

Research Migration Project

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Three-Phase 12-Pulse Controlled Rectifier

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1. Abstract

A three-phase 12-pulse controlled rectifier is used to convert AC power into a controlled DC output with reduced ripple and improved power quality. It consists of two 6-pulse thyristor bridges supplied through a phase-shifting transformer. This work presents the simulation of the rectifier using eSim and analysis of the input and output waveforms.

2. Working Principle

A 12-pulse rectifier is formed by connecting two three-phase 6-pulse thyristor bridges. These bridges are supplied from a transformer that provides two sets of three-phase voltages with a 30° phase shift.

Because of this phase shift:

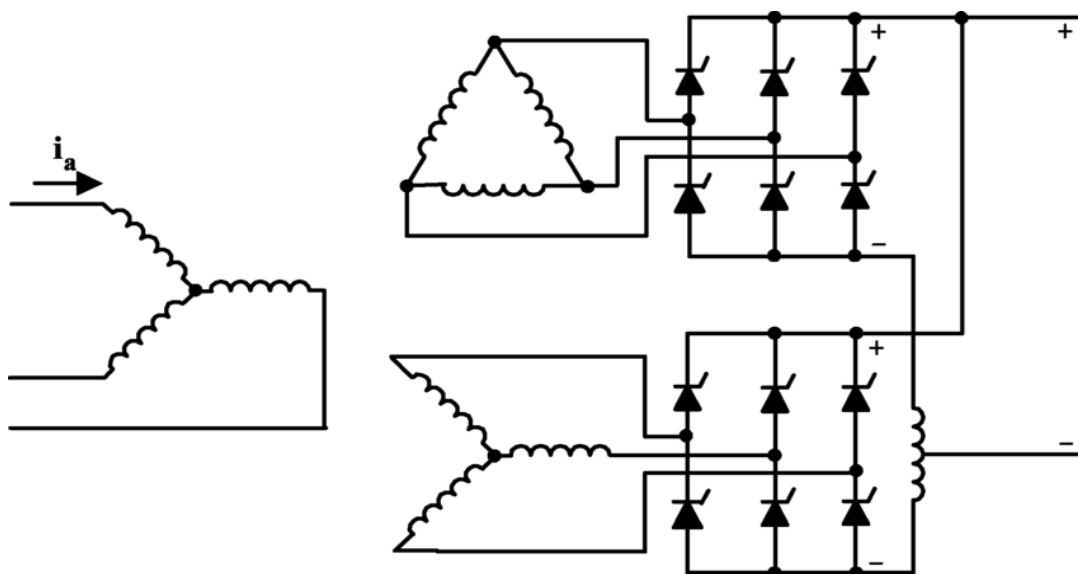
Ripple in the DC output is reduced.

Harmonic distortion decreases.

Output voltage becomes smoother.

The DC output voltage depends on the firing angle of the thyristors. By changing the firing angle, the output voltage can be controlled.

3. Circuit Description



The circuit consists of:

- Three-phase AC supply (50 Hz)
- Phase-shifting transformer (30° shift)
- Two 6-pulse thyristor bridges
- DC load

Both bridges operate together and produce a 12-pulse DC output.

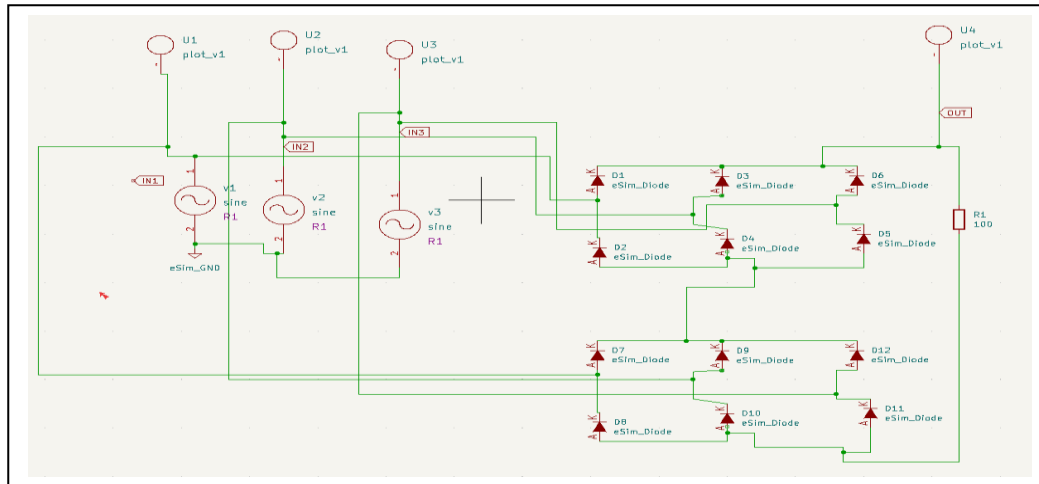


Figure 1: Schematic diagram of 12-pulse rectifier

4. Simulation and Results

The circuit was simulated using eSim to observe the rectification process and output characteristics.

