

THREE PHASE INVERTER

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Abstract

An inverter is a circuit that is used to convert DC voltage(input) to AC voltage(output). Here nine phase inverter is designed in 130nm technology using skywater -pdk, to drive nine-phase load as well as achieve step-up voltage along with nine steps. In this, I used three CMOS inverters to build a three-phase inverter which is made as a subcircuit to develop as a nine-phase inverter, each CMOS inverter consists of NMOS and PMOS switches. each switch is triggered accordingly at a delay time to avoid a short circuit between switches. I used only R loads, As a result, I achieved the desired output of inverted AC as well as step-up voltage along with a nine-step quasi-square waveform.

1 Circuit Details

The schematic diagram considered here is a nine-phase voltage source inverter where a DC supply is converted to a nine-phase AC supply. There are three, three-phase inverter subcircuits in the circuit shown in figure.1. Each subcircuit consists of six electronic switches as shown in the subcircuit figure .2, Switches in the same limb should not conduct simultaneously as it leads to a short circuit of the supply. The excitation sequence is S1, S6, S3, S2, S5, and S4. Each switch conducts for 180 degrees and delays by a phase angle of 60 degrees as mentioned in the previous sequence. The output from this inverter is fed to a 3-phase balanced load. The output voltage is 120 degrees out of phase. As a three subcircuit works combinedly to get the nine-phase voltage. The simulated circuit doesn't use any anti-parallel freewheeling diode connected across each electronic switch. In this case, the output drove only for R load, if we use L & C load then we should use an anti-parallel freewheeling diode to protect switches from discharging current. The combined Waveform of loads A, B, and C are shown in the figure. waveform.1. The other three waveforms show quasi-square waveforms between each combined load of A and B, similarly, B and C, C and A, as shown in the figure. Waveform.2, Waveform.3, Waveform.4. The input Dc voltage is 25v given to the inverter and the output drawn from the inverter is 40v Ac Here the schematic diagram is drawn using esim and simulated by Ngspice.

2 Implemented Circuit

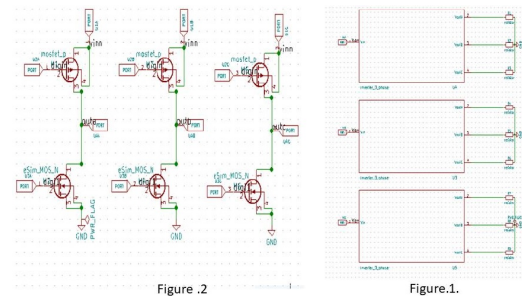


Figure 1: Implemented circuit diagram.

3 Implemented Waveforms

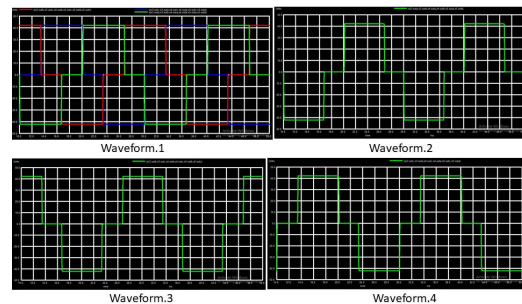


Figure 2: Implemented waveform.

References

- [1] K. P. Dr.P.S.Bimbhra. Three phase inverter. POWER ELECTRONICS.
- [2] M. I. M. I. Dr Tawfikur Rahman, Sma Motakaber. Design of a switching mode three phase inverter. https://www.researchgate.net/publication/312185467_Design_of_a_S