Contributor Name-Sumanto Kar

Institute-Fr. Conceicao Rodrigues College of Engineering, Bandra

Year-2020

Title of the experiment

Monostable Multivibrator Using BJTs

Theory:

Multivibrators have two different electrical states, an output “HIGH” state and an output “LOW” state giving them either a stable or quasi-stable state depending upon the type of multivibrator. One such type of a two state pulse generator configuration are called Monostable Multivibrators.

Monostable Multivibrators have only ONE stable state (hence their name: “Mono”), and produce a single output pulse when it is triggered externally. Monostable Multivibrators only return back to their first original and stable state after a period of time determined by the time constant of the RC coupled circuit.

Our project is based on basic collector-coupled transistor Monostable Multivibrator circuit and its associated waveforms. When power is firstly applied, the base of transistor TR2 is connected to Vcc via the biasing resistor, RT thereby turning the transistor “fully-ON” and into saturation and at the same time turning TR1 “OFF” in the process. This then represents the circuits “Stable State” with zero output. The current flowing into the saturated base terminal of TR2 will therefore be equal to Ib = (Vcc – 0.7)/RT.

If a negative trigger pulse is now applied at the input, the fast decaying edge of the pulse will pass straight through capacitor, C1 to the base of transistor, TR1 via the blocking diode turning it “ON”. The collector of TR1 which was previously at Vcc drops quickly to below zero volts effectively giving capacitor CT a reverse charge of -0.7v across its plates. This action results in transistor TR2 now having a minus base voltage at point X holding the transistor fully “OFF”. This then represents the circuits second state, the “Unstable State” with an output voltage equal to Vcc.

Timing capacitor, CT begins to discharge this -0.7v through the timing resistor RT, attempting to charge up to the supply voltage Vcc. This negative voltage at the base of transistor TR2 begins to decrease gradually at a rate determined by the time constant of the RT CT combination. As the base voltage of TR2 increases back up to Vcc, the transistor begins to conduct and doing so turns “OFF” again transistor TR1 which results in the monostable multivibrator automatically returning back to its original stable state awaiting a second negative trigger pulse to restart the process once again.

Schematic diagram:

The circuit schematic of the Monostable Multivibrator Using BJTs in eSim is as shown below:

