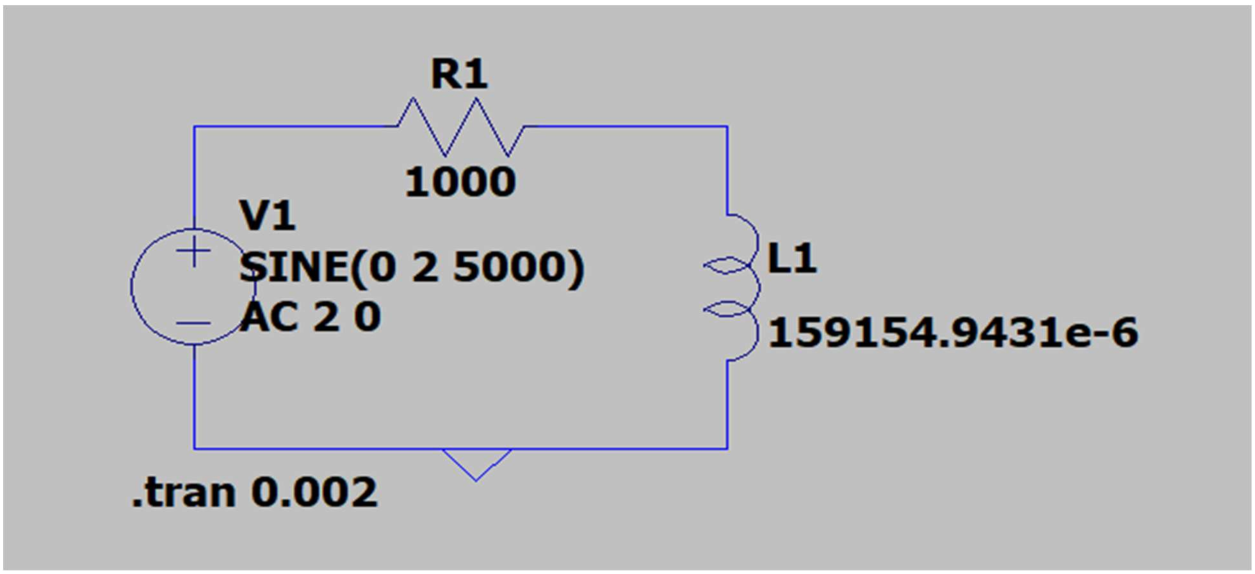


Bode Plot:



High pass filter(RL)

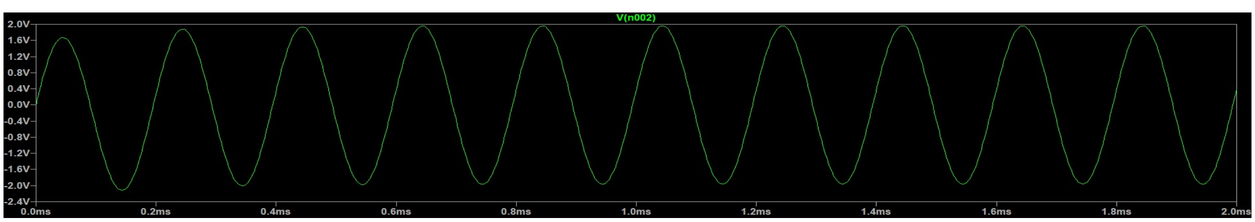
An RL high-pass filter uses a resistor and an inductor to allow high-frequency components of a signal to pass while attenuating low-frequency and DC components. At low frequencies the inductive reactance is small, so most of the input voltage appears across the resistor and little appears at the output. As the frequency increases, the inductive reactance increases, causing a larger portion of the input voltage to develop across the inductor and appear at the output. The frequency at which the filter begins to significantly pass the input is called the cutoff frequency and is determined by the values of the resistor and the inductor. The output voltage in an RL high-pass filter is taken across the inductor.



Cutoff frequency: It is the frequency at which the output voltage magnitude rises to 70.7% of the input voltage or when the gain is -3dB of the max value.

$$f = \frac{R}{2\pi L} = \frac{1000}{2\pi \times 159154.9431 \times 10^{-6}} = 1kHz$$

Simulation Waveform:



Bode plot: