Comparator Circuit Using Op-Amp

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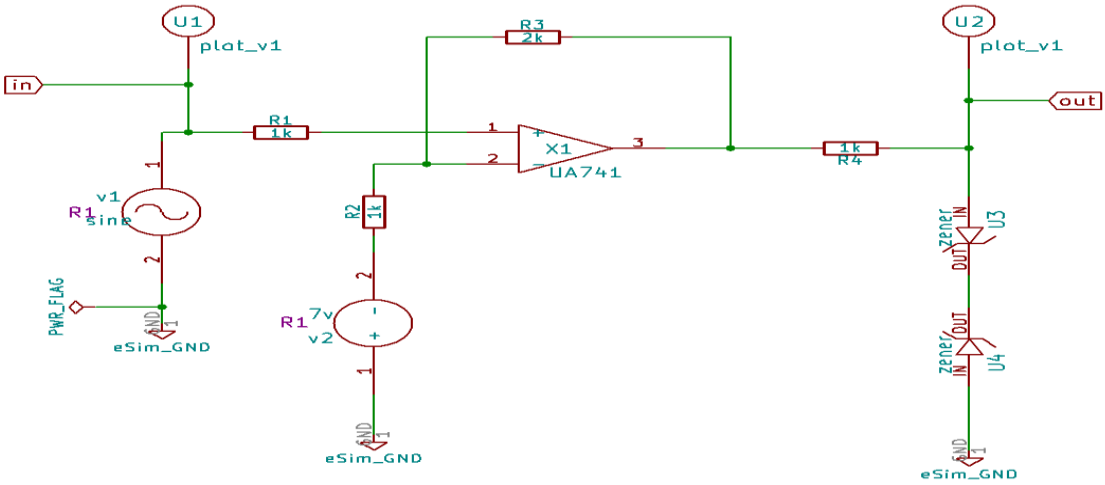
Introduction: The comparator circuit compares the two input signals which can either be voltage or current signals. In this circuit the sinusoidal voltage given at one input is compared with the reference voltage given at the other input output and an positive or negative output voltage is produced depending upon which input is larger. There are basically 2 types of comparators:

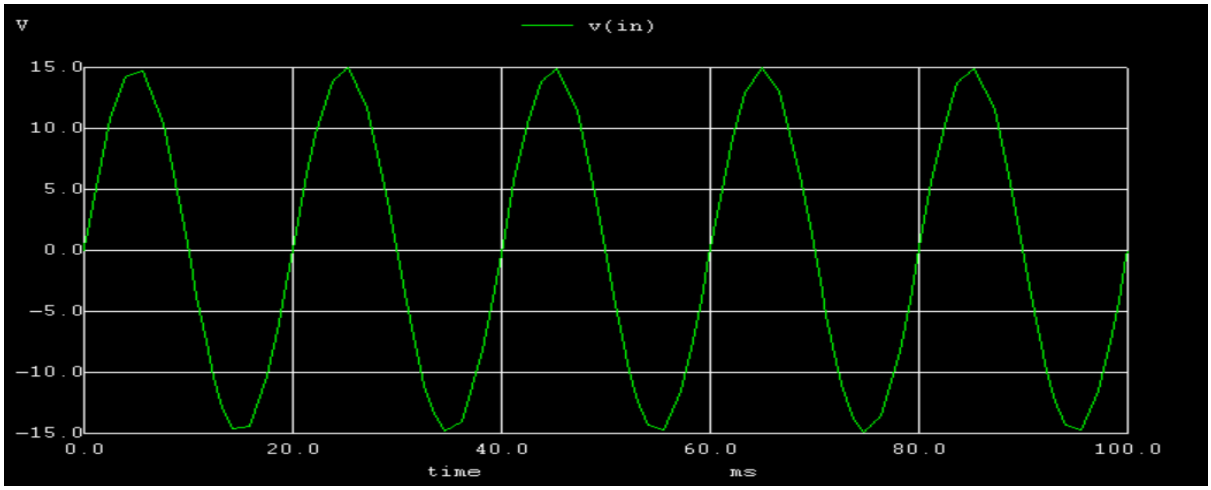
1. Non inverting comparator
2. Inverting comparator

Non-inverting comparator with negative reference

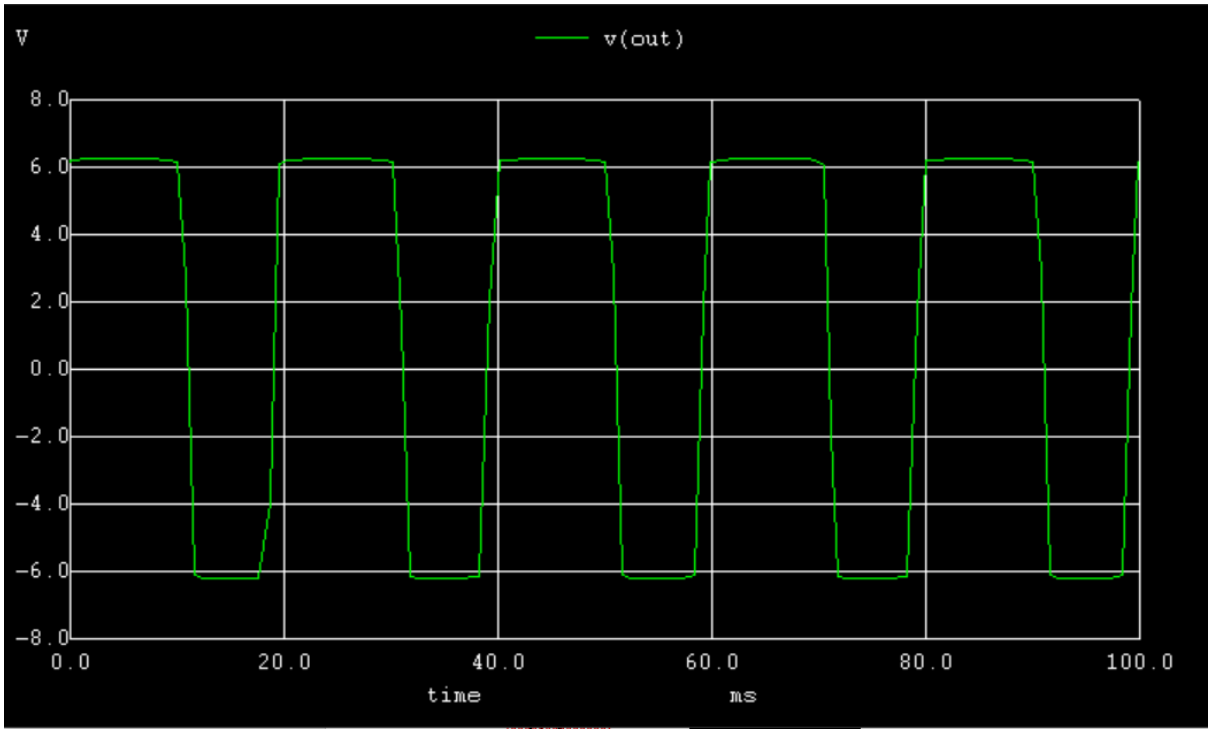
Schematic diagram:



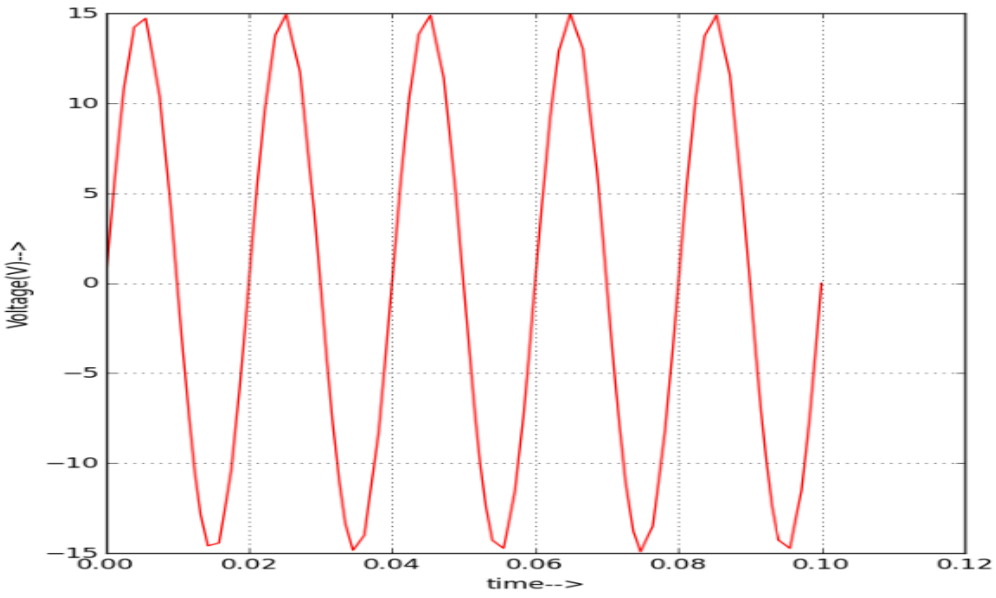
Simulation Results : Ngspice Plots- Input signal



