Contributor Name-Sumanto Kar

Institute-Fr. Conceicao Rodrigues College of Engineering, Bandra

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Title of the experiment

IC LM317 Design and Implementation

Theory:

LM317 is a positive-voltage regulator with an adjustable voltage range from 1.25 V to 37 V. It can supply greater than 1.5 A at the output. In most of the applications, due to irregular loads, the output voltage produced has fluctuations in it which can lead to damaging loads. Therefore, voltage regulators are used. The main function of the LM317 IC is to maintain the constant and stable voltage at the output. It is used for linear regulation. its load and line regulation are better as compared to other fixed regulators.

The Features of LM317 are:

- An adjustable positive voltage regulator
- The output voltage can be set through an adjustable input in a range of 1.25V to 37V
- Output current is 1.5A
- Internal short-circuit protection to limit the current
- Safe area compensation for transistor output
- Operating temperature is 125°C
- Ripple rejection is 80dB
- Load regulation is typically 0.1%
- Line Regulation is typically 0.01%/V

This IC is intended for use in a regulation of variable voltages. It can be used for multiple purposes. It can be used as a fixed voltage regulator, AC voltage regulator, current limiter, Battery charger, local and on-card regulation. Furthermore, it can be used as a current regulator by connecting a resistor between the output and adjustment pin. It has one drawback that during regulation its voltage drop to about 2.5V.

The LM317 IC develops and maintains 1.25V between its output and adjustment pin. Its output can be adjusted by connecting a network of two resistors externally between the output pin and adjust the input pin. The two decoupling capacitors are connected in a circuit. They are used to remove the undesired coupling and avoid the effect of noise. A capacitor of 1µF is connected at the output to improve transient response. To use it is a variable regulator, we have connected a potentiometer at the adjustable pin. By changing the value of a potentiometer, you can obtain the desired voltage at the output.

Schematic diagram:

The circuit schematic of the IC LM317 Design and Implementation in eSim is as shown below:

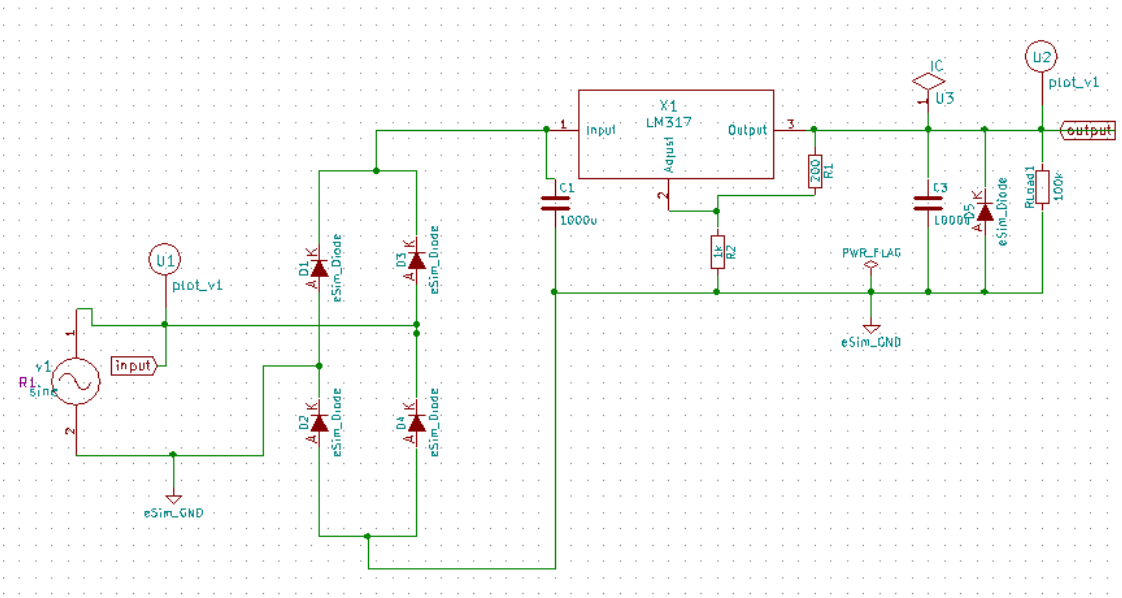

Figure 1: IC LM317 Design and Implementation

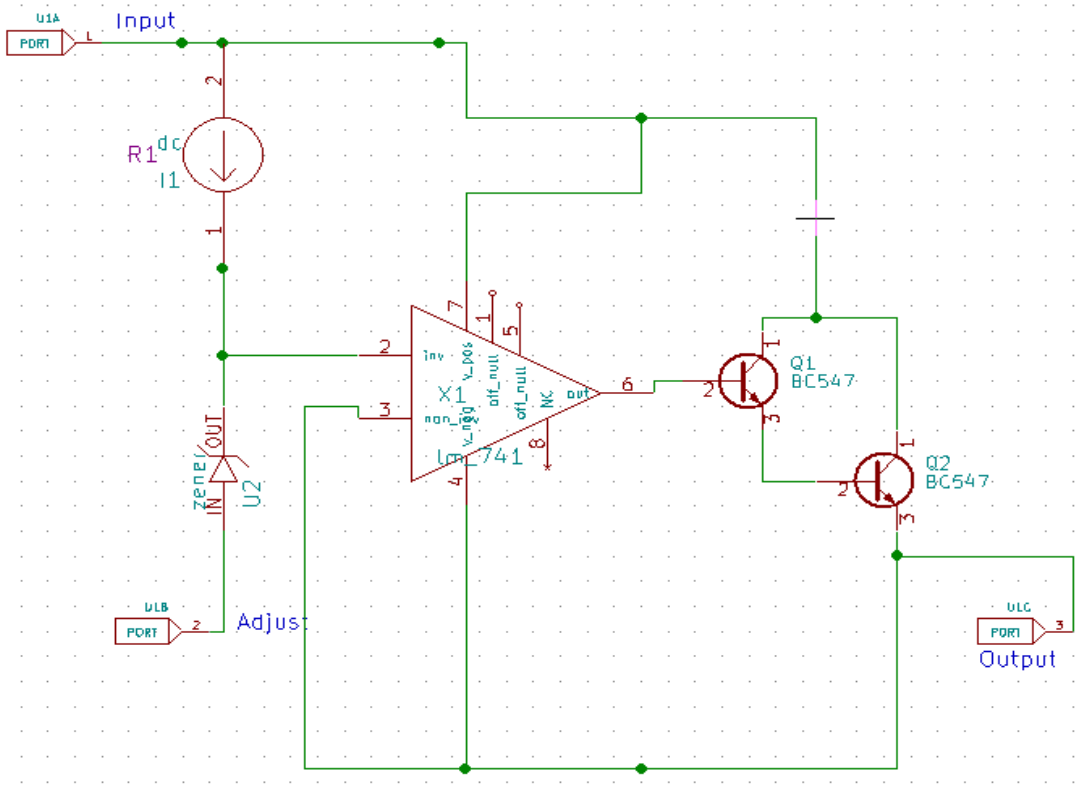

Figure 2: IC LM317 Subcircuit Model

Simulation Results:

1.Ngspice Plots-

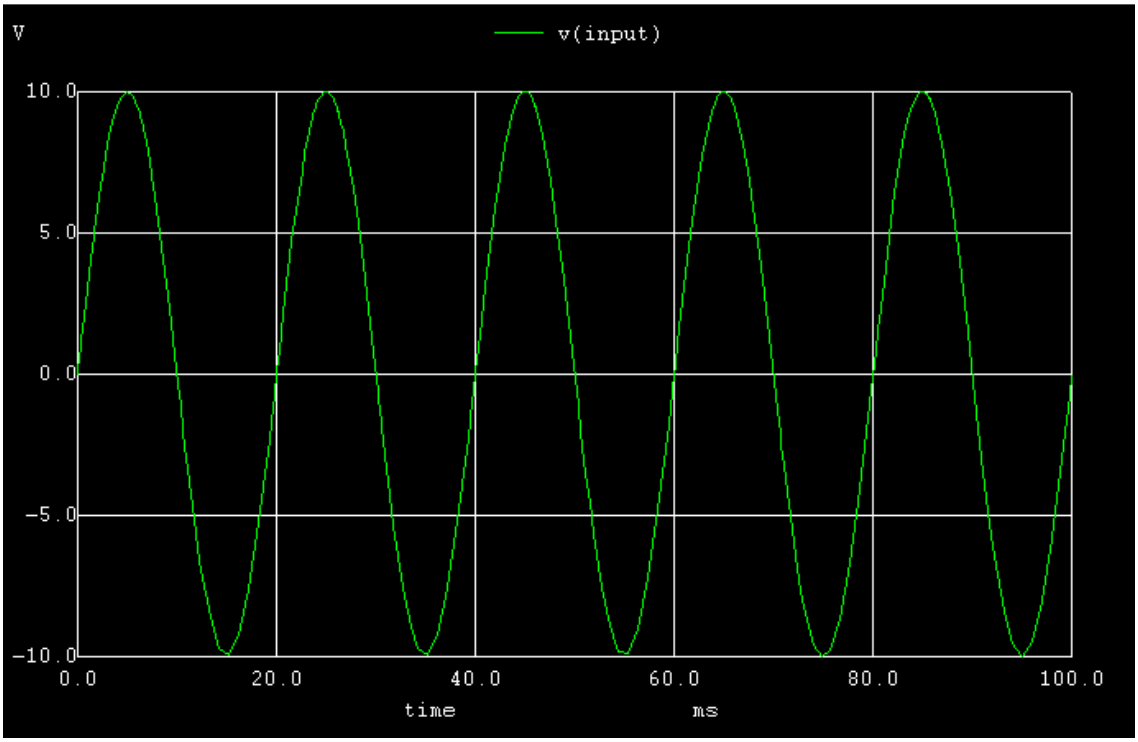

Figure 3: Ngspice Input Plot

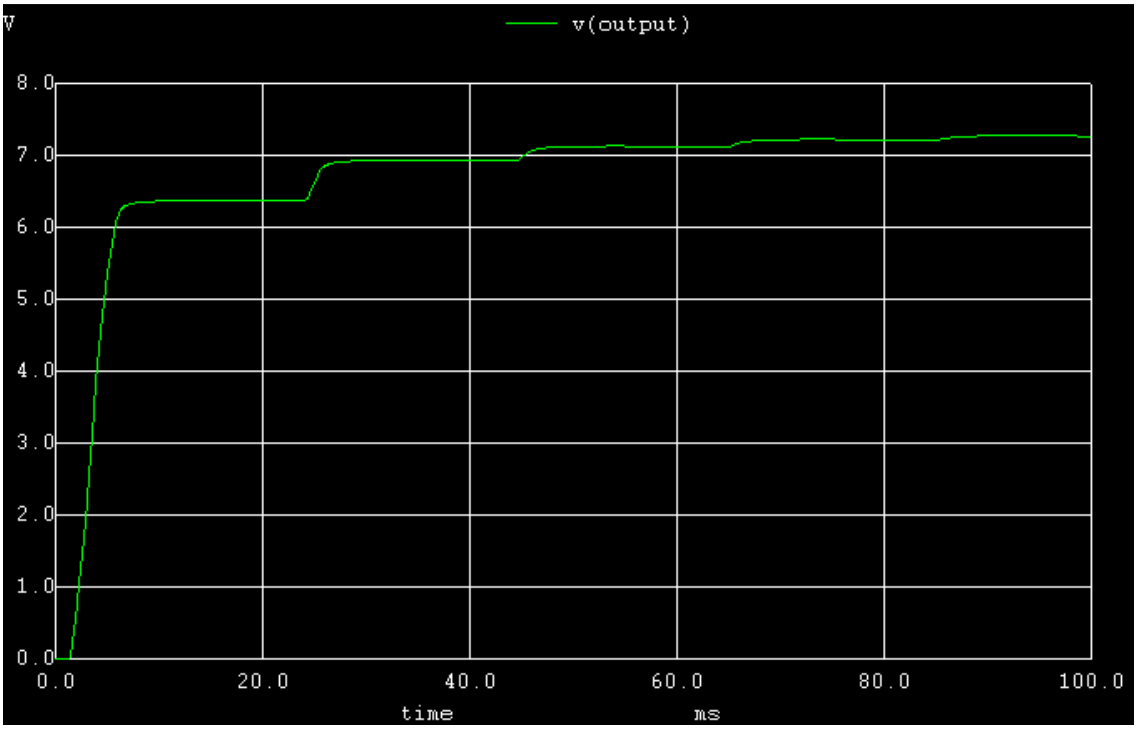

Figure 4: Ngspice Output Plot

2.Python Plots-

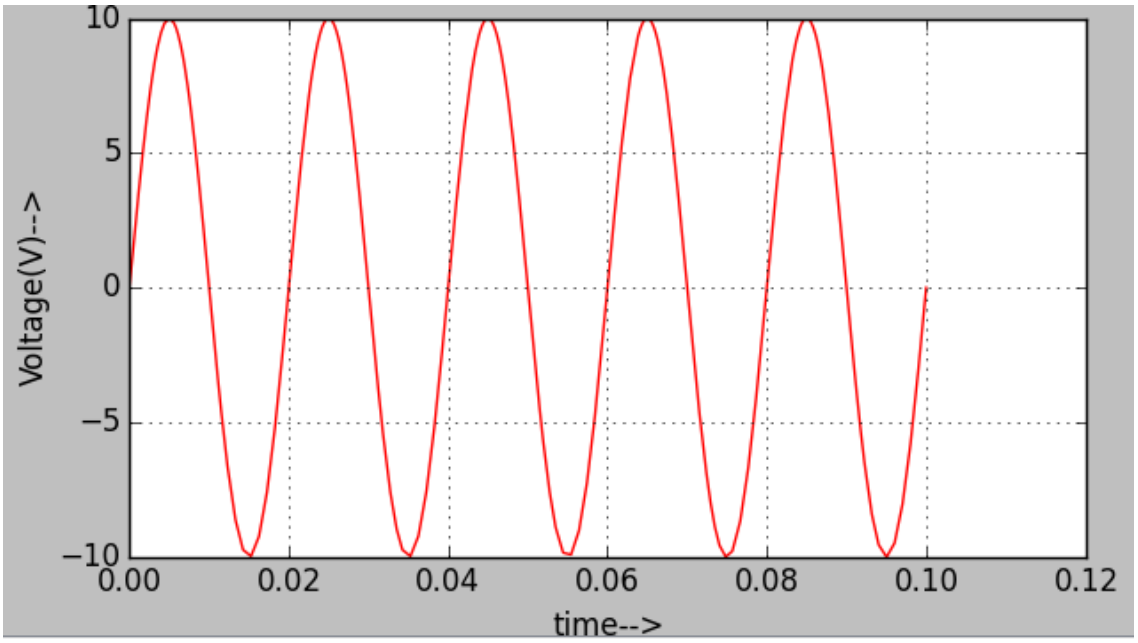

Figure 5: Python Input Plot

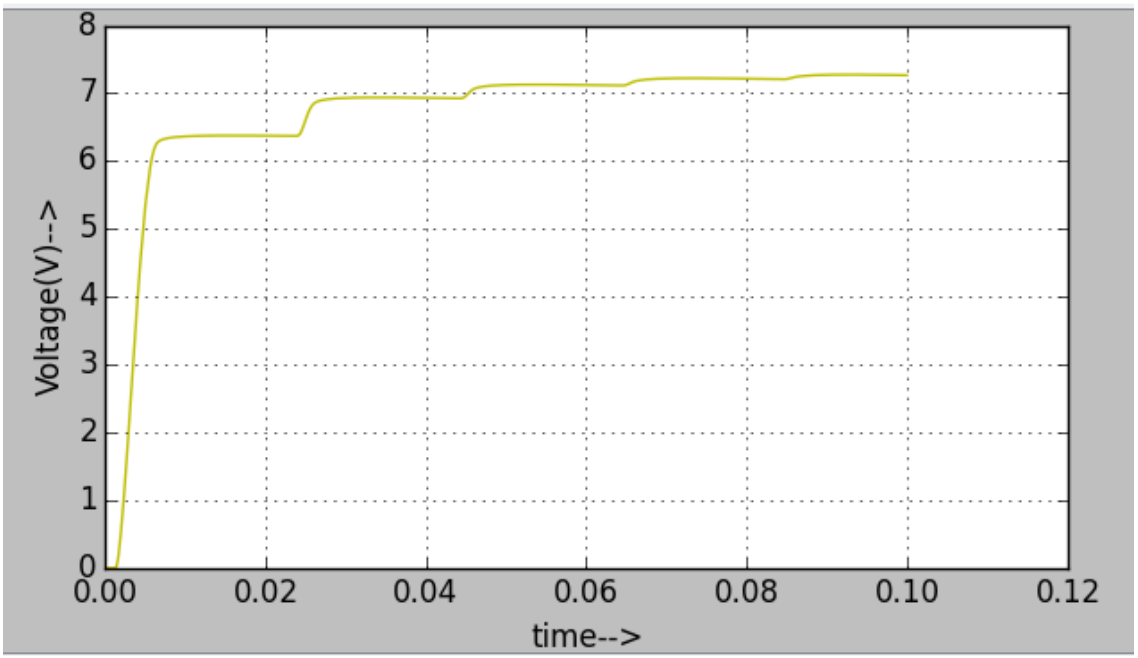

Figure 6: Python Output Plot

Conclusion:

Thus, we have studied the IC LM317 Design and Implementation and the simulation plot of ngspice and python plot obtained in eSim.

References:

1) https://microcontrollerslab.com/lm317-adjustable-voltage-regulator/
2) http://www.ti.com/lit/ds/slvs044x/slvs044x.pdf
3) https://en.wikipedia.org/wiki/LM317