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Five Level Electrical Converter Victimisation POD PWM Techniques

Dr. K.Vinay Kumar

Asst.prof , Dept of EEE, SVS Institute of Technology, Hanamkonda, T.S, INDIA.

D.Kumara Swamy

Assoc. Prof, H.O.D, Dept of EEE, SV**S** Institute of Technology, Hanamkonda, T.S, INDIA.

Ch.Suresh , E.Arun Kumar , B.Pavan Kumar , Y.Raj Kumar

B.Tech scholars, Dept of EEE, SVS Institute of Technology, Hanamkonda, T.S, INDIA.

Abstract

This paper explains the implementation of single part five level electrical converter with Dc link Switches based mostly on POD technique .The planned multilevel electrical converter is capable of generating five level output with less element count .This technique uses single carrier wave and 2 sin waves for pulse generation .The entire system is designed and enforced victimisation MATLAB/Simulink .The electrical converter is connected to a R-Ioad and performance are analyzed .Hardware is enforced victimisation PIC16F877A small controller.

Keywords: POD , EMI, THD, DC,AC,SDCS.

Introduction

Now a day's Multi level electrical converter ar extensively used because of their multiplied power rating, reduced EMI , rising harmonic performance. Multi level inverters ar switched at low switch frequency once compared to 2 level inverters, thus the switch losses ar nearly negligible .The multi level device topology has drawn tremendous interest in the power trade since it will give the high power needed for high power applications .. To cope up with the issues associated with the two-level electrical converter, multi-level inverters (MUs) ar introduced [1]. The electrical converter ought to meet the following needs.

• To come up with a pure curving output voltage.

• Electrical converter output current ought to have low total harmonic distortion (THD).

In case of a two-level electrical converter, the switch frequency ought to be high or the inductance of the output filter inductance want to be massive enough to satisfy the needed doctor's degree, thus multi-level electrical converters (MUs) ar introduced for grid connected inverter [3-5].

Multi level inverters are classified into three varieties

• Diode clamped multi level electrical converter.

• Cascaded H bridge multi level electrical converter.

• Flying capacitance kind multi level electrical converter

The applications of structure electrical converter ar reactive power compensation, variable speed drives etc[6-8]. The topological structure of Multi level inverters ought to be capable of withstanding high input voltage for high power applications. a brand new multi level electrical converter is planned that is capable of reducing issues round-faced by usage of standard multi level inverters.

Multilevel Inverters

Inverter:

An electrical converter is associate device that converts electrical energy (DC) to electricity (AC); the regenerate AC is at any needed voltage and frequency with the utilization of acceptable transformers, switching, and management circuits.

Static inverters don't have any moving elements and are utilized in a good vary of applications, from tiny switch power provides in computers, to giant electrical utility high-voltage electrical energy applications that transport bulk power. Inverters ar normally won't to provide AC power from DC sources like star panels or batteries.

The electrical electrical converter may be a high-voltage electronic generator. it's thus named as a result of early mechanical AC to DC converters were created to figure in reverse, and therefore were "inverted", to convert DC to AC.

The electrical converter performs the other perform of a rectifier

Cascaded H-Bridges electrical converter

A single-phase structure of associate m-level cascaded electrical converter is illustrated in Figure thirty one.1. every separate dc supply (SDCS) is connected to a single-phase full-bridge, or H-bridge, inverter. every electrical converter level will generate 3 totally different voltage outputs, +Vdc, 0, and –Vdc by connecting the dc supply to the ac output by totally different combos of the four switches, S1, S2, S3, and S4. to get +Vdc, switches S1 and S4 are turned on, whereas –Vdc is obtained by turning on switches S2 and S3. By turning on S1 and S2 or S3 and S4, the output voltage is zero. The ac outputs of every of the various full-bridge electrical converter levels are connected nonparallel specified the synthesized voltage wave shape is that the add of the electrical converter outputs. the amount of output part voltage levels m in an exceedingly cascade electrical converter is outlined by m = 2s+1, wherever s is that the variety of separate dc sources. associate example part voltage wave shape for associate 11-level cascaded H-bridge electrical converter with five SDCSs and five full bridges is shown in Figure thirty one.2. The part voltage van = va1 + va2 + va3 + va4 + va5.