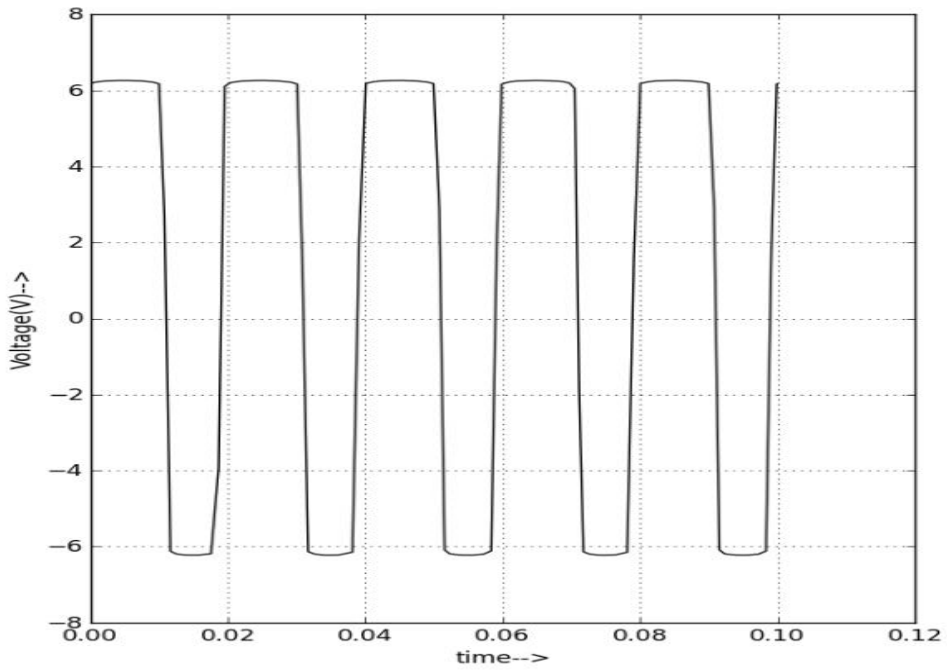
Ngspice Plots- Output signal



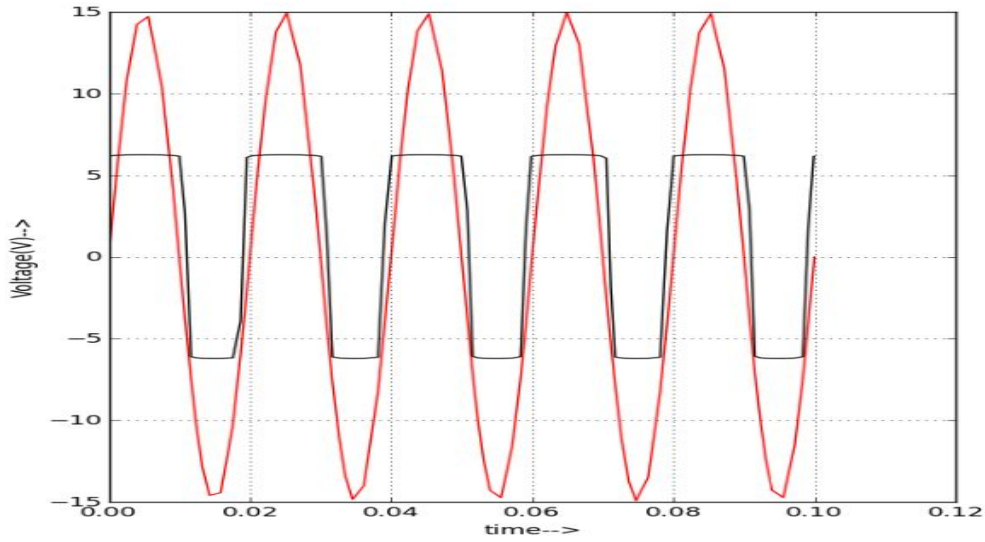
Python Plots - Input signal

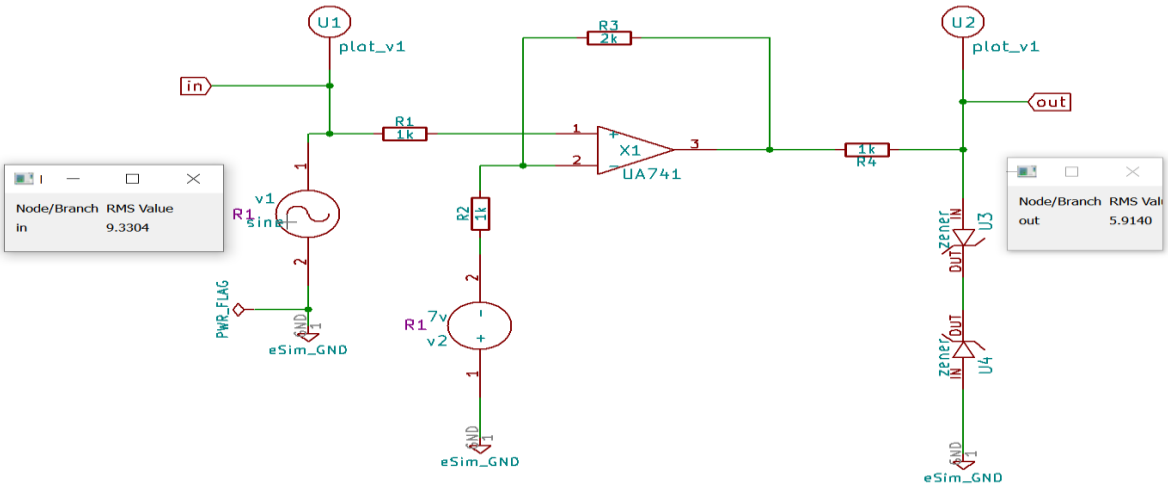


Python Plots - Output Signal



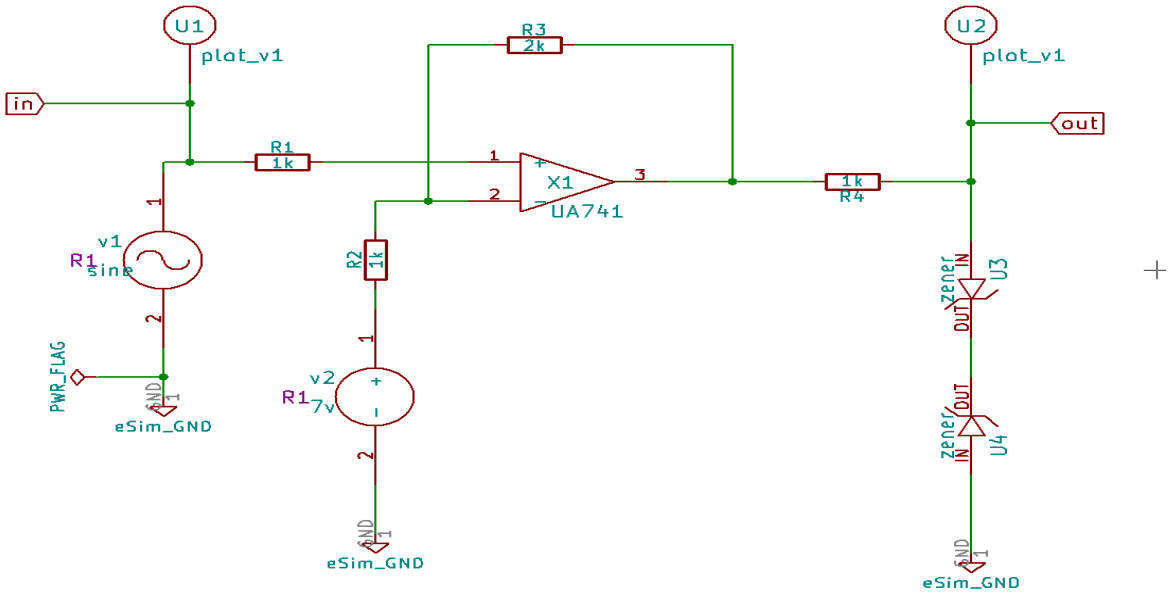
Python Plots - Input and Output signal overlapped





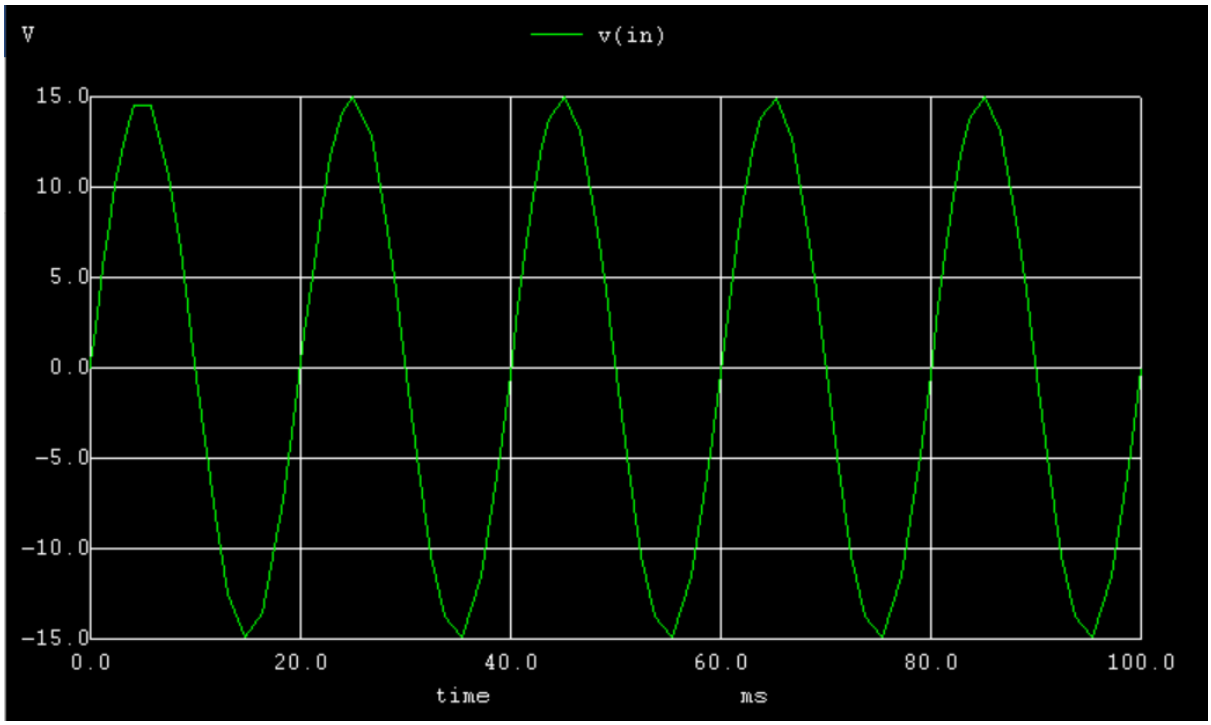
Non-inverting comparator with positive reference

Schematic diagram:

