

Circuit Simulation Project

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

Title:

Three-Phase Uncontrolled Rectifier with RL Load and filter circuit.

Theory/Description:

Rectifier converts AC supply into DC. Rectifiers are also known as AC-DC converter. Diodes are extensively used in rectifier circuit. Three phase full wave bridge rectifier is used for high power applications shown in Fig. 1. Six diodes are used in between source and load. During the operation of rectifier only two diodes conduct at a time and each will conduct for 120° . The diodes are numbered in order of conduction of sequence. The sequence of conduction D_1D_2 , D_2D_3 , D_3D_4 , D_4D_5 , D_5D_6 and D_6D_1 . Three phase voltage source is used to fed the rectifier circuit. V_a , V_b and V_c voltages having V_m as maximum value, the line voltages V_{ab} , V_{bc} and V_{ca} . Only one diode from upper side (i.e D_1 , D_3 and D_5) and one diode from lower side (i.e D_2 , D_4 and D_6) remain turn ON. Diode of same leg never be turn ON at a time.

This circuit simulation of three-phase uncontrolled rectifier with RL load is carried out with a capacitor circuit.

Circuit Diagram:

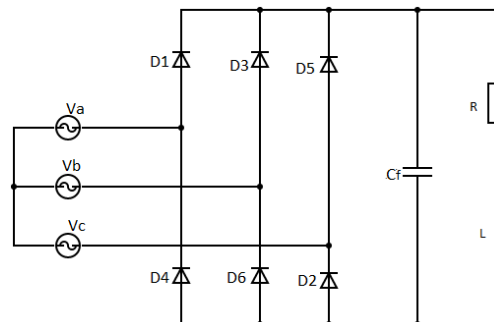


Fig.1 Circuit diagram of three-phase uncontrolled rectifier with RL Load and Filter circuit C_f

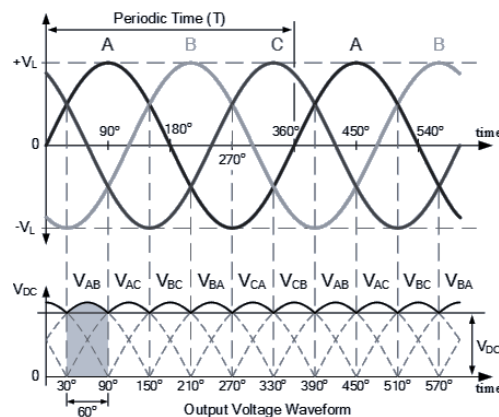


Fig.2 Input/Output voltage waveform of three-phase uncontrolled rectifier with RL Load

Results/ Output (ngspice and Python plots)