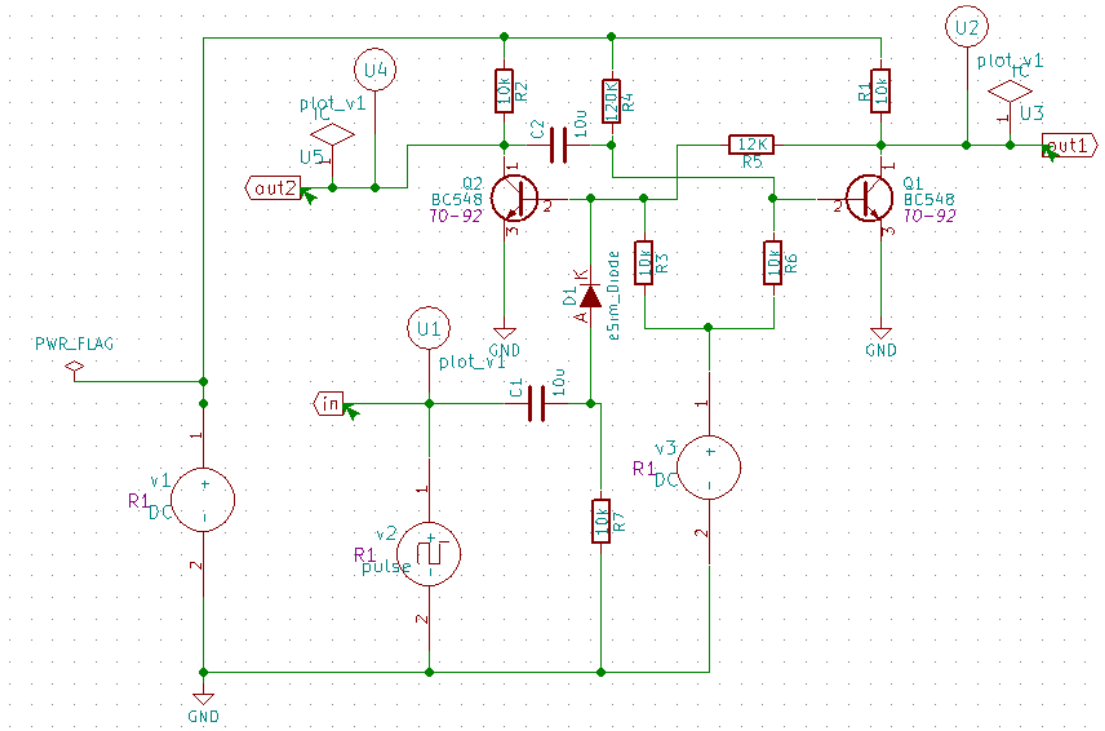

Figure 1: Monostable Multivibrator Using BJT

Simulation Results:

1.Ngspice Plots-

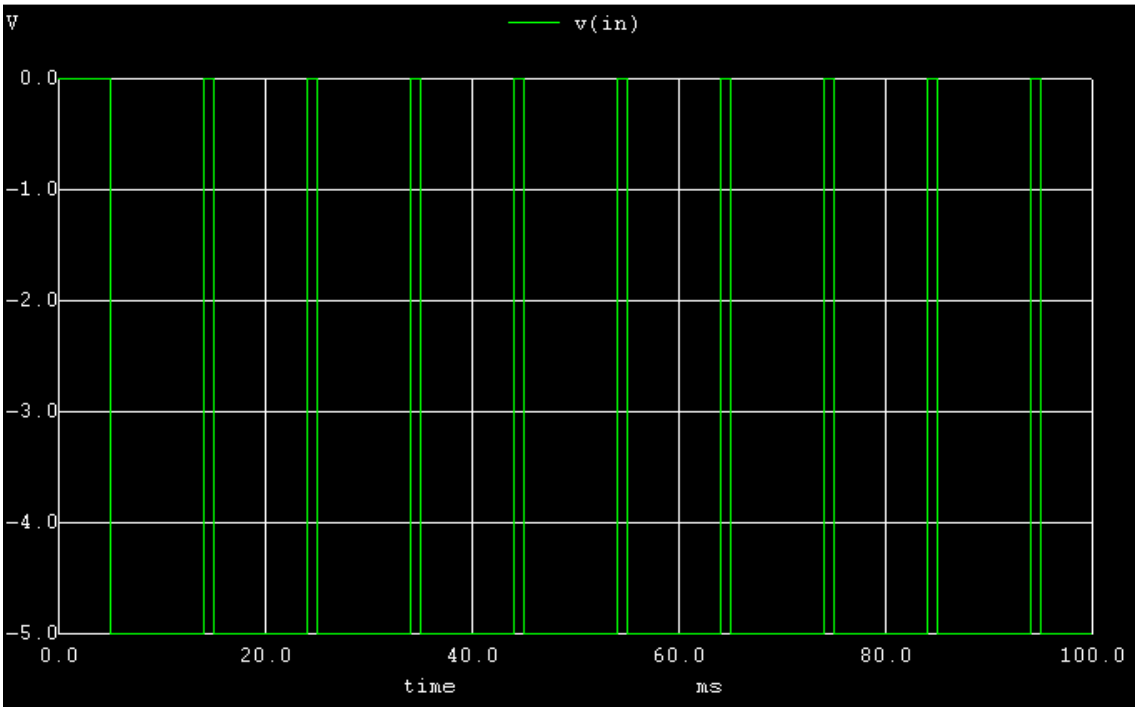

Figure 2: Ngspice Input Trigger Plot

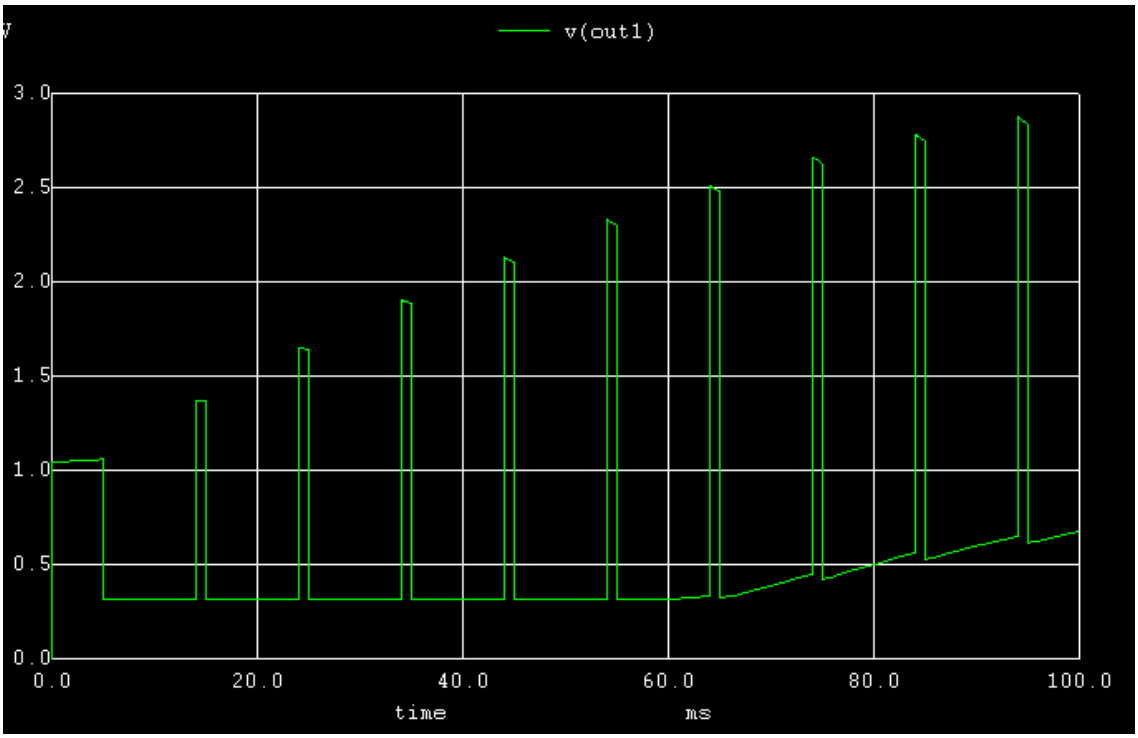

Figure 3: Ngspice Output 1 Plot

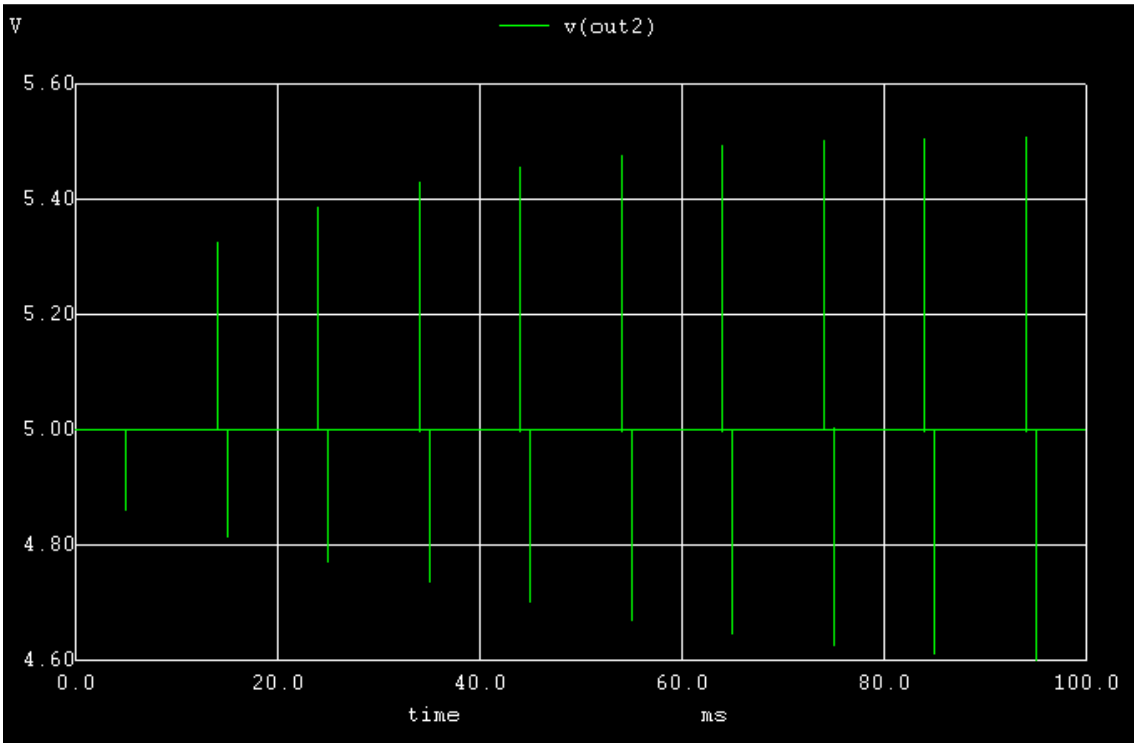

Figure 4: Ngspice Output 2 Plot

2.Python Plots-

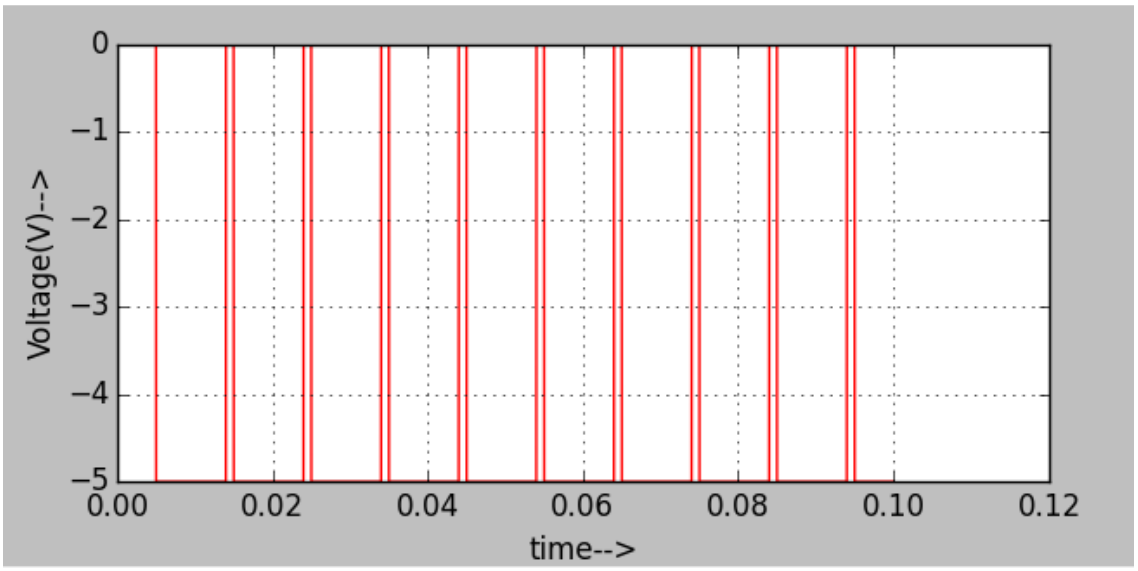

