Research Migration Project

https://esim.fossee.in/research-migration-project

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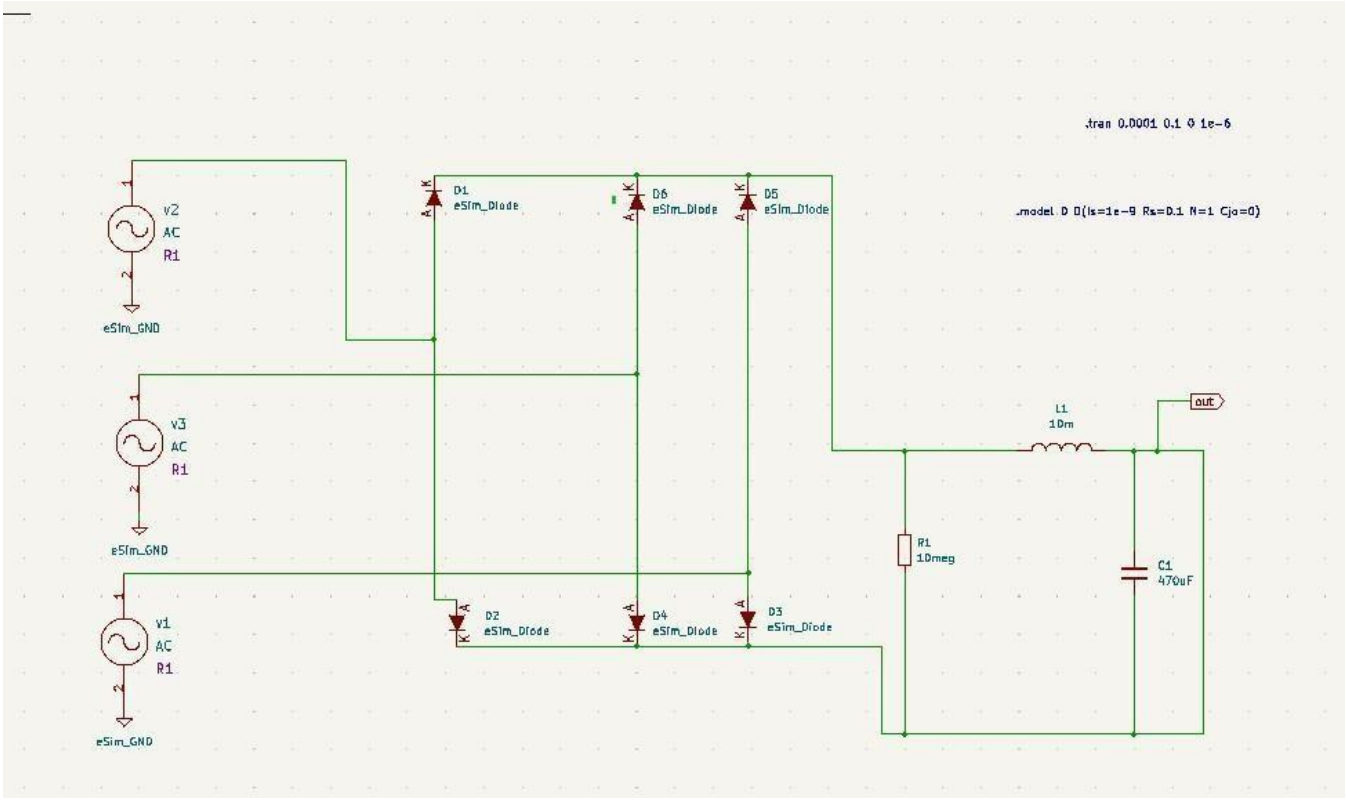
Title of the circuit : Three-Phase Full-Wave Diode Bridge Rectifier with LC Filter Simulation