For a stepped wave shape like the one pictured in Figure thirty one.2 with s steps, the Fourier remodel for this wave shape follows

$$V(\omega t) = \frac{4V_{dc}}{\pi}\sum_{n}\left[\cos(n\theta_1) + \cos(n\theta_2) + \ldots + \cos(n\theta_s)\right]\frac{\sin(n\omega t)}{n}, \quad \text{where } n = 1, 3, 5, 7, \ldots$$

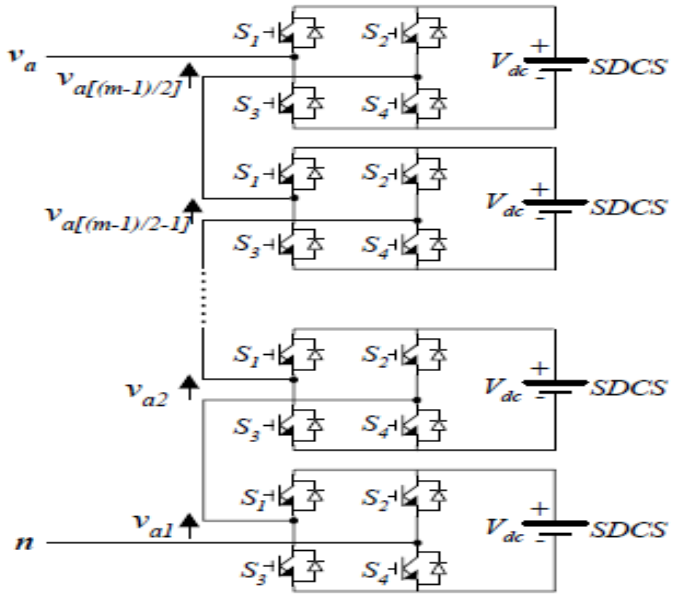

Fig : Single-phase structure of a structure cascaded H-bridges electrical converter

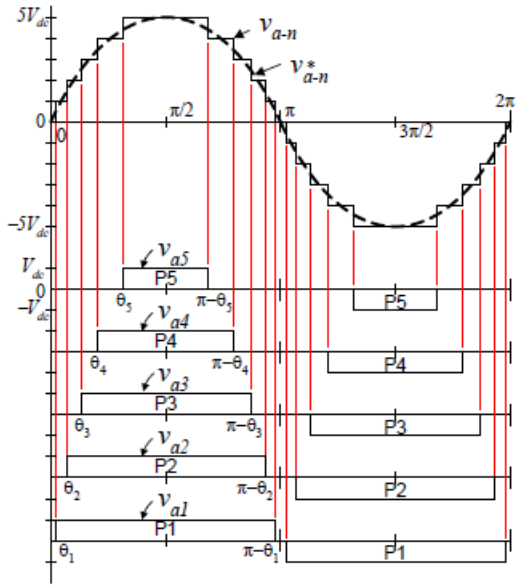

Fig : Output part voltage wave shape of associate 11-level cascade electrical converter with five separate dc sources.

Simulation Analysis And Results

Simulation of proposed multi level inverter is carried out in MATLAB/Simulink .ln Figure 4 Dc supply of 100 volts is given using batteries and 2 dc link capacitors are used and 8 MOSFET are used as switches and output of multi level Inverter is connected to L,C filter to eliminate harmonics. The technique used for pulse generation is POD technique .Generally in order to turn on 8 switches 8 carrier signals are needed but using proposed technique single carrier wave is used to generate switching pulses to 8 switches. Voltage measurement device is connected across each capacitor to measure the voltage across the capacitor.

