

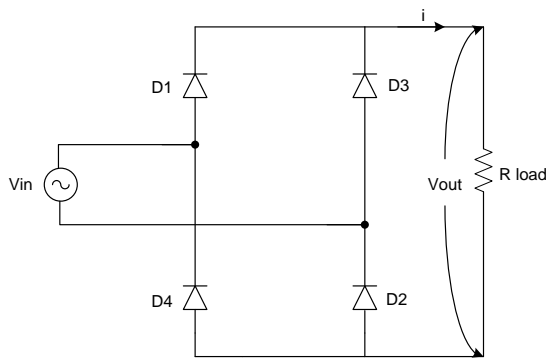
Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

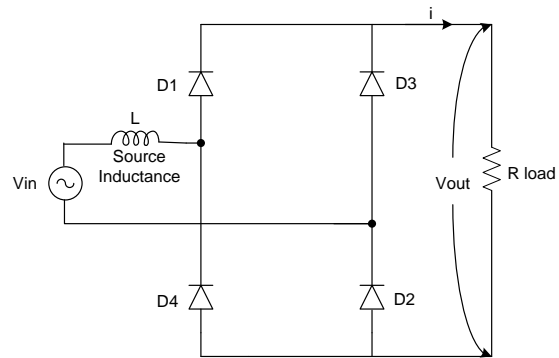
Name of the participant: Mrs. Nivedita S. Padole

Title of the circuit: Effect of Source Inductance on the Performance of Diode Bridge Rectifier

Theory/Description:



(a) Bridge rectifier without source inductance



(b) Bridge rectifier with source inductance

Figure 1: (a) A diode bridge rectifier without source inductance (b) A diode bridge rectifier with source inductance

A diode bridge rectifier without source inductance is shown in Fig. 1 (a). During positive half cycle, diode D1 and D2 conducts with the +Vo across the load. During negative half cycle, diode D3 and D4 are forward biased resulting into +Vo across the load. The output voltage Vo for uncontrolled bridge rectifier is given by (1),

$$V_o = \frac{2V_m}{\pi} \quad (1)$$

Fig.1 (b) shows a diode bridge rectifier with source inductance. Due to the presence of source inductance, the output voltage Vo decreases.

Hence, in this simulation, two cases are considered to depict the effect of source inductance on the performance of uncontrolled bridge rectifier;

1. Considering the ideal source
2. Considering the practical source

Using the source inductance, the average output voltage reduces which is demonstrated using this simulation.

Circuit Diagram(s):

The circuit schematic of diode bridge rectifier considering the ideal source in eSim is shown below:

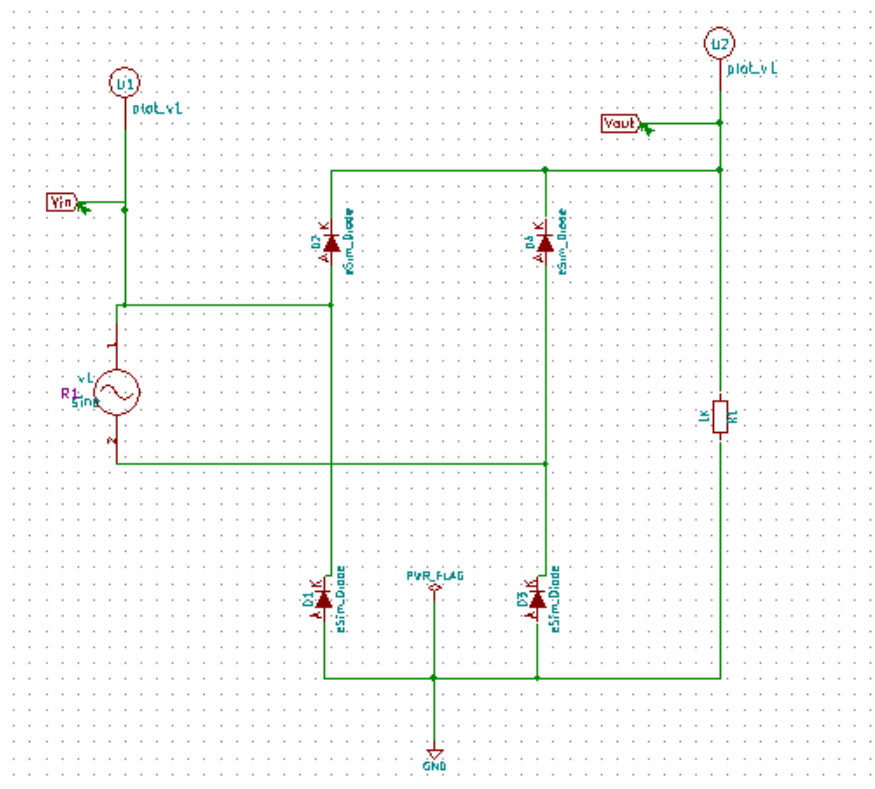


Figure 2. Schematic diagram of a diode bridge rectifier with ideal source

The circuit schematic of diode bridge rectifier considering the practical source in eSim is shown below:

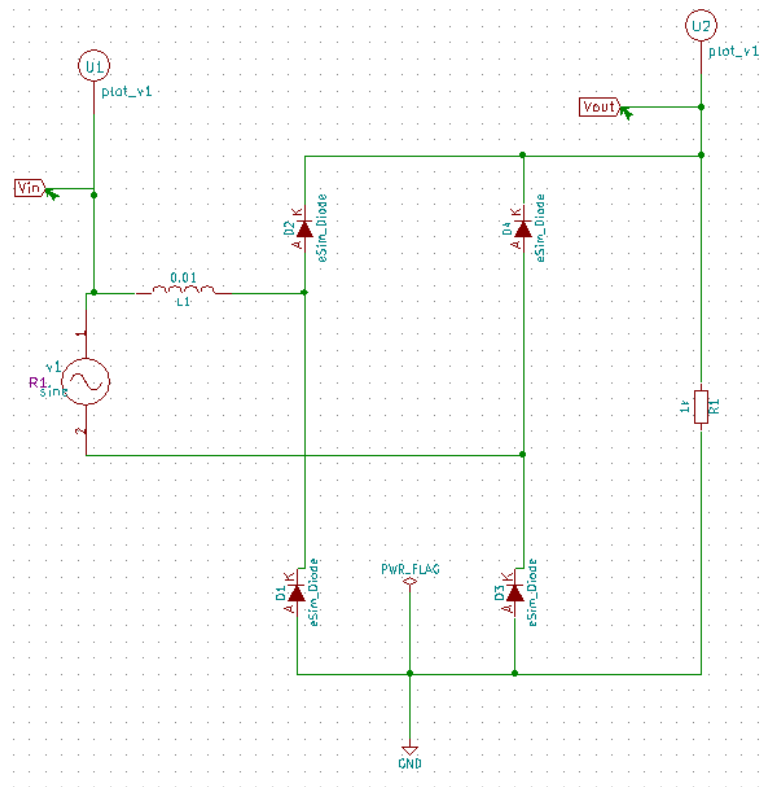


Figure 3. Schematic diagram of a diode bridge rectifier with practical source

Results (Input, Output waveforms and/or Multimeter readings) :

Ngspice Plots:

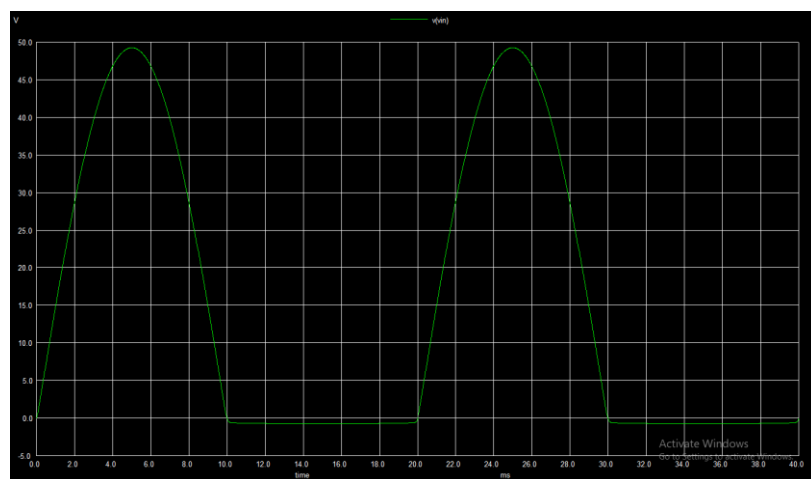


Figure 4: Input Voltage of a diode bridge rectifier without source inductance

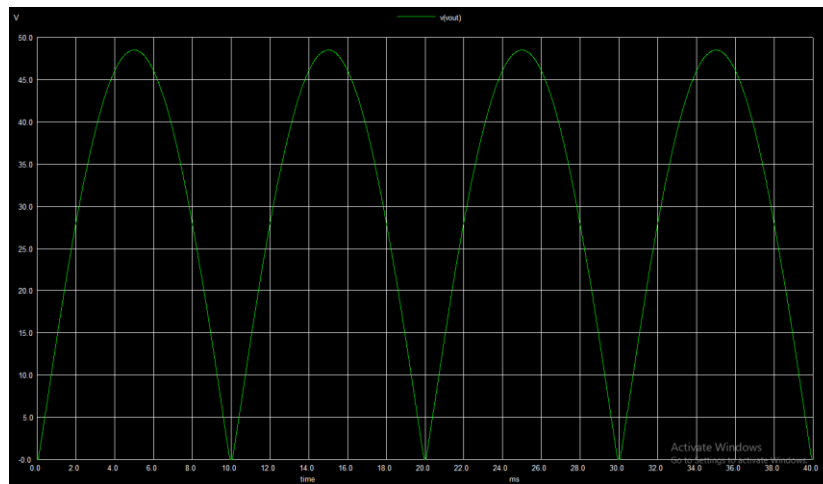


Figure 5: Output Voltage a diode bridge rectifier without source inductance

Multimeter Reading:

Considering ideal source

RMS value of Input Voltage: 24.507 V

RMS value of Output Voltage: **33.994 V**

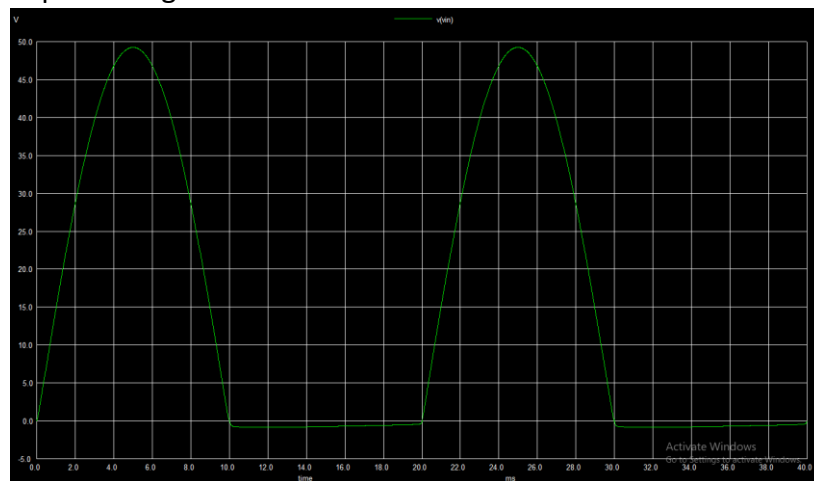


Figure 6: Input Voltage of a diode bridge rectifier with source inductance

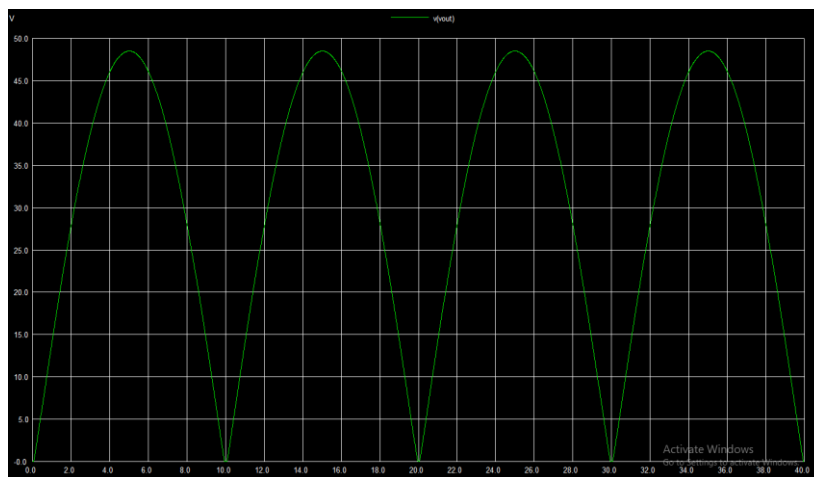


Figure 7: Output Voltage of a diode bridge rectifier with source inductance

Multimeter Reading:

Considering practical source

RMS value of Input Voltage: 22.815 V

RMS value of Output Voltage: **31.645 V**

Python Plots:

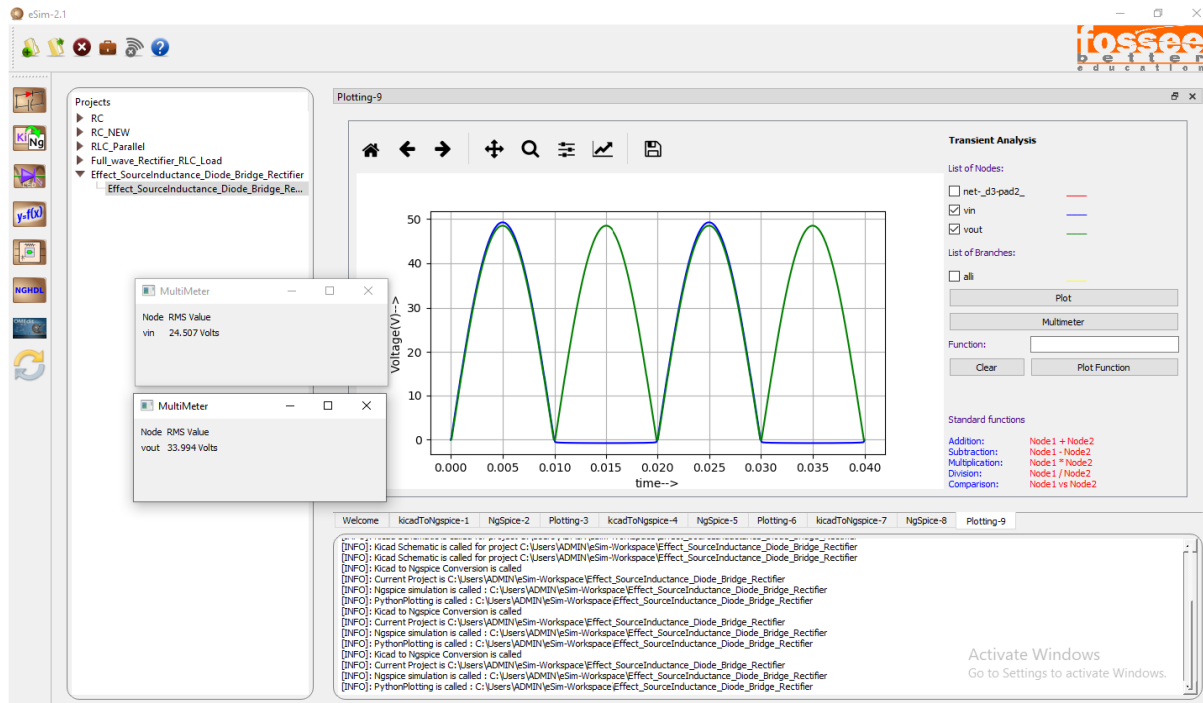


Figure 8: Output Voltage of a diode bridge rectifier without source inductance

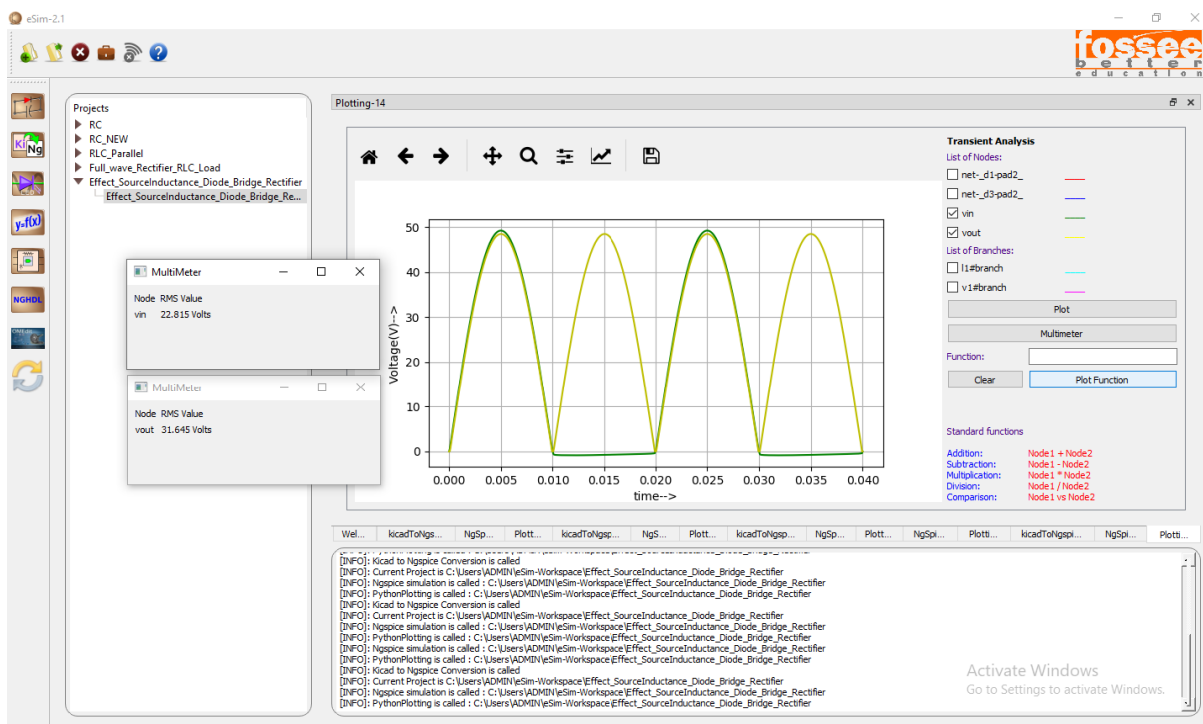


Figure 9: Output Voltage of a diode bridge rectifier with source inductance

Conclusion: Thus, the effect of source inductance on the performance of a diode bridge rectifier has been studied and it has been verified that the output voltage decreases due to the presence of source inductance by simulating the circuit in eSim.

Considering the ideal source, the RMS value of output voltage obtained is 33.994 V.

Considering the practical voltage source, the RMS value of output voltage obtained is 31.645 V.

Source/Reference(s) : Power Electronics by Dr. P. S. Bhimbra, chapter no. 3 and 6.