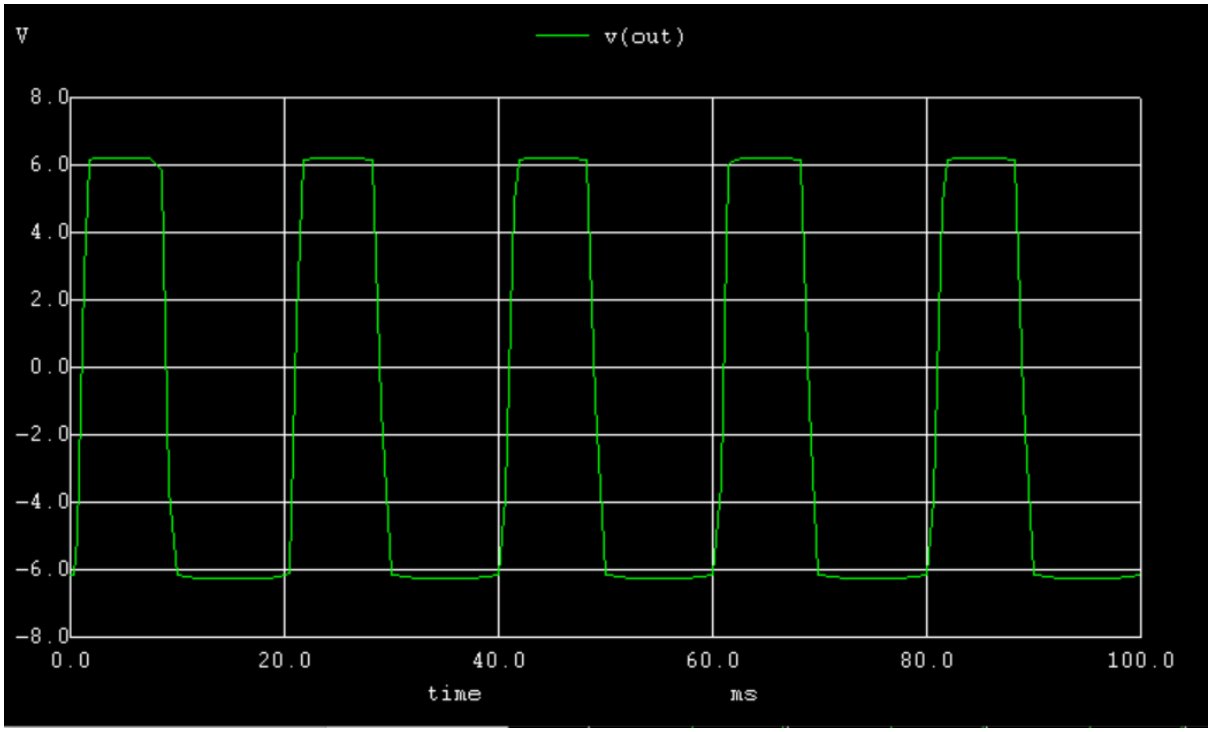


Simulation Results :

