

Title of the experiment

Analysis of Voltage Doubler using IC555 in eSim

Theory:

Voltage Doubler is a circuit which is used to double the input voltage fed to it. For example if we give input voltage as 5V we will get the output as 10V. The circuit is divided into two parts, the first part consists of the 555 timer IC which is used in Astable mode to generate the square wave of frequency approx. 2KHz. The second part consists of the 2 diode and 2 capacitors to double the output voltage of IC 555.

When the output of 555 IC is low diode D1 get forward biased and capacitor C3 get charged through D1. Now when output at PIN 3 goes high, D1 get reverse biased and blocks the discharging of the capacitor C3, and at the same time D2 is forward biased and allow the capacitor C4 to charge. Now the capacitor C4 charges with the combined voltage of Capacitor C3 and the input source voltage, means 5v of capacitor C3 and 5v of input supply, so it charges up to 10v (twice the voltage of input source). But in practical we get output voltage less than the twice of input voltage, like in our case we have input as 4V and we get approx. 7.8V instead of 8V.

It is recommended to use input voltage from 3V-12V.

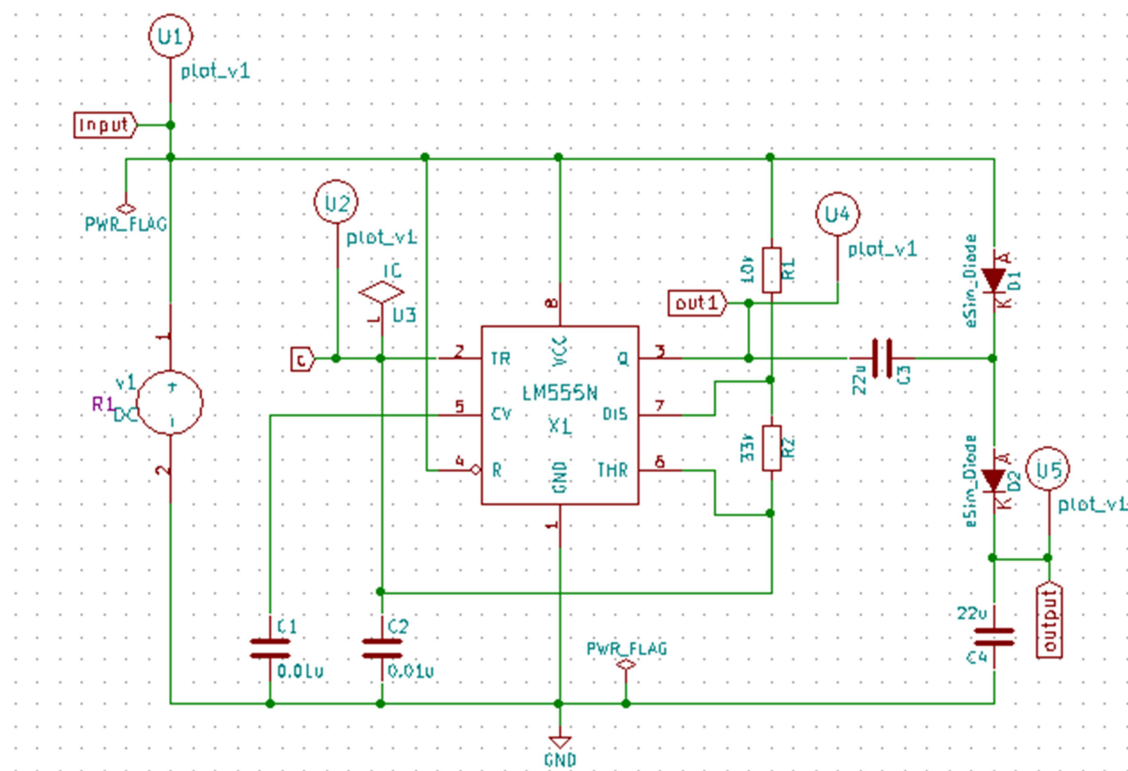


Figure 1: Schematic of Voltage Doubler

Simulation Results:

1. Ngspice plots:

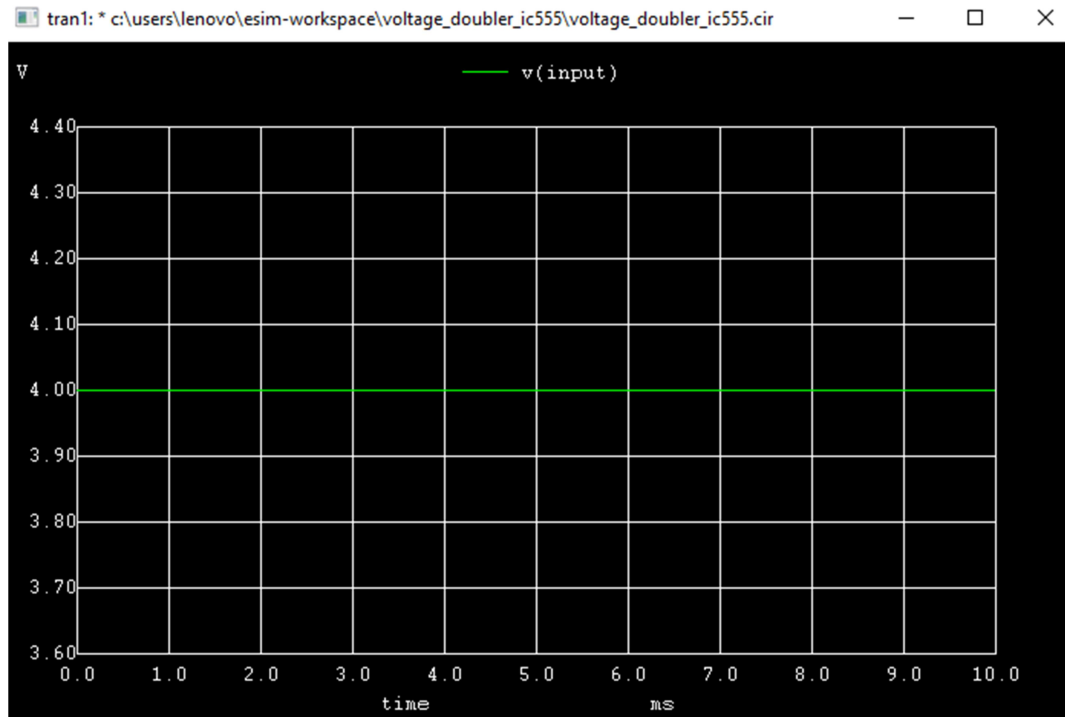


Figure 2: ngspice input plot

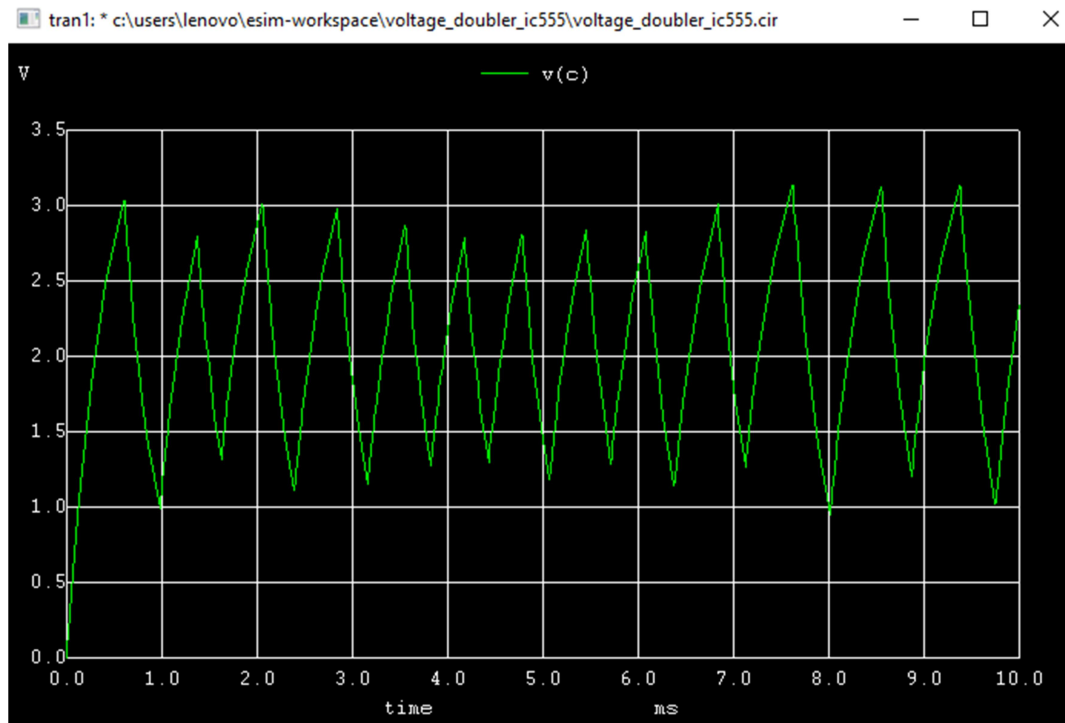