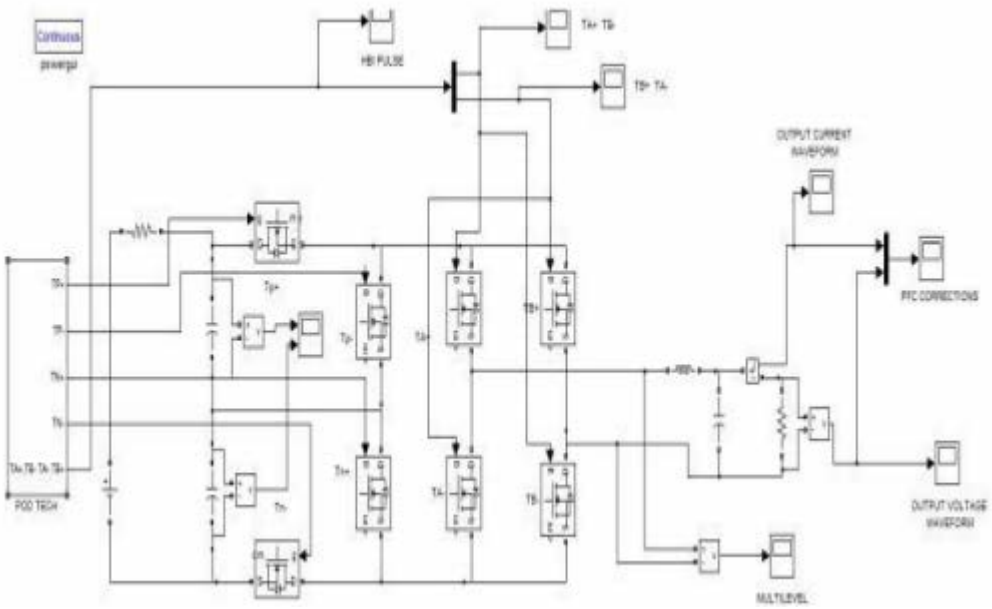

Fig: SIMULINK model of proposed five-level inverter

For the simulation of five-level inverter, single carrier wave and two sine waves are generated as shown in Fig.5.Reference voltage for first sine wave is set as l.7 volts and reference voltage for second sine wave is set as 0.8 volts. Both sine waves are operating at frequency50 Hz. Time period for one carrier wave is set as 800 ms. In Fig.3 DC supply of 100 volts is provided as input. Voltage is divided equally across two capacitors. Voltage across each capacitor is 50 volts . Voltage across each capacitor is measured using voltage measurement device .The output of Multilevel Inverter is connected to LC filter in order to eliminate harmonics and pure sine wave is obtained .Load Voltage are measured using voltage measurement device and Load current is measured using current measurement device. This type of MLI is mainly used for grid connected applications.

