Circuit Simulation Project

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

Name of the participant: Mrs. Nivedita S. Padole

Title of the circuit: Single Phase Diode Bridge Rectifier with CR Load.

Theory/Description:

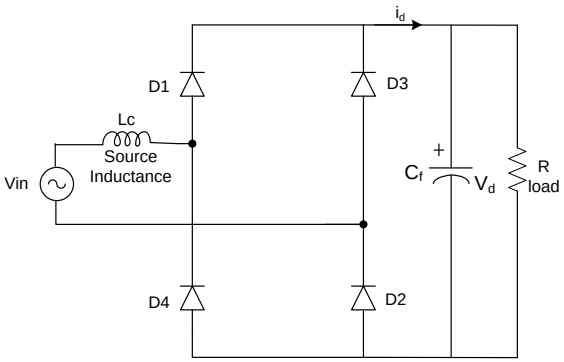


Figure 1: A diode bridge rectifier with CR Load

A diode bridge rectifier with capacitance resistance (CR) load is shown in Fig. 1. In this configuration a practical voltage source having L_S as a source inductance is consider. Capacitor C_f used to filter out the rectified DC output voltage to make the DC output voltage smooth. The equivalent resistance R represents the load. The output DC voltage is used for various applications such as input to the voltage fed inverter or chopper (DC-DC Converter) 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 capacitor will charge after every half cycle near the peak voltage V_m. Capacitor then discharge with a load time constant C_F*R. The value of load current is always proportional to the supply voltage. In practical circuit, the capacitor is charged through series resistor to minimize high inrush current, during steady state, the resistor is bypassed through diode. The output voltage ripple is minimized by using high rating of capacitor, with large energy storage the load current is always smooth.

The output voltage is given by the equation (1),

$$V_d = V_m \sin\theta \quad (1)$$

Where,

V_d = Capacitor/Output voltage
V_m = Maximum/Peak Input voltage
Θ = Theta is angle at which capacitor start charging

Circuit Diagram(s):

The circuit schematic of diode bridge rectifier with source inductance in eSim is shown below:

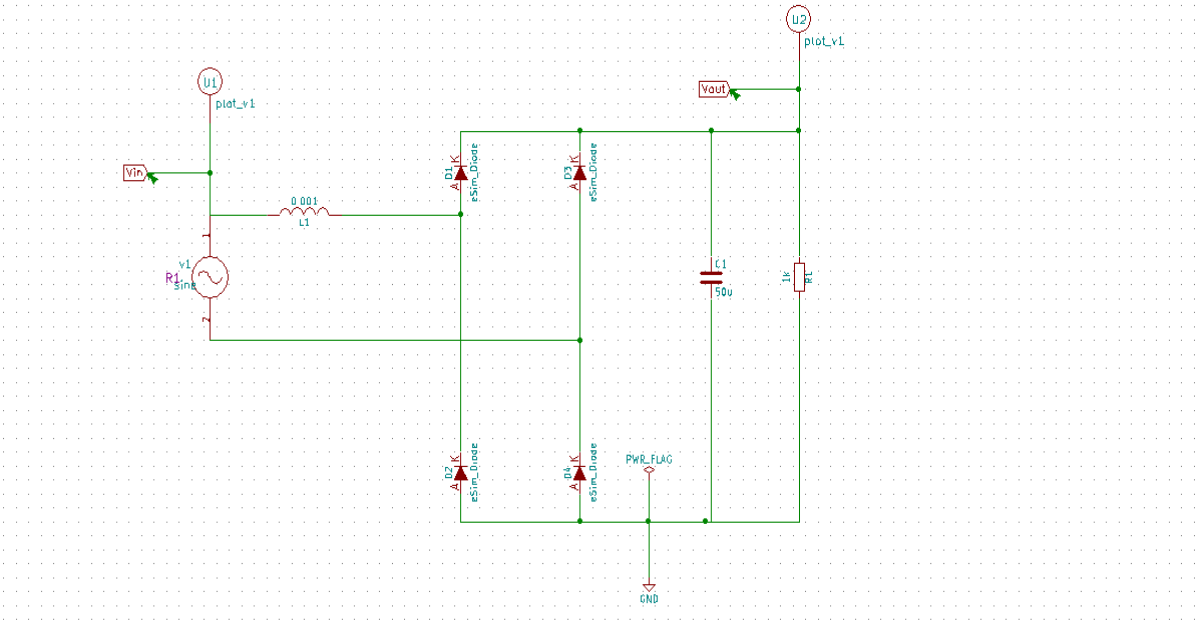


Figure 2. Schematic diagram of a diode bridge rectifier with CR Load

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

Ngspice Plots:

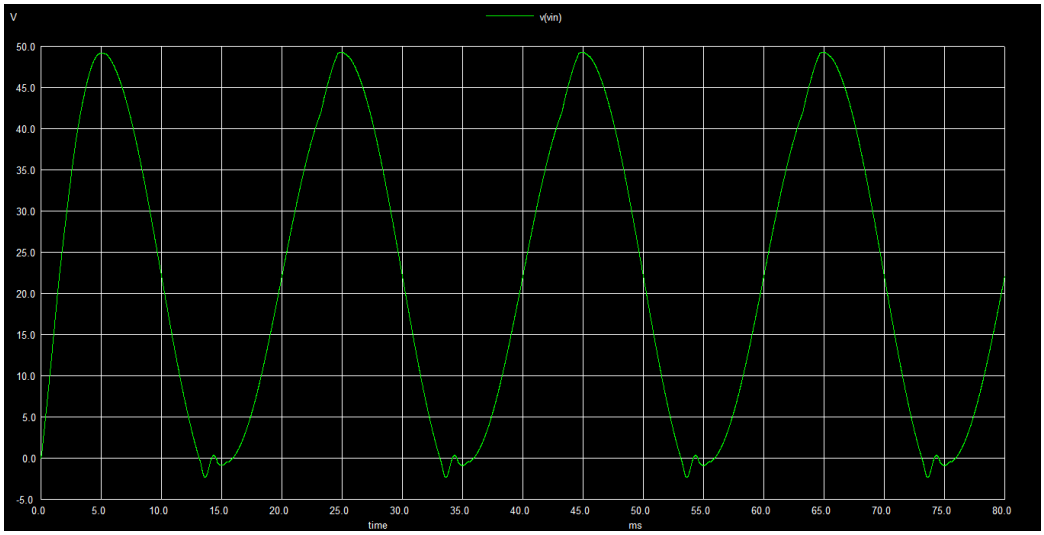


Figure 3: Input Voltage of a diode bridge rectifier with source inductance

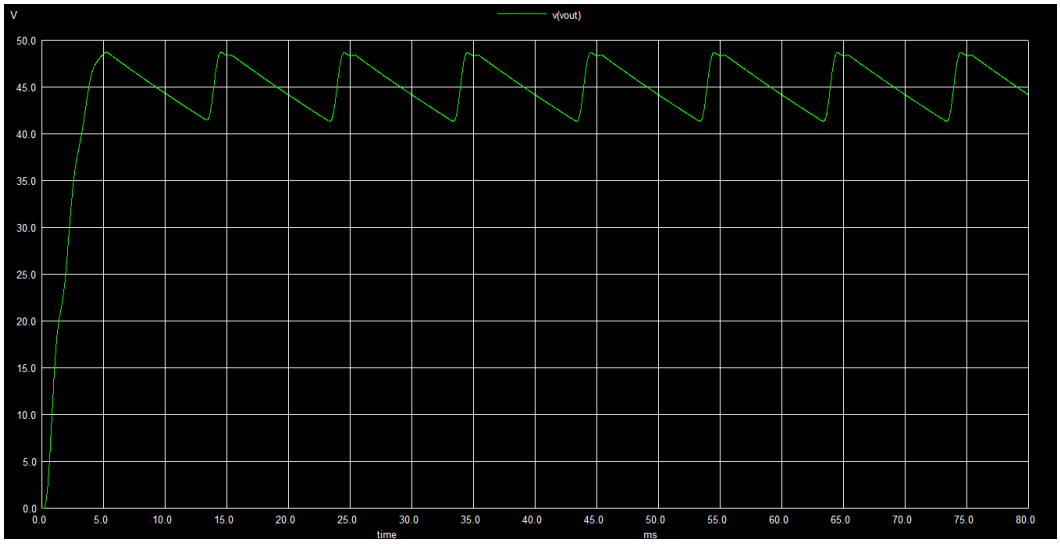
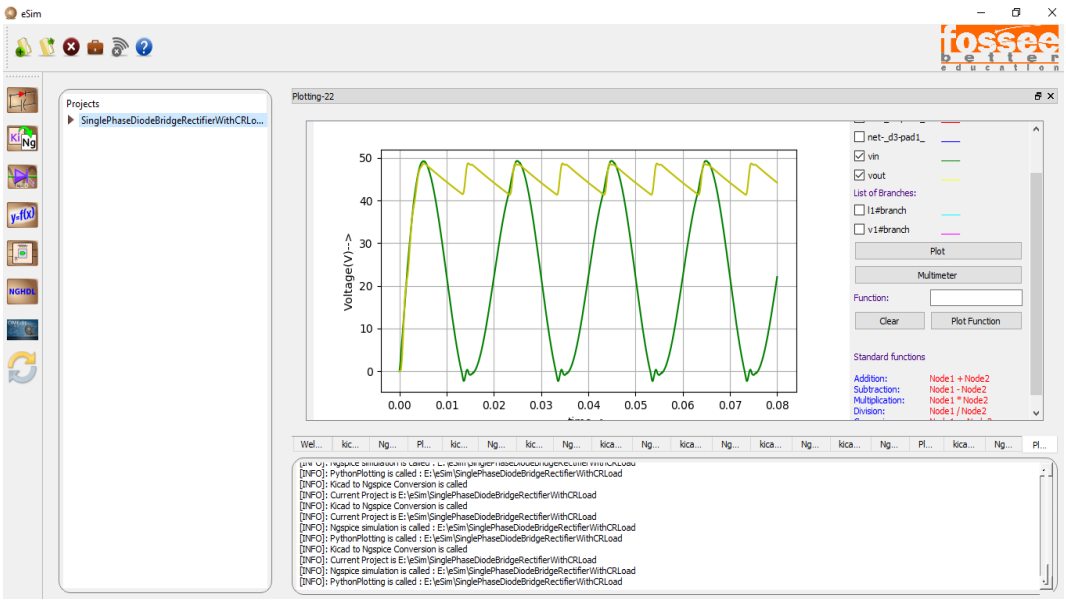


Figure 4: Output Voltage a diode bridge rectifier with source inductance

Python Plots:



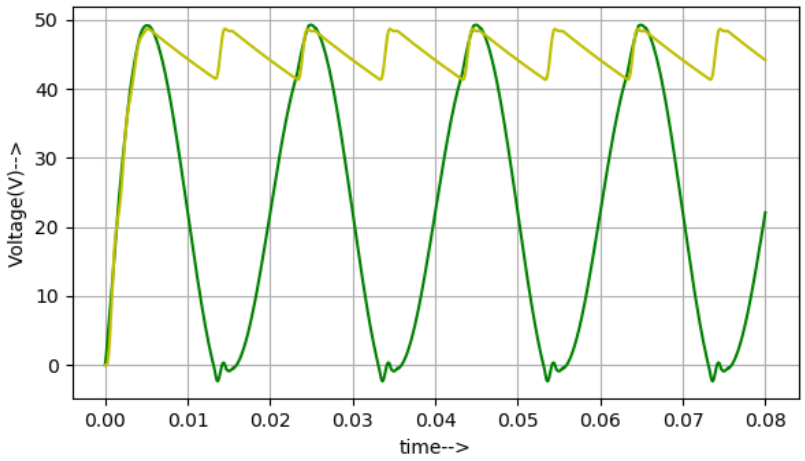


Figure 5: Output Voltage of a diode bridge rectifier with source inductance and CR Load

Conclusion: Thus, the effect of source inductance on the performance of a diode bridge rectifier with CR load has been studied by simulating the circuit in eSim.

Source/Reference(s) : Modern Power Electronics and AC Drives by Bimal K. Bose