Figure 3: ngspice trigger plot at pin2

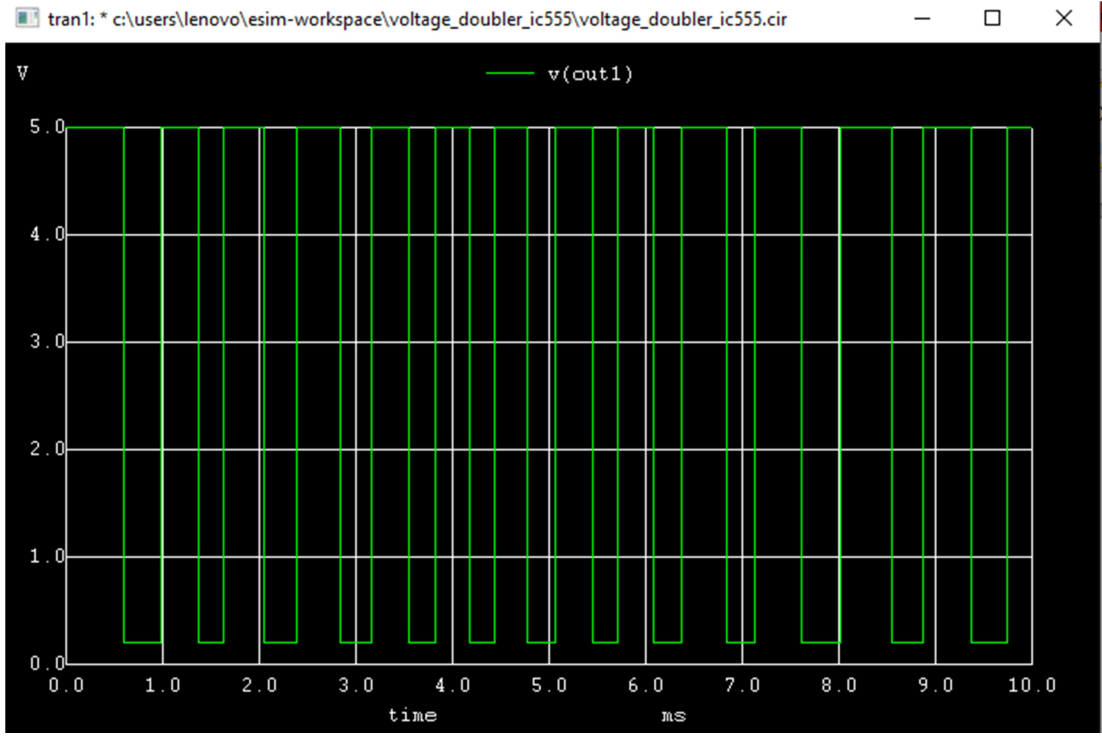


Figure 4: ngspice IC555 output plot (Astable mode)