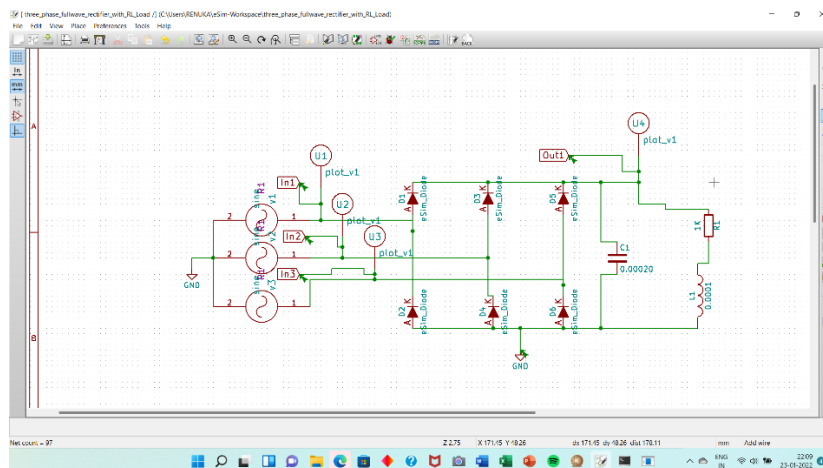


Fig. 3 Three phase uncontrolled rectifier with RL load in esim

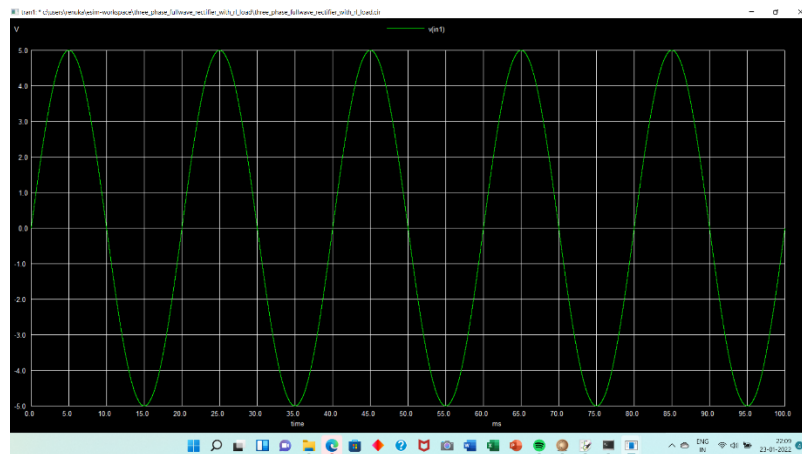


Fig. 4 Ngspice plot of Input Voltage Va

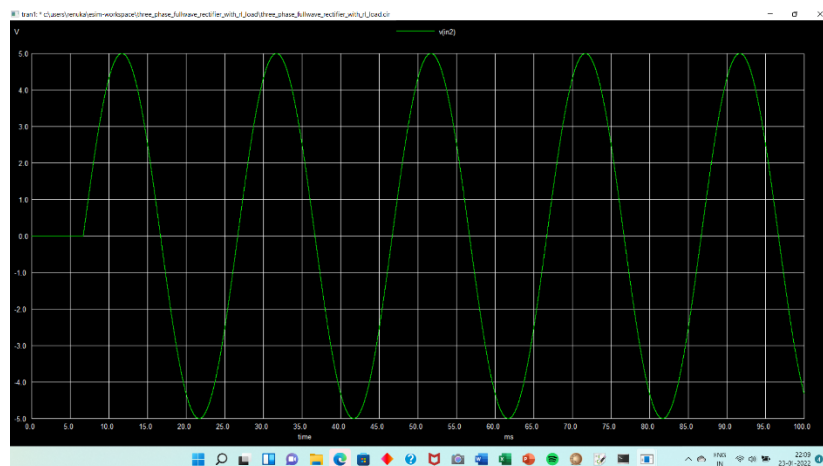


Fig. 5 Ngspice plot of Input Voltage Vb

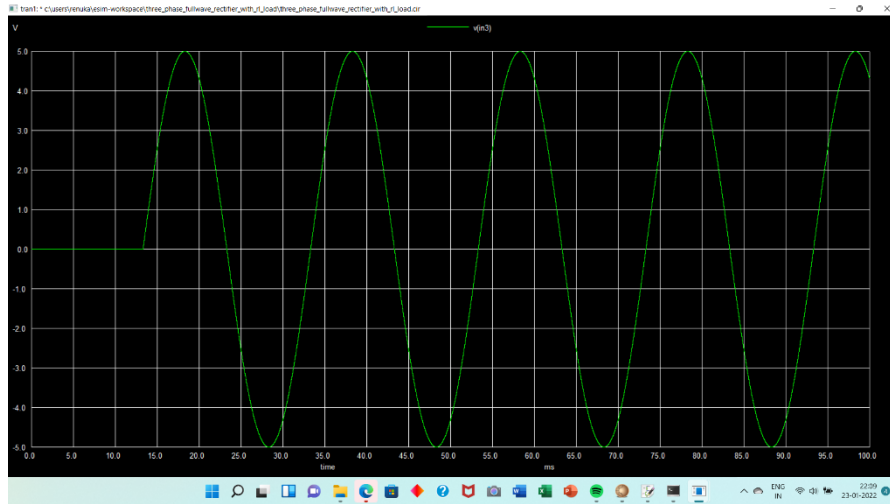


Fig. 5 Ngspice plot of Input Voltage V_c

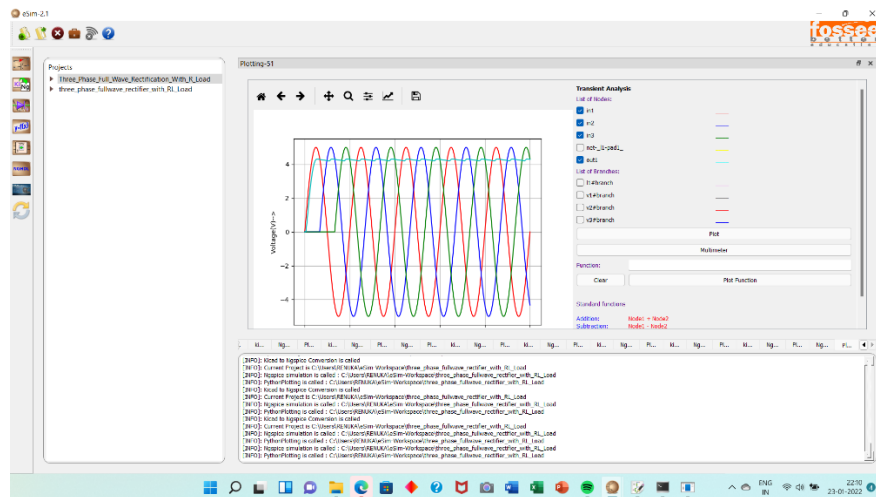


Fig. 6 Python plot of Input/Output Voltage V_s/V_0 with RL load and filter circuit

Conclusion: Three phase diode based full wave rectifier is simulate successfully using esim tool.

Source/Reference(s): P.S.Bimbhra, *Power Electronics* , 4th ed, Khanna Publisher, 2009, pp.85-89.