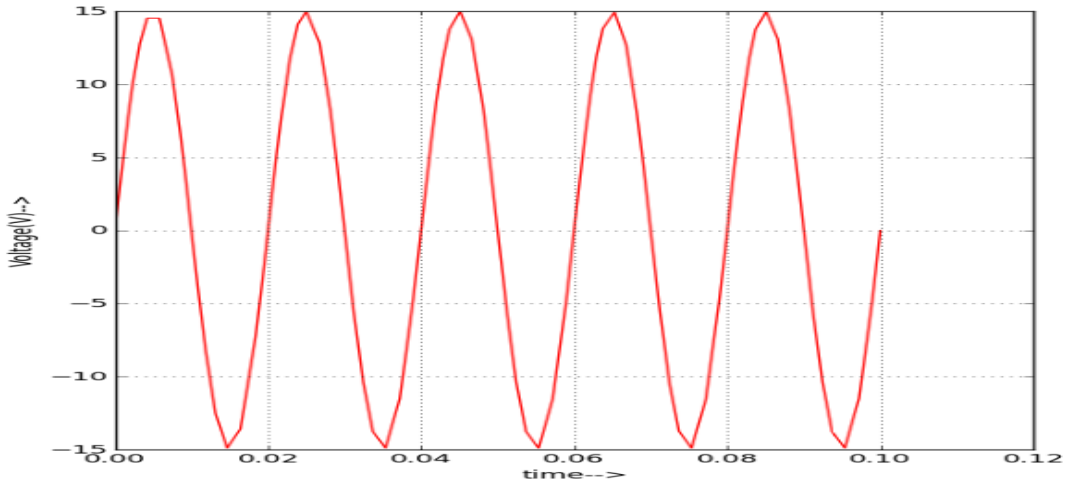
Ngspice Plots- Input signal



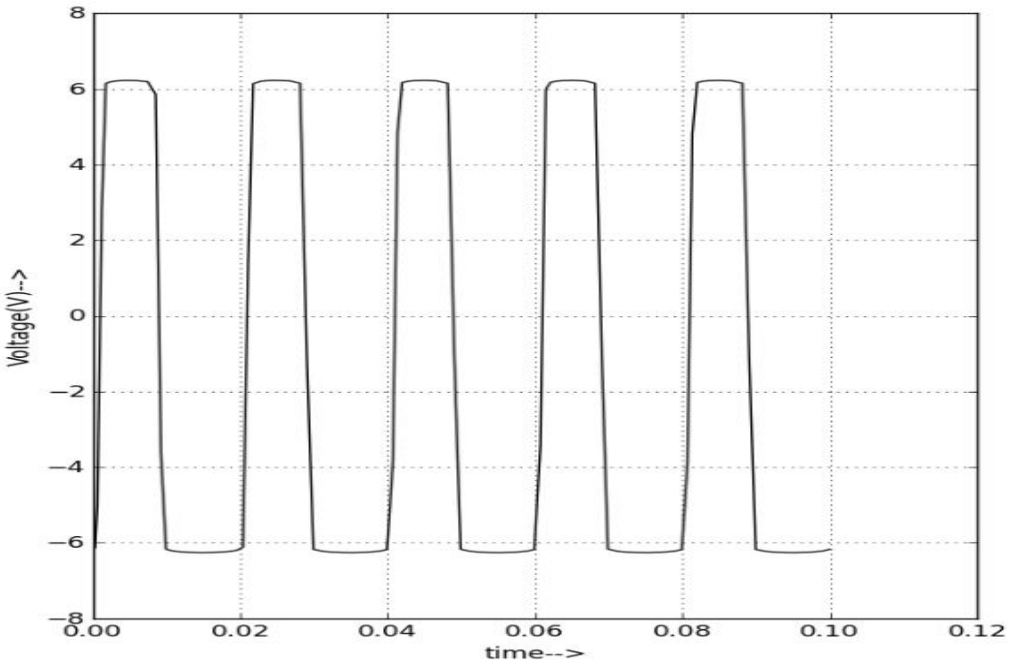
Ngspice Plots- Output signal



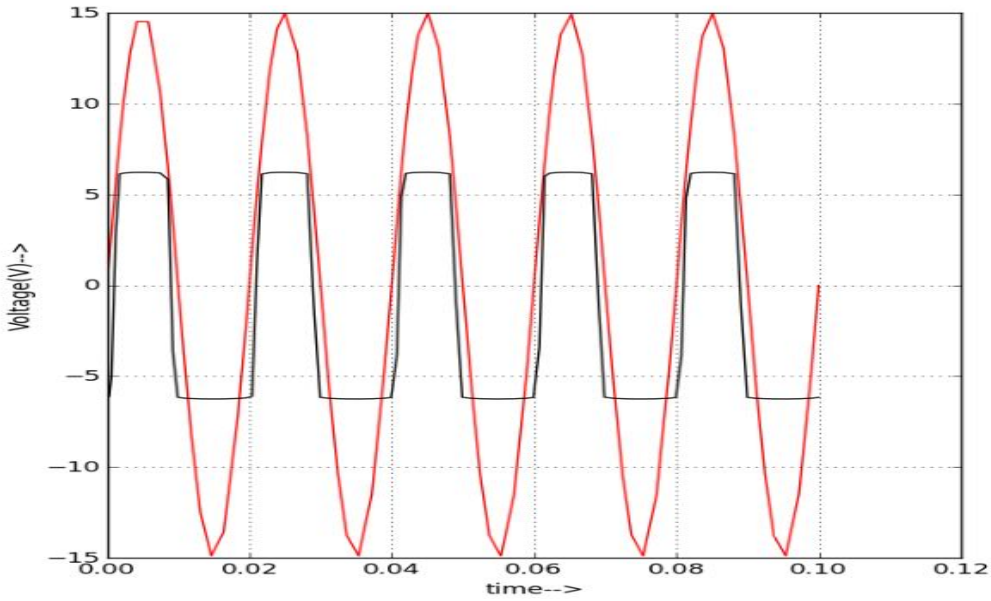
Python Plot - Input signal

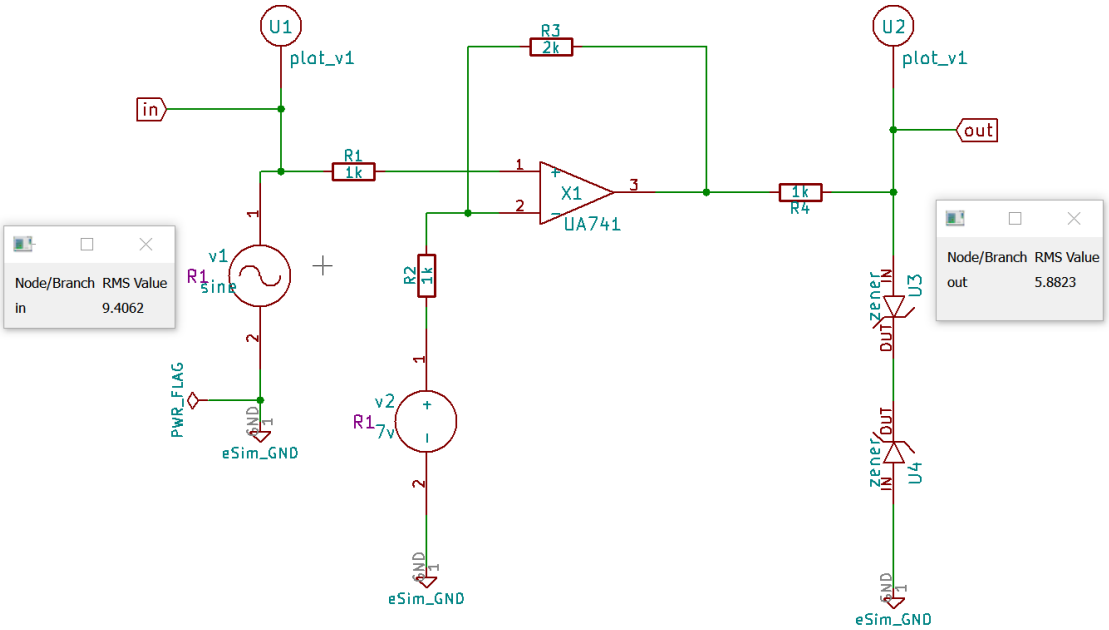


Python Plot - Output Signal



Input and Output signal overlapped

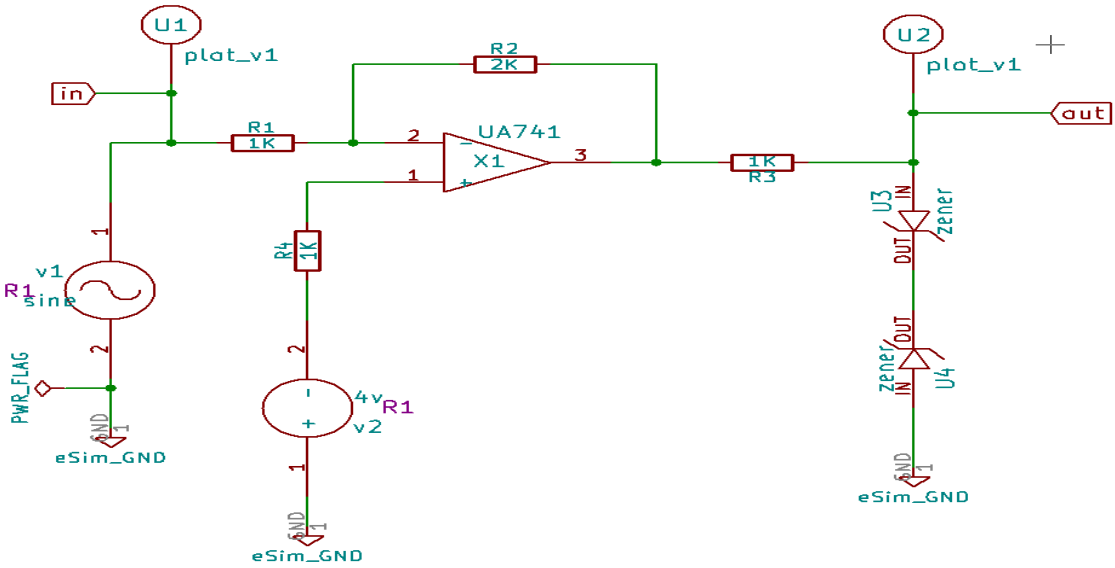




INVERTING COMPARATOR

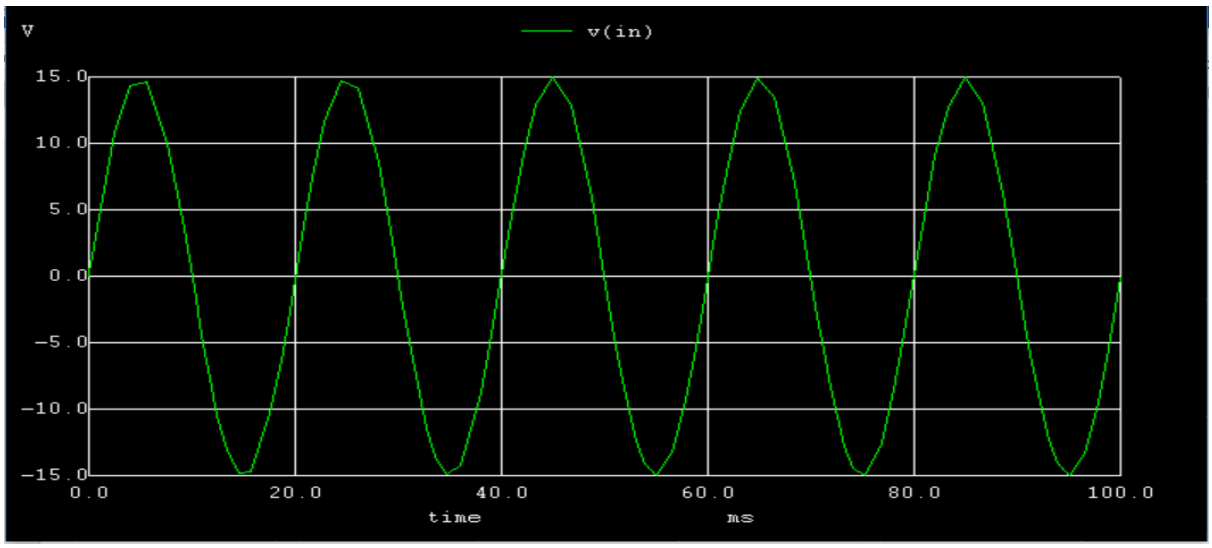
Inverting comparator with negative reference

Schematic diagram:

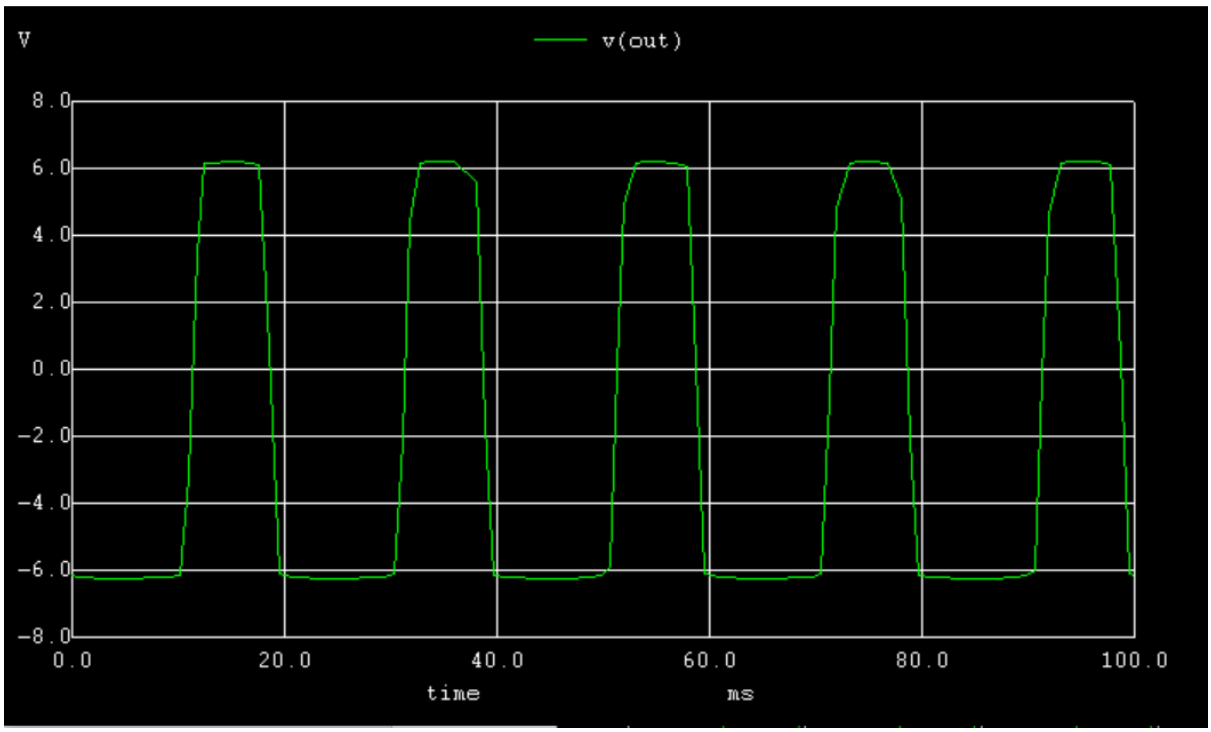


Simulation Results :