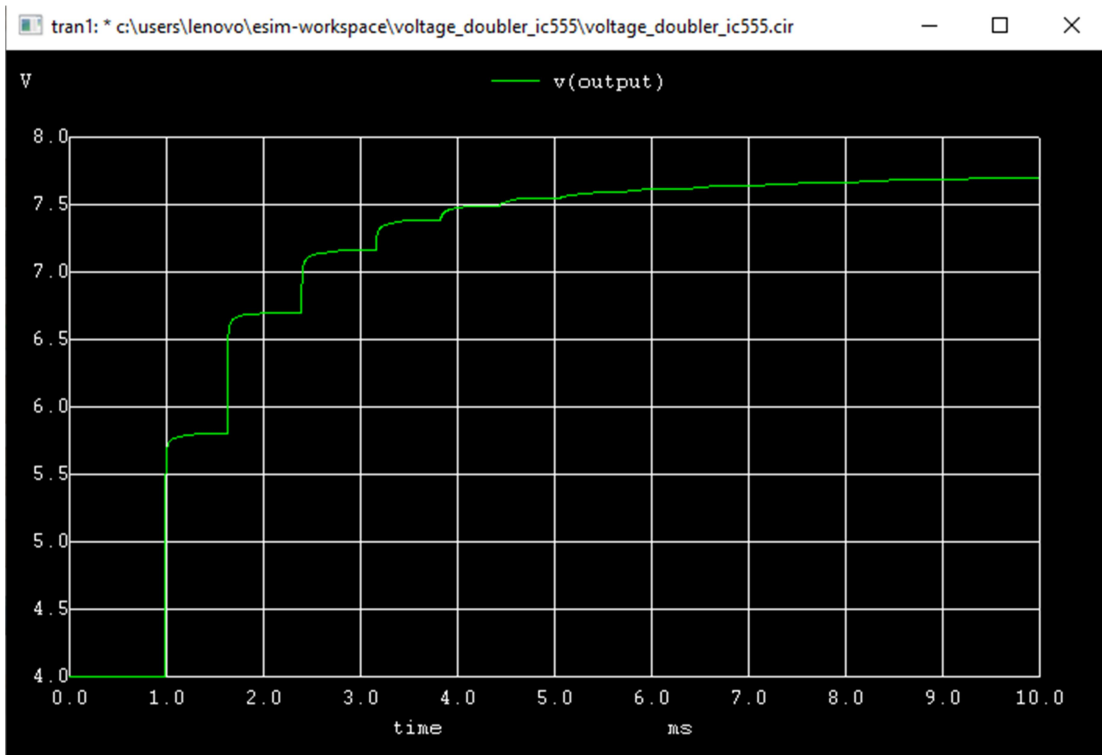


Figure 5: ngspice final output plot (voltage doubled)

Python Plot:

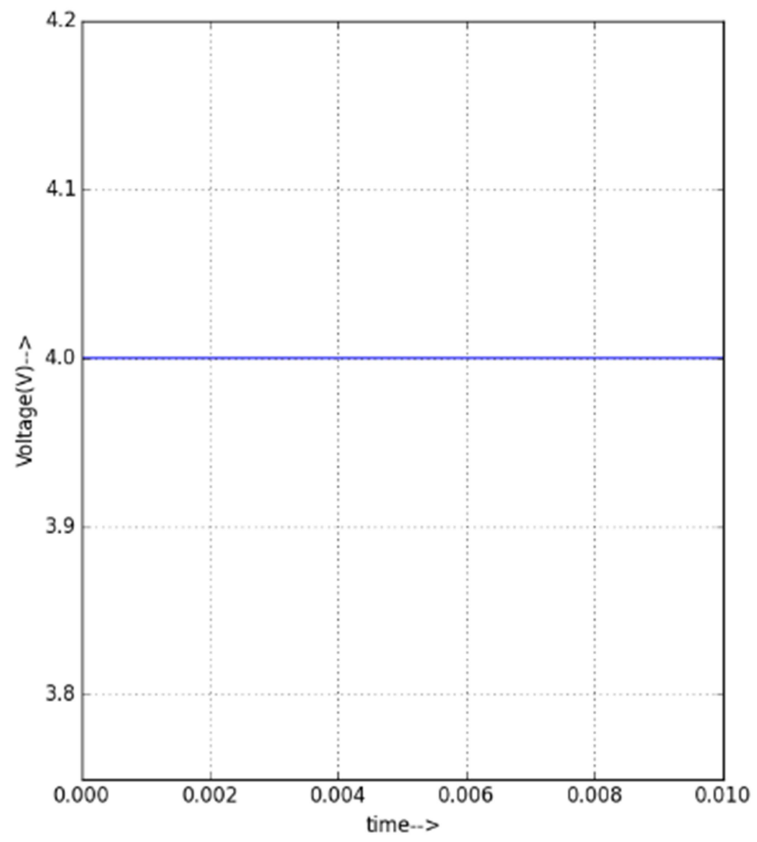


Figure 6:python input plot

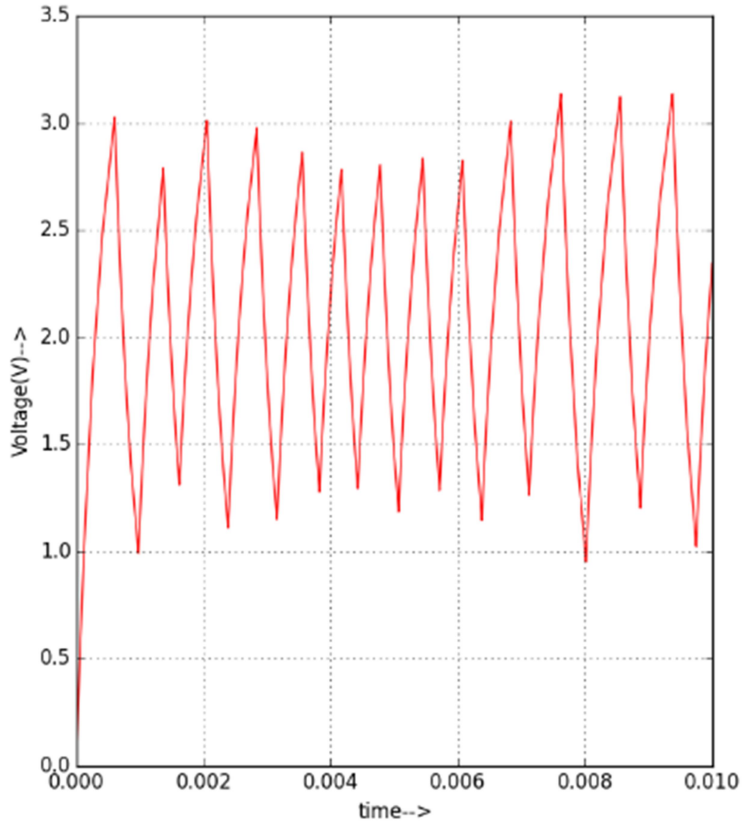


Figure 7: python trigger plot at pin2

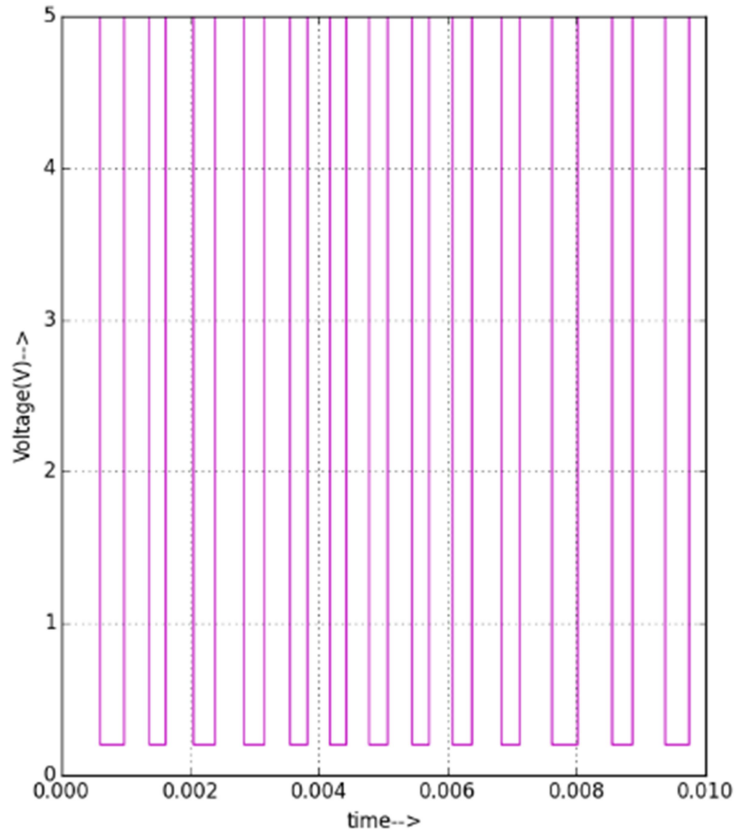


Figure 8: python IC555 output plot (Astable mode)

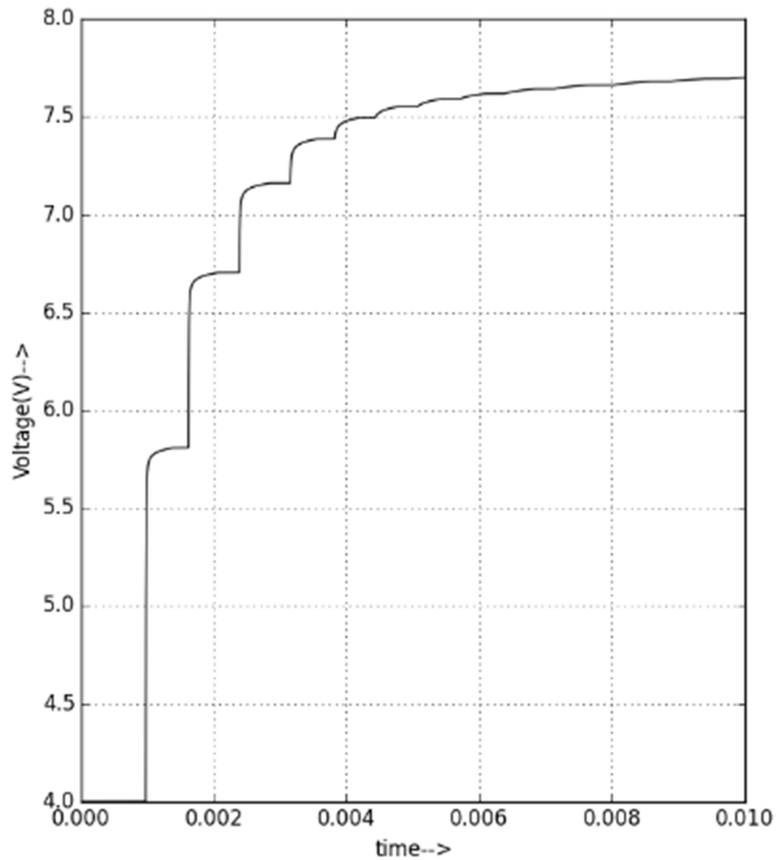


Figure 9: python final output plot (voltage doubled)

Conclusion :

Thus, we have studied the voltage doubler using IC555 and the simulation plot of ngspice and python plot obtained in eSim.

Reference:

1. <https://circuitdigest.com/electronic-circuits/voltage-doubler-circuit-diagram>
2. https://en.wikipedia.org/wiki/Voltage_doubler