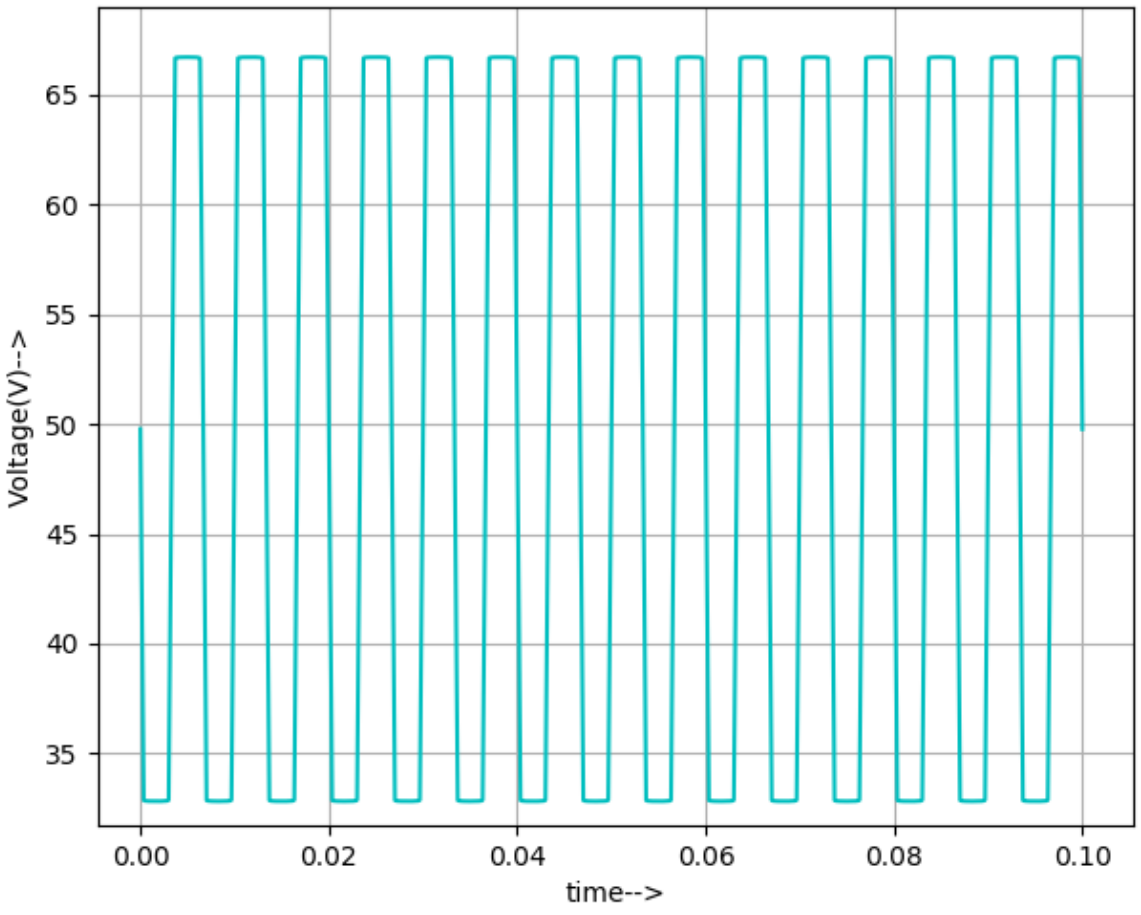
Theory/Description : A three-phase full-wave diode bridge rectifier, commonly known as a 6-pulse rectifier, converts three-phase AC power into DC. The circuit consists of six diodes (D1–D6) arranged in a bridge — three in the upper group (D1, D6, D4) whose cathodes connect to the positive DC rail, and three in the lower group (D3, D2, D5) whose anodes connect to the negative DC rail (ground). Each AC phase is connected to one upper diode anode and one lower diode cathode. At any instant, the pair of diodes associated with the highest instantaneous line-to-line voltage conducts, producing six voltage pulses per AC cycle. The ripple frequency is 300 Hz (6 times the 50 Hz supply frequency). An LC output filter (L = 10 mH, C = 470 µF) smooths the pulsating DC output. A 100 Ω resistive load is connected at the output. The three AC voltage sources (325 V peak, 50 Hz) are phase-shifted by 120° each. Theoretical average DC output voltage: Vdc = 1.35 × VL-L ≈ 1.35 × 230 ≈ 310 V.

Reason to reproduce with eSim : eSim is a free and open-source EDA tool developed by FOSSEE, IIT Bombay, supporting ngspice-based SPICE simulation. Reproducing this threephase rectifier in eSim demonstrates its capability to simulate standard power electronics circuits without the need for proprietary tools. It provides strong educational value for students learning AC-to-DC power conversion, enables verification of theoretical results such as average DC output voltage and ripple frequency, and contributes to the growing open-source simulation library for power electronics circuits.

Expected Outcome/outputs : When simulated, the circuit produces a rectified DC output voltage of approximately 310 V average with a 300 Hz ripple (6-pulse rectification). The LC filter (L = 10 mH, C = 470 µF) reduces the output ripple significantly. The output waveform V(out) is always positive, varying between approximately 162 V (trough) and 324 V (peak). The six diodes conduct in sequence: D1-D2, D1-D6, D3-D6, D3-D4, D5-D4, D5-D2, each conducting for 120° per cycle. The simulation results validate the 6-pulse rectification principle and the effectiveness of the LC filter in smoothing the DC output. **Circuit Diagram(s)** :-



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



Input: Three sinusoidal AC voltages at 325 V peak (230 V RMS), 50 Hz, mutually phaseshifted by 120° (0°, 120°, 240°).

Output V(out): Rectified 6-pulse DC waveform with peak ≈ 68 V, ripple frequency = 50 Hz, average DC ≈ 50 V. The output is always positive confirming correct full-wave rectification by the diode bridge.

Research Paper:-

Title : Three Phase Passive Bridge Rectifier with Low Distortion Input Current and Boosted DC Output Voltage

Author : (IEEE Conference Publication — IEEE Xplore

Page No. : IEEE Xplore Document 4651672

Link https://ieeexplore.ieee.org/document/4651672/