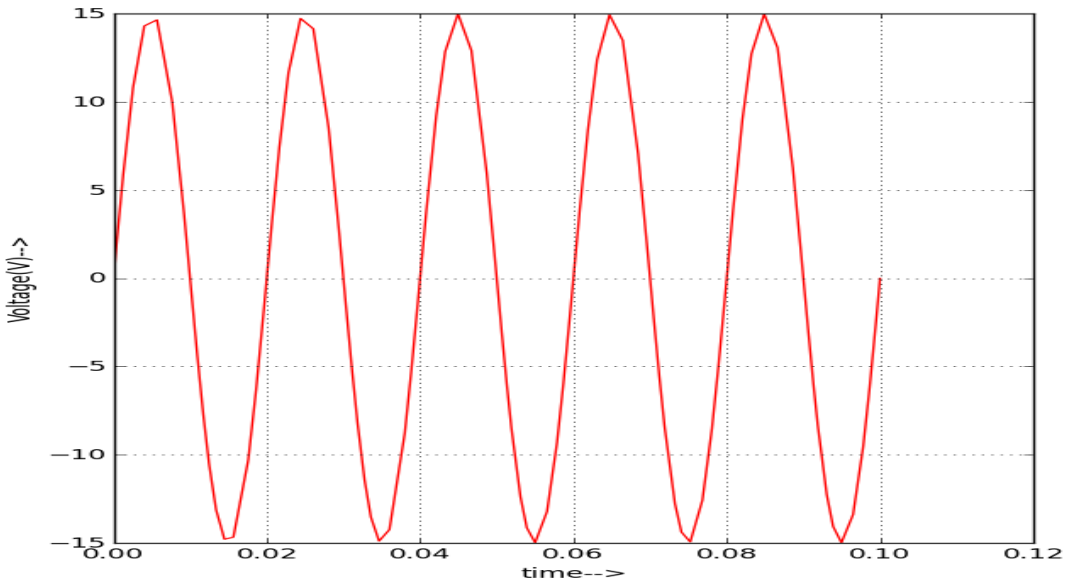
Ngspice Plots- Input signal



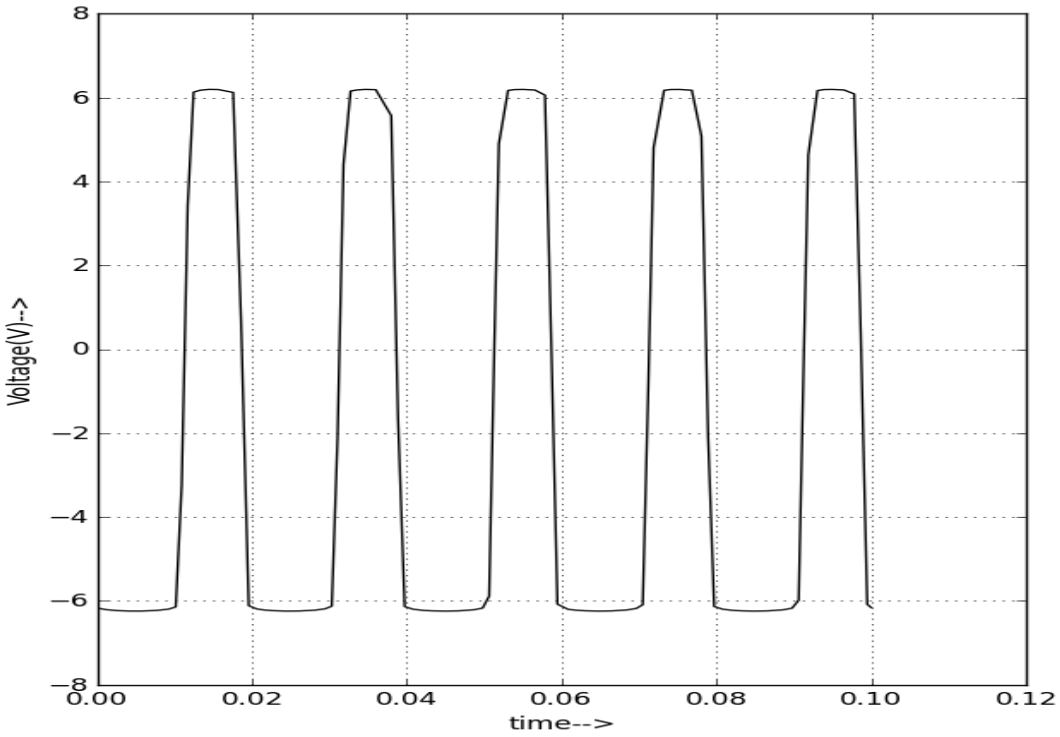
Ngspice Plots- Output signal



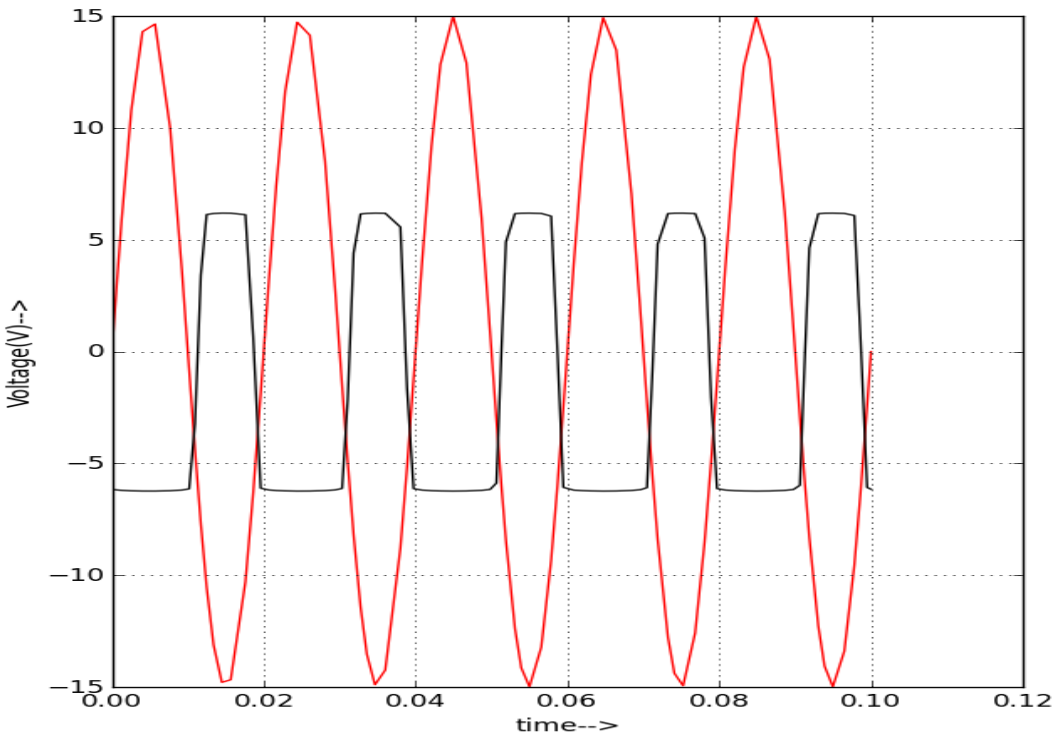
Python Plots - Input signal

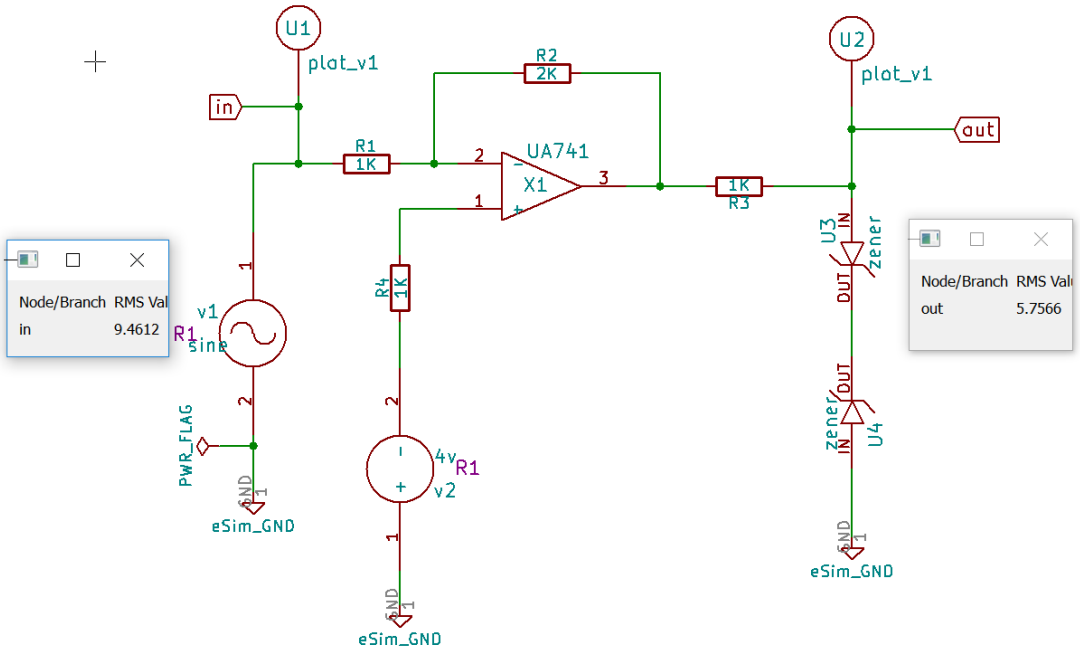


Python Plots - Output signal



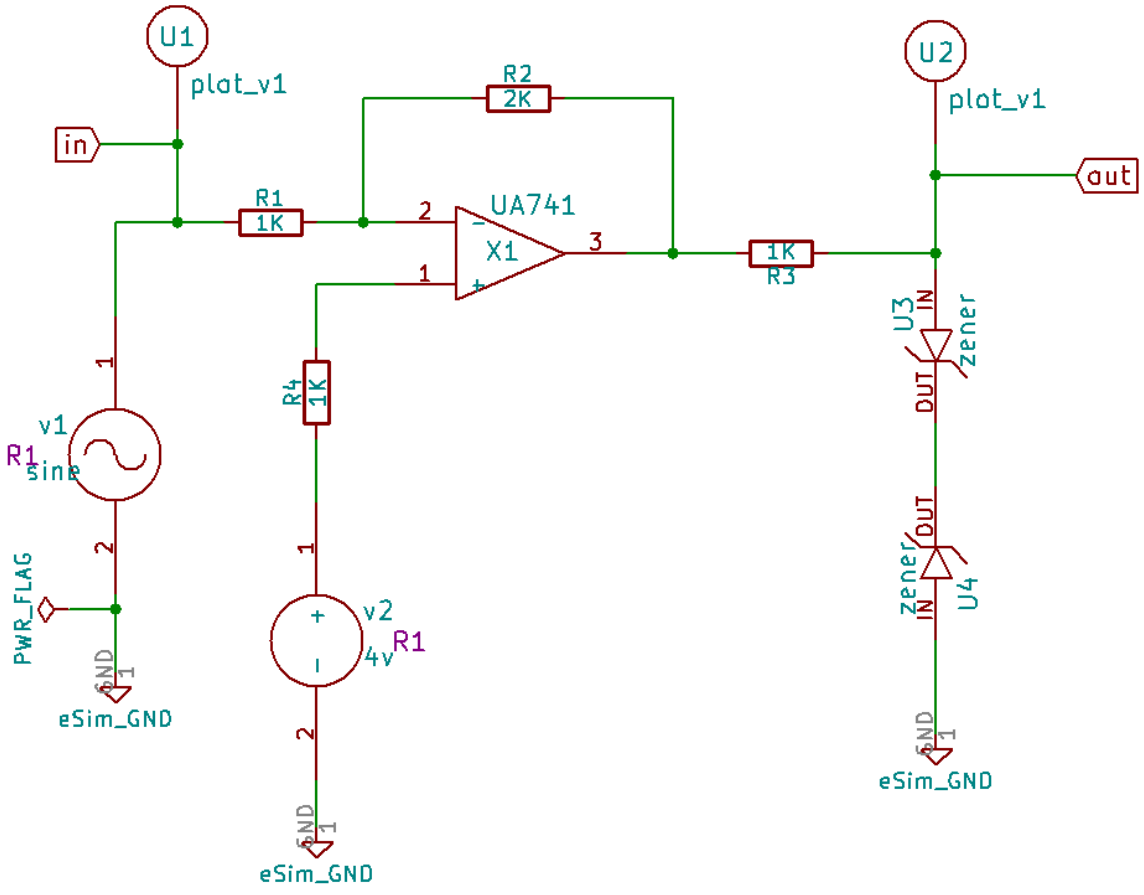
Python Plots - Input and Output signal overlapped