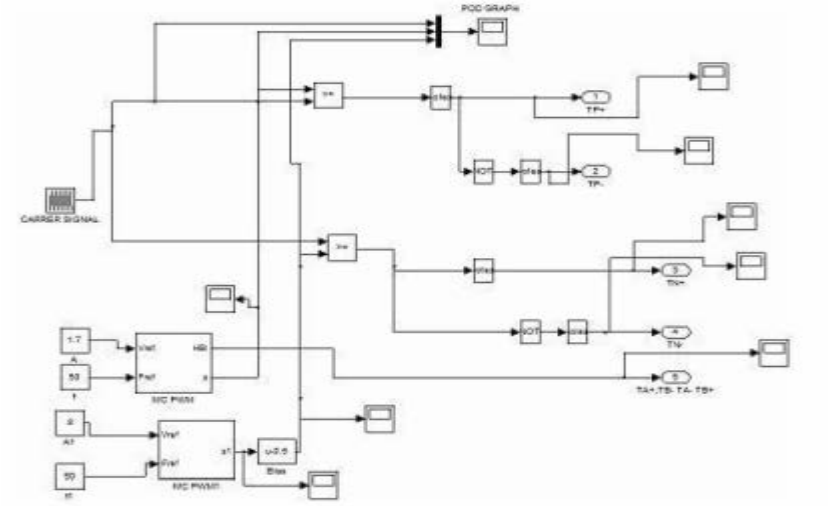

Fig. : SIMULINK model for switching pulse generation

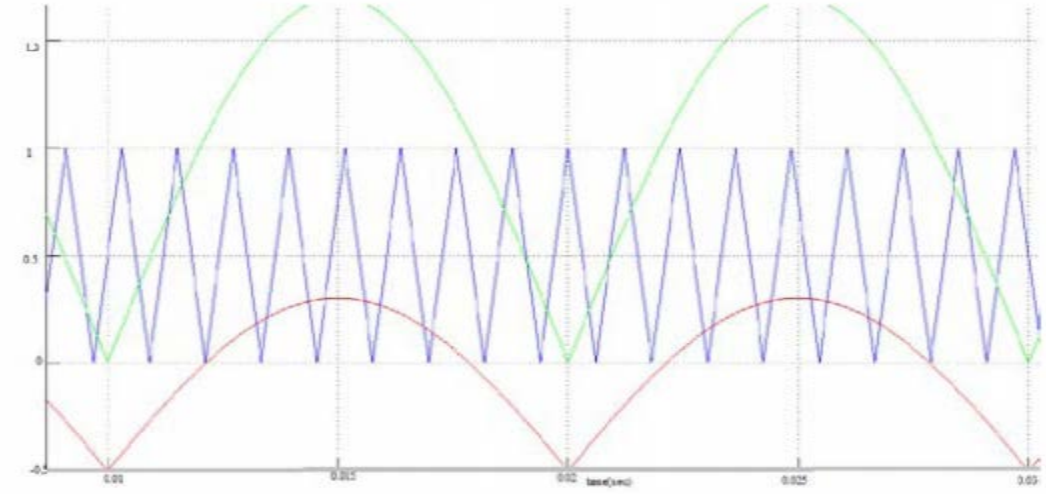

Fig. : Two sine reference waves and triangle carrier wave

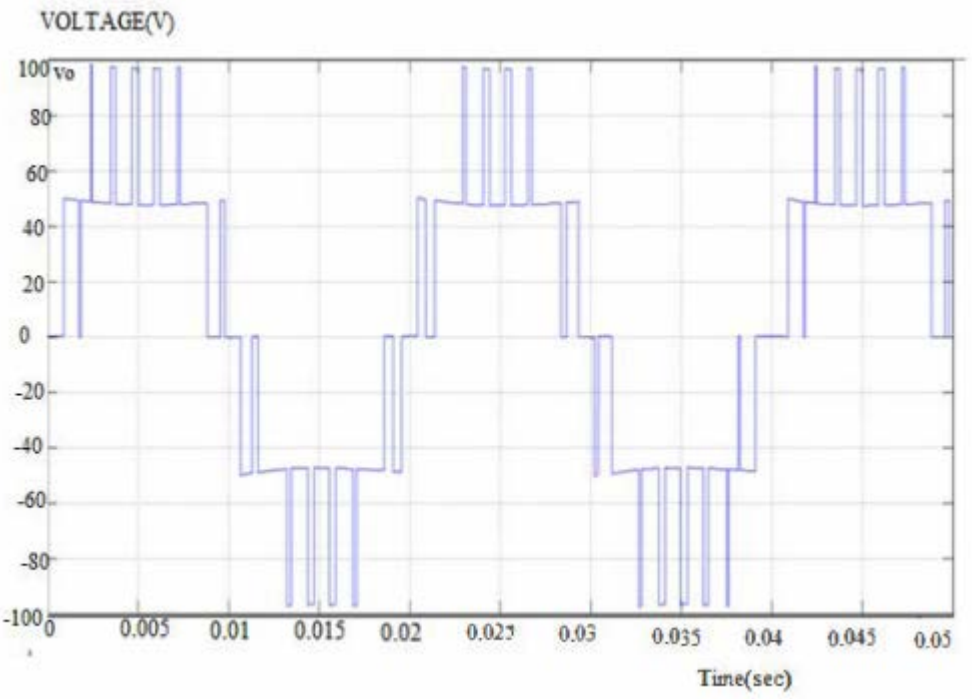

Fig.: Multi level inverter output voltage without LC filter

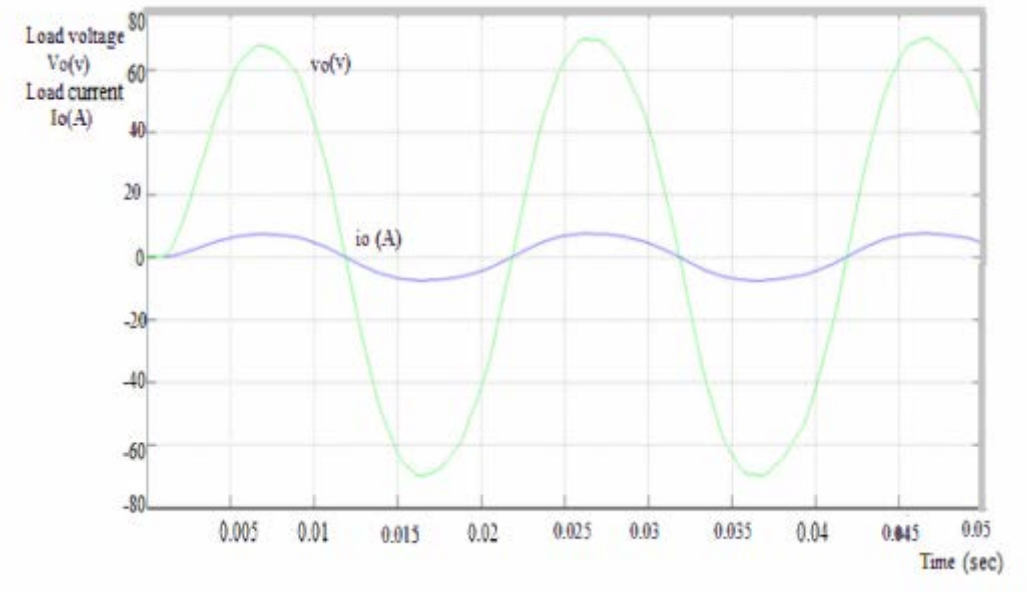

Fig. : Load voltage and load current (R-Load) with LC filter

Conclusion

A new Five level inverter topology using POD technique is designed and the same is implemented in MATLAB/Simulink which is capable of producing 5 level output with less component count .No of dc supply sources used in proposed multi level inverter are less when compared to conventional Cascaded H bridge multi level inverter. The proposed MLI has the following advantages over the conventional inverters:

• Proposed topology can be easily extended to 9-level or higher level with minimized active device component count

• Switches are turned on at low switching frequency (50Hz). Hence switching losses are almost negligible.

• Single H bridge is used to produce 5 level output

• No of DC link capacitors used to produce 5 level output is less when compared to conventional cascaded H-bridge multilevel inverter.

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