Figure 5: Python Input 1 Plot

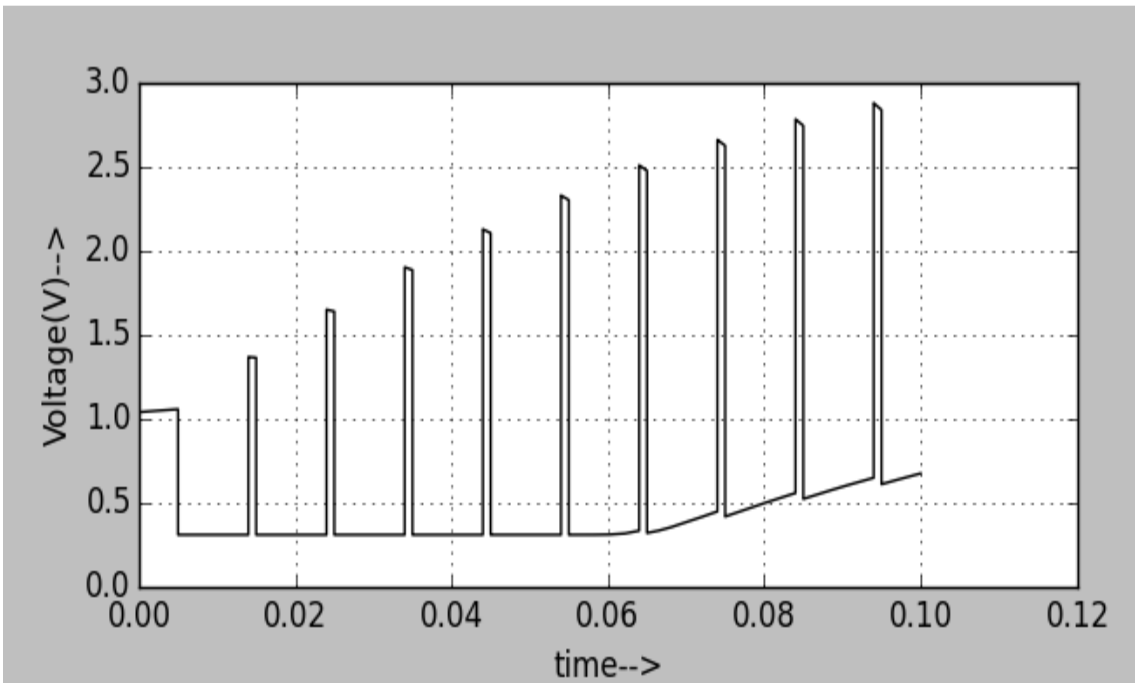

Figure 6: Python Output 1 Plot

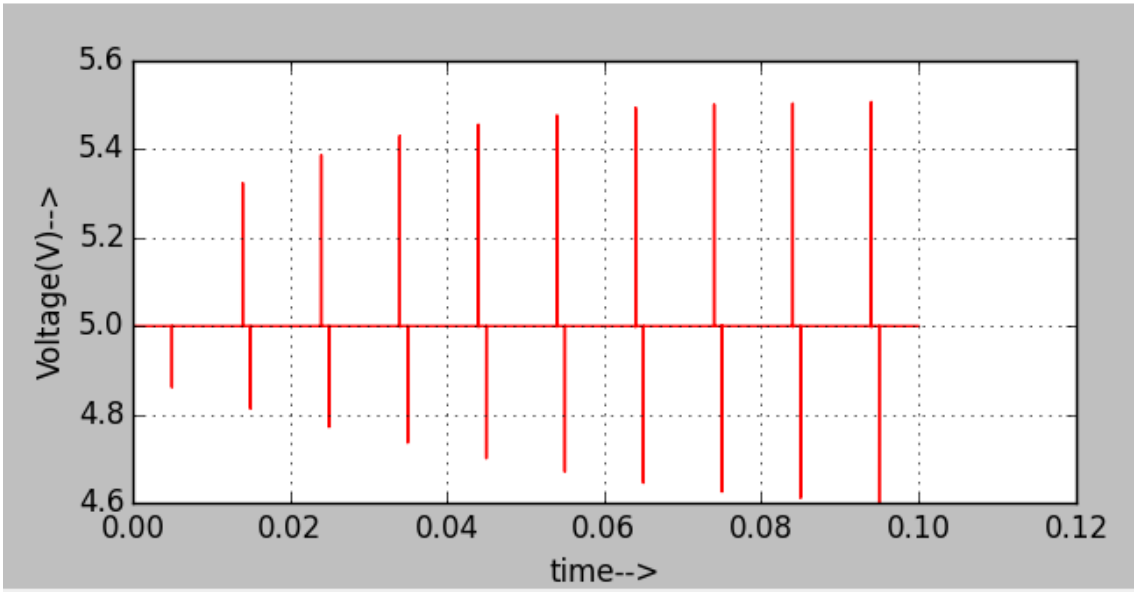

Figure 7: Python Output 2 Plot

Conclusion:

Thus, we have studied the Monostable Multivibrator Using BJTs and the simulation plot of ngspice and python plot obtained in eSim.

References:

1) https://www.electronics-tutorials.ws/waveforms/monostable.html
2) https://www.tutorialspoint.com/pulse_circuits/pulse_circuits_monostable_multivibrator.htm
3) https://electrosome.com/monostable-multivibrator-transistors/