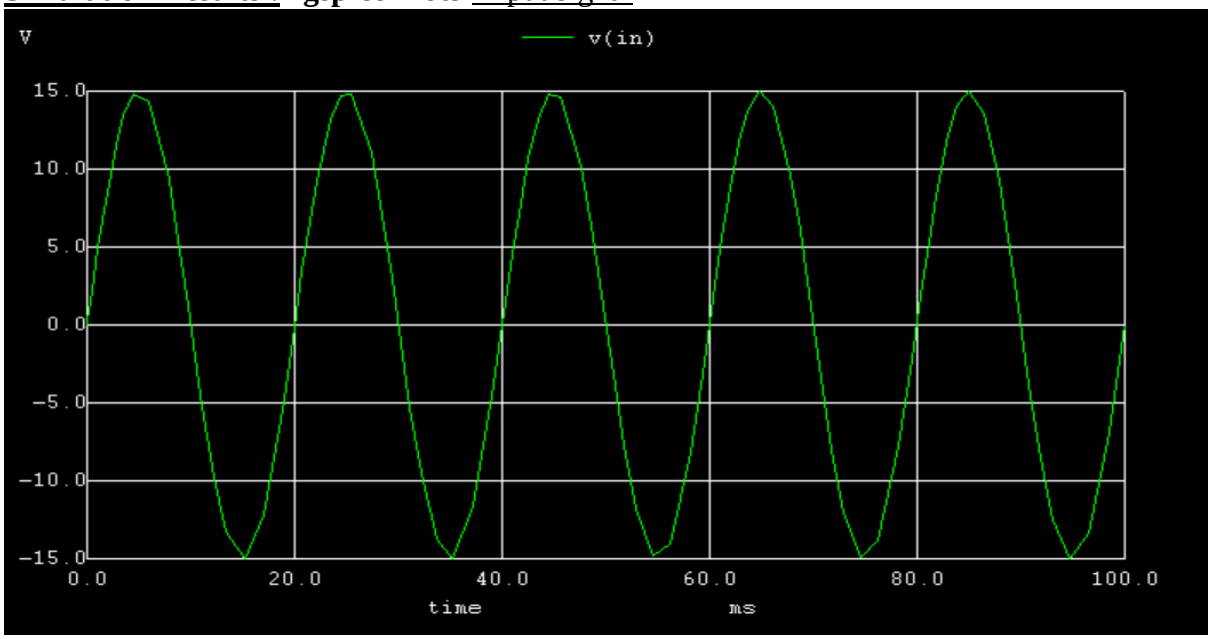


Inverting comparator with positive reference

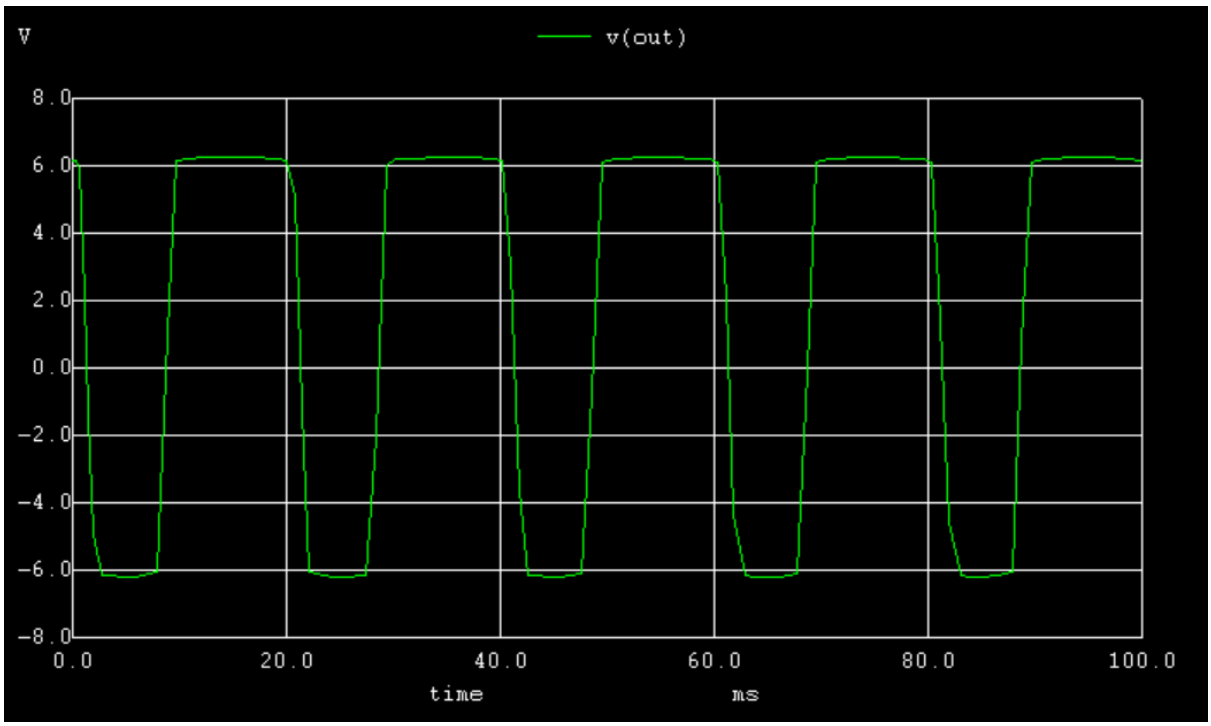
Schematic diagram:



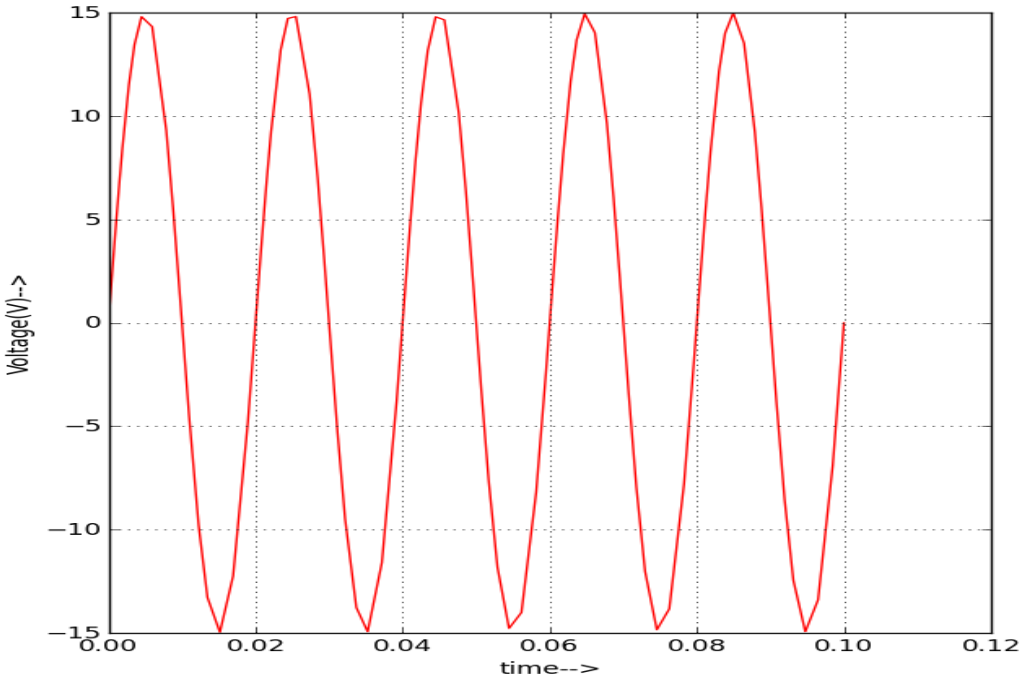
Simulation Results :Ngspice Plots- Input signal