Input:

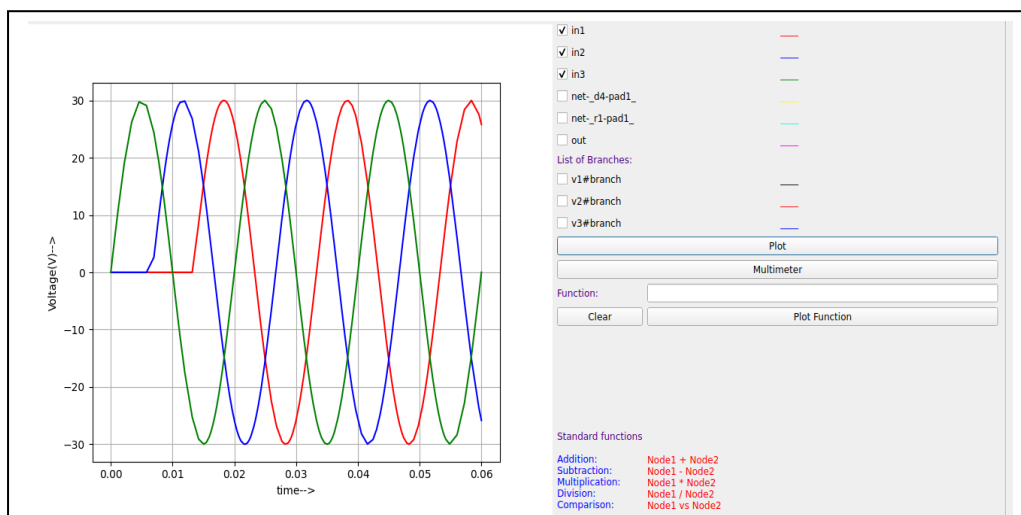


Figure 2: Input waveform

Output:

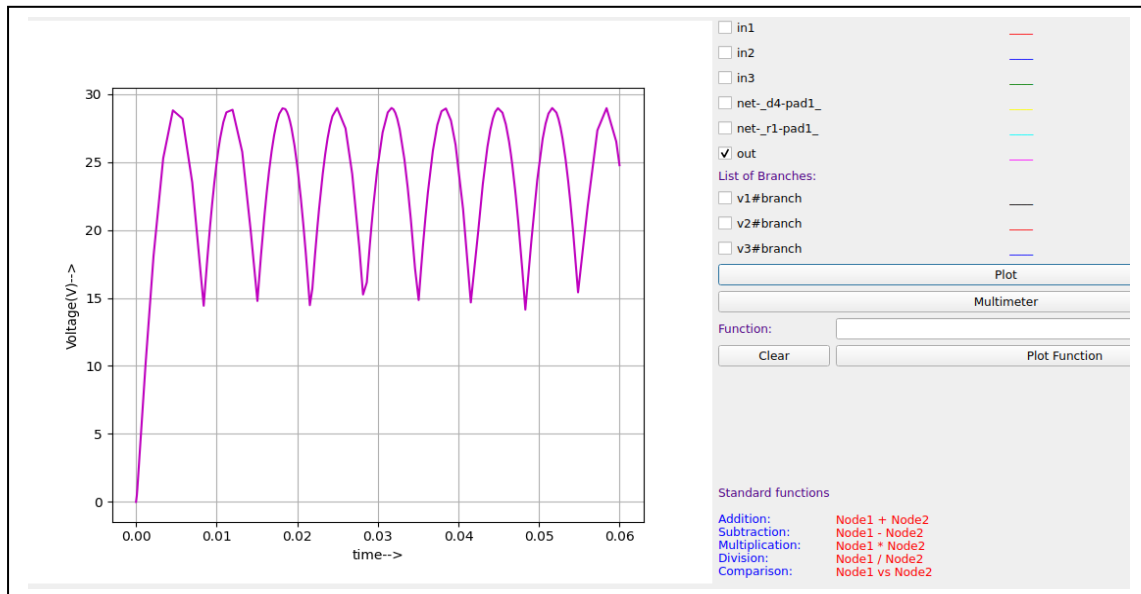


Figure 3: Output waveform

5. Conclusion

The three-phase 12-pulse controlled rectifier was successfully simulated using eSim. The output waveform showed reduced ripple and improved DC quality. The simulation helped in understanding the operation of the rectifier and the effect of firing angle on output voltage.

References

1. M. D. Singh and K. B. Khanchandani, *Power Electronics*.
2. D. J. Perreault and J. G. Kassakian,
“Effects of Firing Angle Imbalance on 12-pulse Rectifiers with Interphase Transformers.”