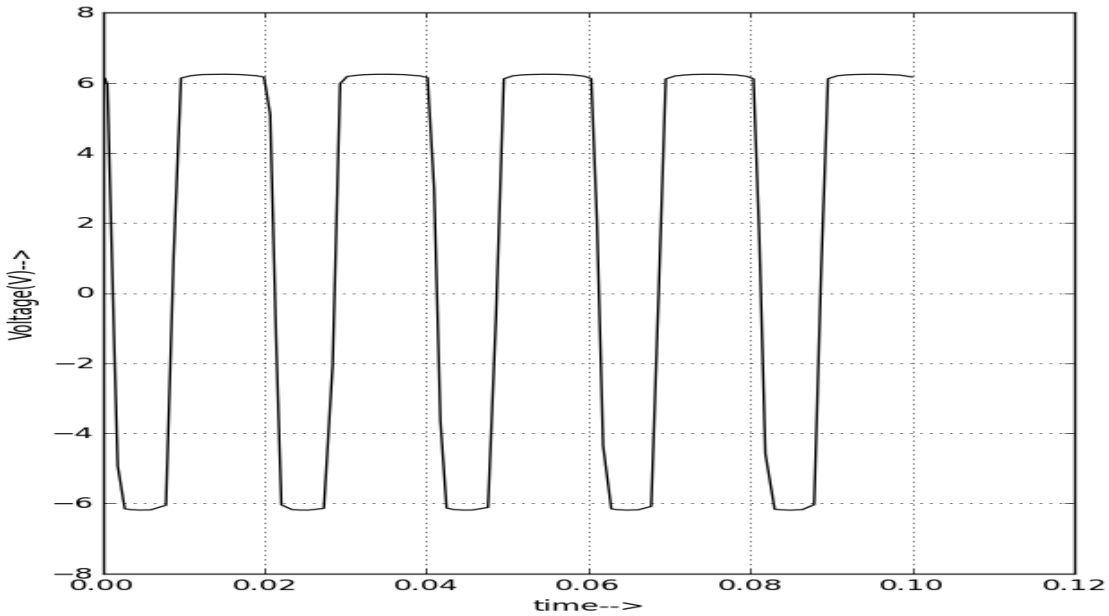
Ngspice Plots- Output signal



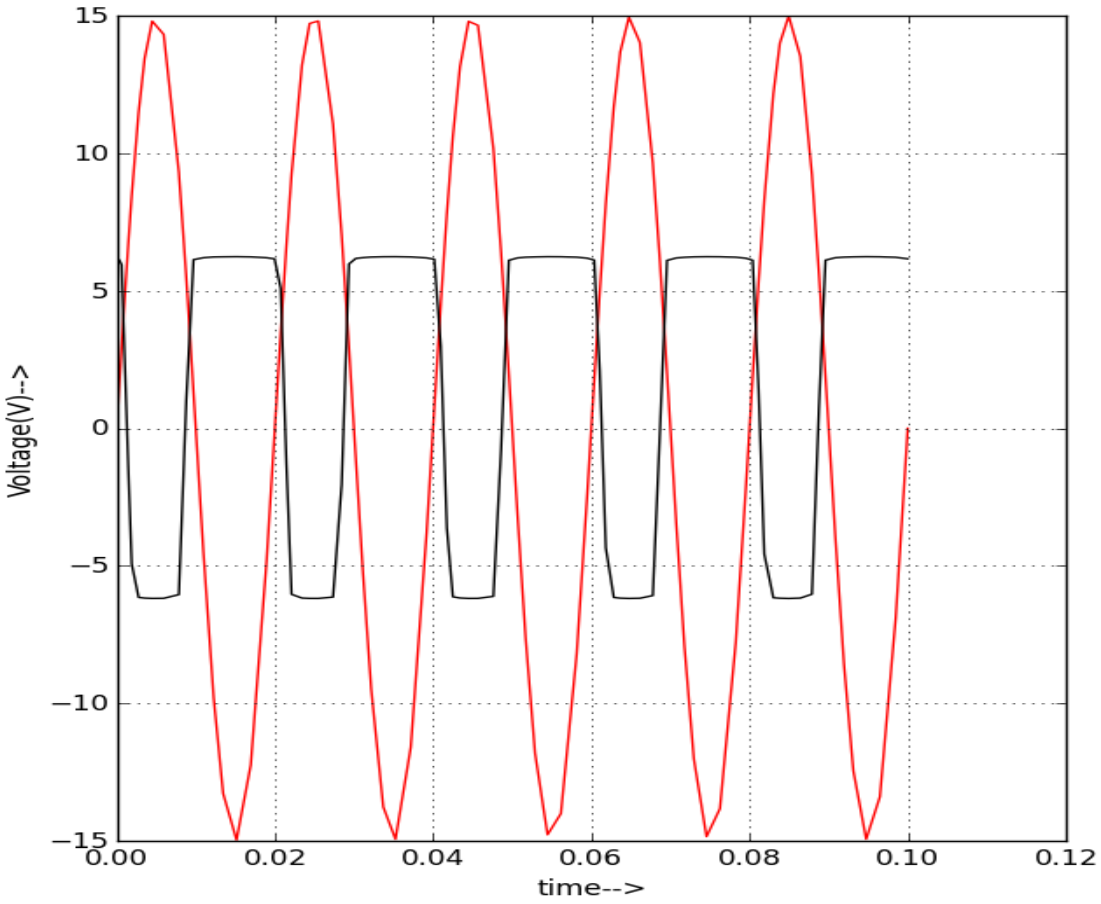
Python Plots - Input signal

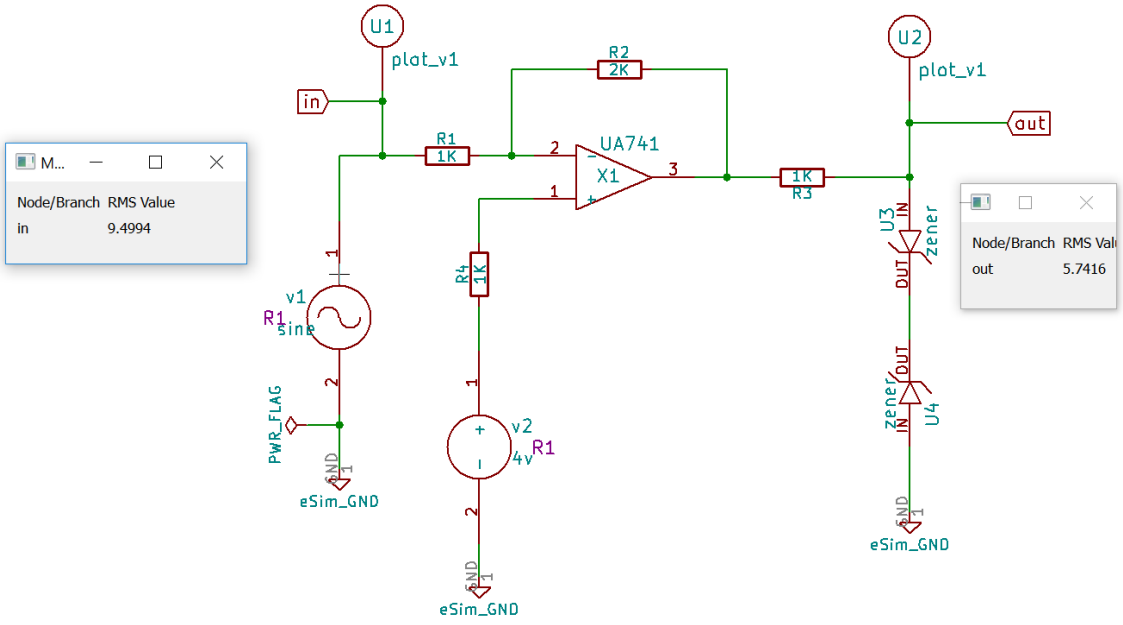


Python Plots - Output signal



Python Plots - Input and Output signal overlapped

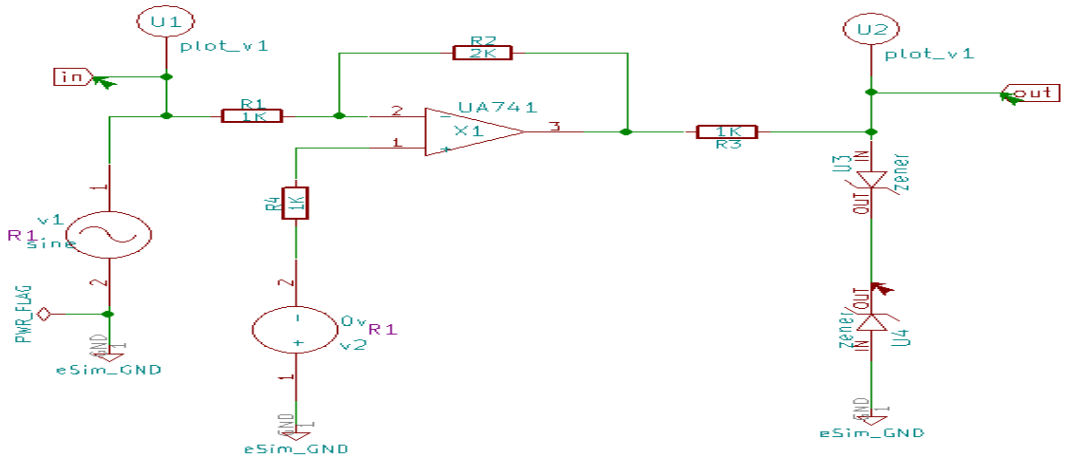




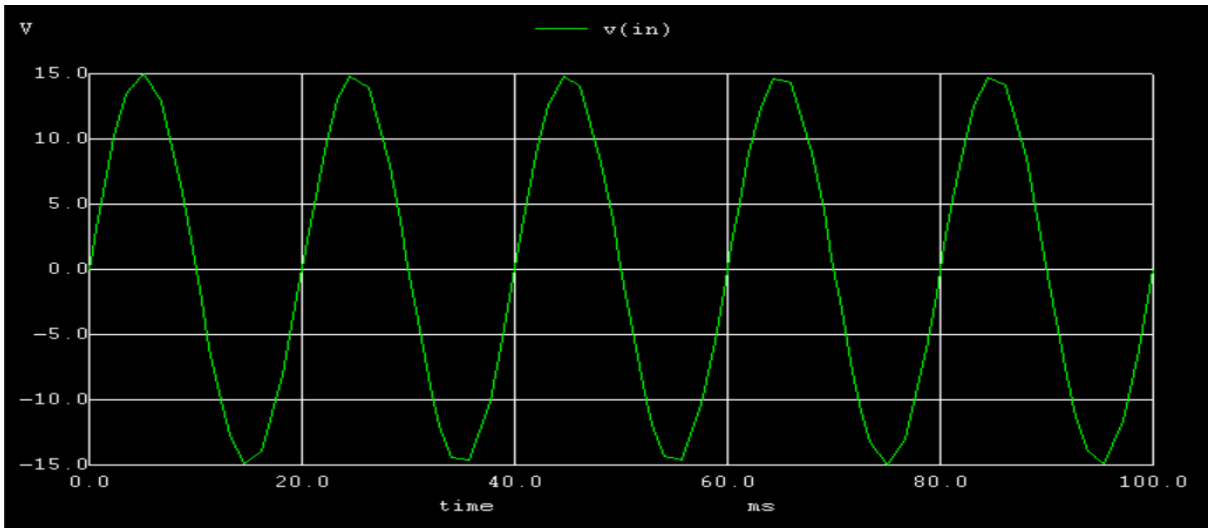
By setting the reference voltages to zero the non-inverting/inverting comparator circuit can be converted to a zero crossing detector.

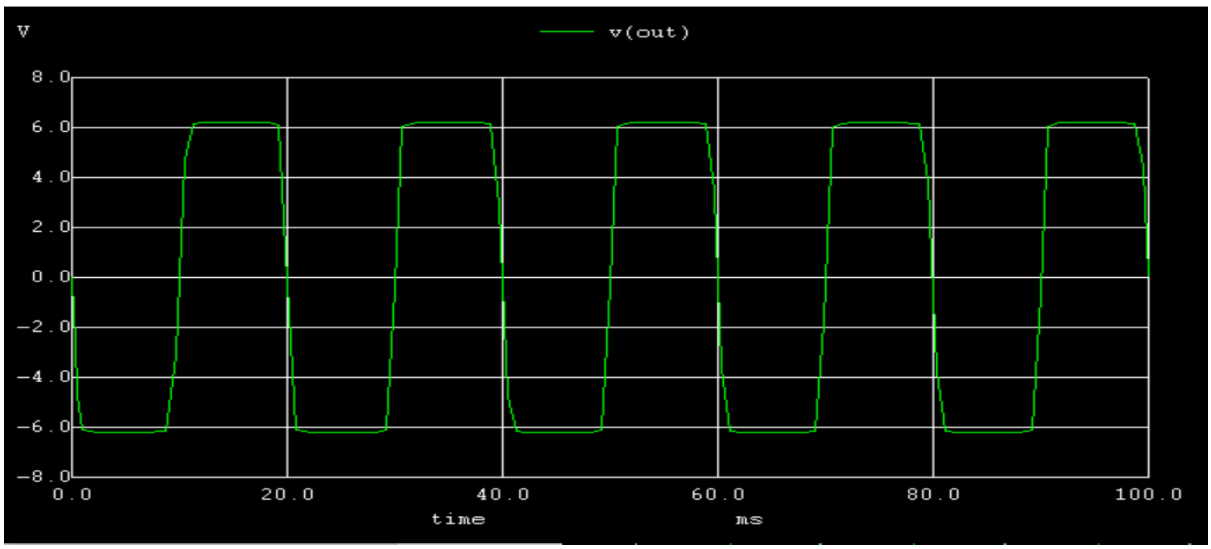
Inverting zero crossing detector

Schematic diagram:

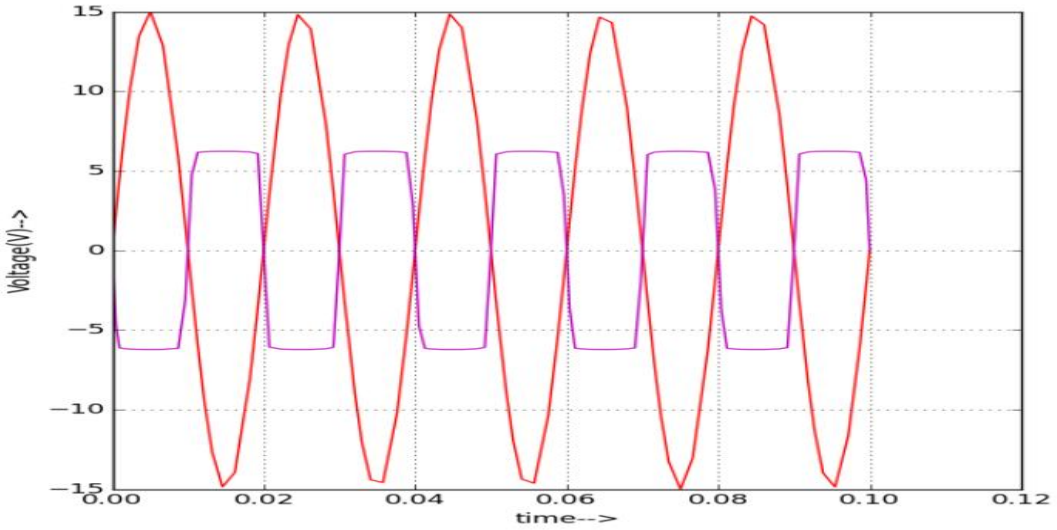


Simulation Results : Ngspice Plots- Input signal, v(in) and output signal, v(out)



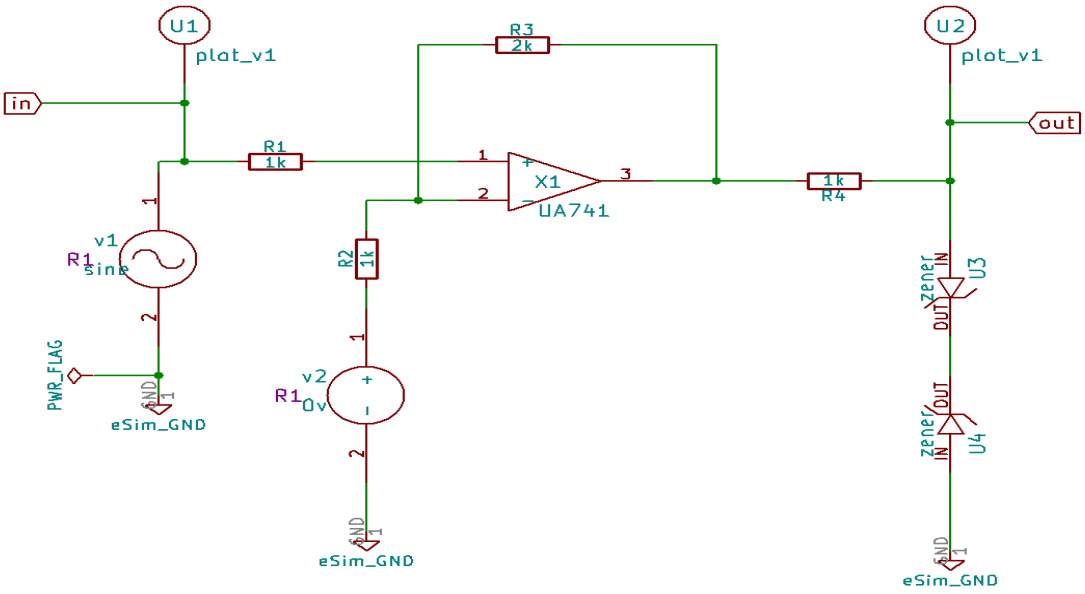


Python Plots - Input and Output signal overlapped

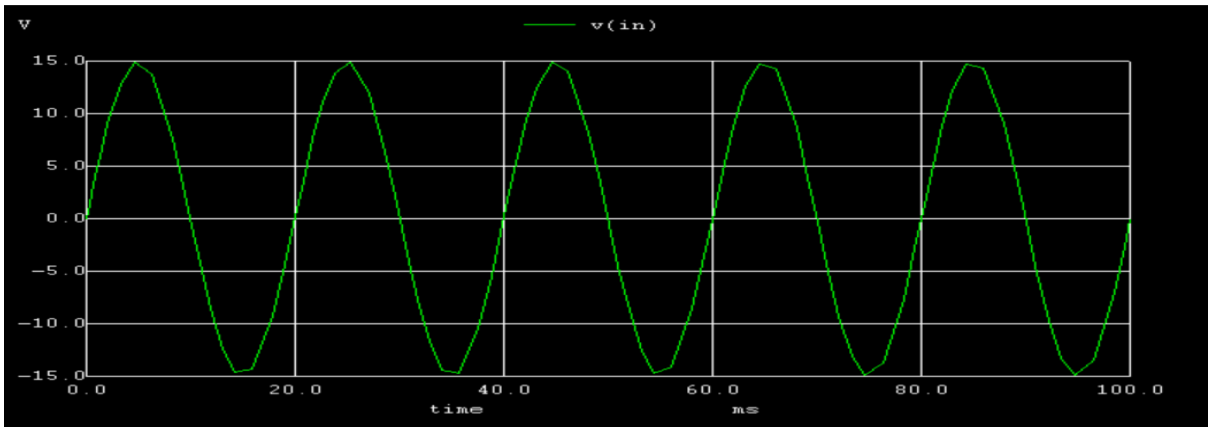


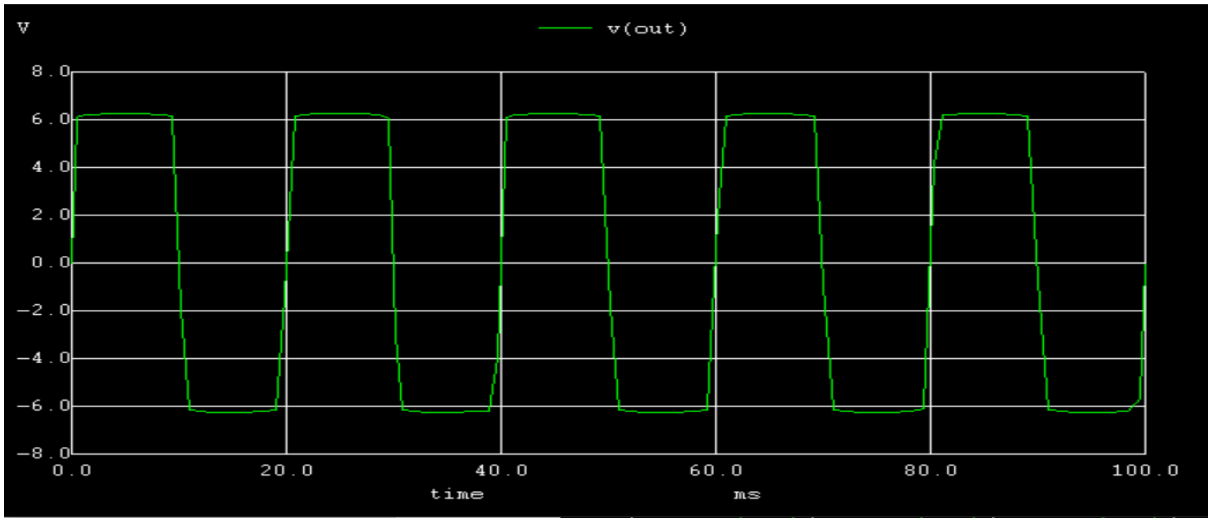
Non-Inverting zero crossing detector

Schematic diagram:

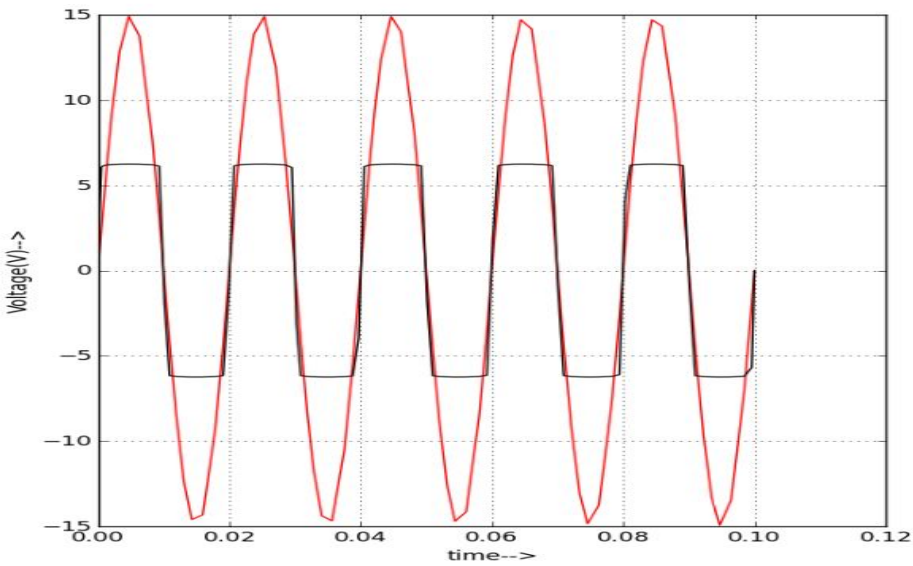


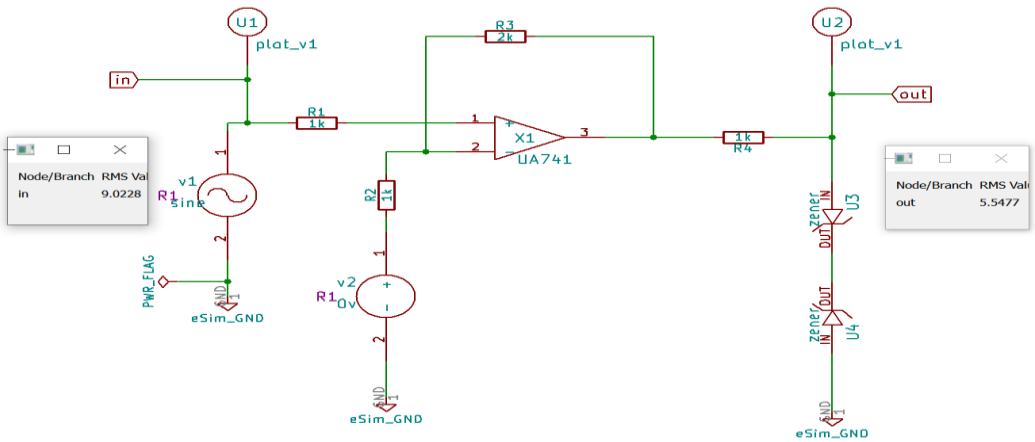
Simulation Results : Ngspice Plots- Input signal, v(in) and output signal, v(out)





Python Plots - Input and Output signal overlapped





Conclusion:

Comparator circuit using op-amp ua 741 was simulated using esim and appropriate waveforms were obtained.

References:

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