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RESEARCH ARTICLE

A SINGLE- PHASE DC–AC CONVERTER WITHOUT INPUT AND OUTPUT FILTER ALSO REDUCTION OF HARMONICS AND HYSTERESIS

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ABSTRACT

This paper shows the simulation design and implementation of a single-phase inverter which produce a symmetric ac output current of considerable magnitude and frequency,by the use of a sine-wave modulation & cancellation technique to get low total harmonic distortion (THD). The most of previous projects on harmonic compensation were depends on the current-controlled method, a novel harmonic control scheme using a voltage-controlled method is developed in this paper. We are fully vanished the LC filter so that ensure of the elimination of hysteresis and harmonics and less number of switching components are to be used.The voltage-controlled method is very adjustable and similar compensation revealed compared to the previous traditional current-controlled method. In additional, by avoiding the implementation of a harmonic current tracking, this paper executes proposed voltage-based method can be seamlessly incorporated into a voltage-controlled DG unit, which is used to give direct voltage and frequency support in all grids. A three-phase 5-kVA laboratory DG prototype simulation results and hardware implementation are provided to improve the value of this paper.

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INTRODUCTION

THE continuous development of renewable generation improved the need for efficient, costless, and robust converters that would contacting them to the grid, without any variations of the quality of supply for the tail end user. Most renewablesources gives a dc source of electric power, thus ensures proper interfacing to the grid requires at least one inverter. rarely, due to the low voltage resulted from sources such as domestic wind turbines, solar arrays or fuel cells, a boost converter or/and a transformer (if isolation is required) is attached at the dc or ac side, respectively, to counter balance of to boost the voltage to the appropriate level. The most common type of commercial inverters used for this kind of applications is a variation of sinusoidal PWM full-bridge inverter. The complex less design results robust operation and easy control, but the harmonic content of the output which has to be eliminated by a low-pass filter(LPF) to compile with the standards. Two disadvantages of this application are the increased size and cost due to the filter and the losses of the semiconducting switches performing the inverting operation at the inverter bridge (four) and the boost converter (one), usually, at a nano-caustic frequency.

Several PWM methods have been developed in order to reduce the harmonic content. Selective harmonic elimination solves the transcendental equations characterizing harmonics, so that approximate switching angles are computed harmonics, so that appropriate switching angles are computed for the elimination of specific harmonics at the output.Theoretically, these methods results applicable harmonic contents. Whatever, the results of these equations is computationally intensive, thus, little bit tough to be done in online. In small-scale applications, like powerful digital signal processor (DSPs) are not currently used due to their higher Cost, switching angles are calculated offline, or the equations are linearized before they are solved or an approximate solution is sought where the topology permits it .

Other methods includes modification of the carrier Signal or the reference sine wave. All of them, though, are open-loop control schemes, which assume a known and perfectly constant dc source (i.e., harmonics induced to the grid by an inductive source are ignored) and ignore the existing harmonic content of the grid voltage or the distortion caused by the load. In simple terms, they aim to reduce the harmonics created by the PWM itself, rather than improve the harmonic content at the terminal bus, which is affected by the PWM only partially.

A suggested method to solve the problem a sine-wave modulated buck–boost converter cascaded with a polarity changing inverter. Simulation results shows that this design works practically well, producing an ac sine-wave output, which based upon the reference sine-wave amplitude. It also achieves small total harmonic distortion (THD) at the output voltage, when supplied by an ideal constant dc source, making the use of a filter redundant. For more, switching losses are practically limited to the single semiconducting switch of the buck–boost converter. Additionally, there is no need for a big and expensive stabilizing electrolytic capacitor at the dc bus. Low inertia is required at the common bus of the two converters, so thin-film, low capacity, and long life capacitor is used, instead.

However, there are drawbacks for this designing procedure and the previously presented modulation methods, which are not mentioned. First, voltage is usually not zero when the inverter swaps output polarity. Low-order odd harmonics are created and THD is compromised. Second, when the dc source is inductive, e.g., a wind turbine generator, the output of the sine-wave modulated buck–boost converter is not an ideal rectified sine anymore. The waveform peaks are shifted to higher angles than 90◦; a distortion which is seems as a significant third harmonics in the Fourier analysis method.

This case, simple, but effective, improvement of the sine-wave modulation of the buck–boost converter, so that the output capacitor's remaining voltage is minimized when the inverter swaps output polarity. Additionally, a low-order harmonic elimination method, employed on the buck–boost modulation, is presented. The starting motivation of the method was to solute the output deviation due to the 'L' power source, but in practical it maximize the harmonic content of the output if the reason of the deviation of the wave form is due to the source, or the load, the synchronized grid, or a combination of the above mentioned elements. Similarly, to the methods showed in particulars, specific harmonics are inserted in order to improve the harmonic content of the output. However, these methods shares the advantages that the inserted harmonic amplitudes are pre-calculated, according to the nominal forecasted harmonic deviation created by the PWM itself. In this method, output harmonic magnitude is progressively noticed and limited. Computational power is charged mostly for the calculations of the angle and magnitude of output harmonics (a pre-requirement of online harmonic limitation control), rather than the creation of the cancellation harmonics. A prototype converter was employed with a single DSP controlling both the buck–boost converter and the inverter. Experimental Results showed the improvements attained for this very efficient power converter, without the additional of any new hardware. The proposed method is given in brief as following.

The features of the proposed method is,

This proposed method is to design a dc to ac converter attached to the grid so that the output voltage is constant.

To design a micro controller based system to interface the load and converter circuits.

To simulate the whole setup with VCM using MATLAB.

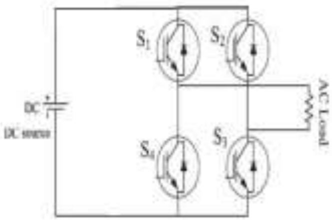
A DC to AC converter is designed using CCM.

Hysteresis reduction has not been analyzed in No specific optimization has been used in the existing work.

PROPOSED METHODOLOGY

An experimentation based on rule based pulse generation is used rather than tuning the LC FILTER.

A system with micro controller is used rather than achieving this control for the better stable power with less harmonic, to maintain the grid voltage somewhat constant.



TOPOLOGY USED

Fig. 1. Converter topology

BLOCK DIAGRAM

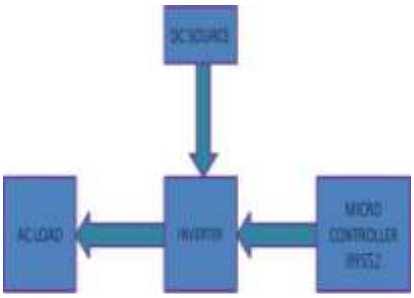


Fig. 2.Blockdiagram

WITHOUT FILTERING

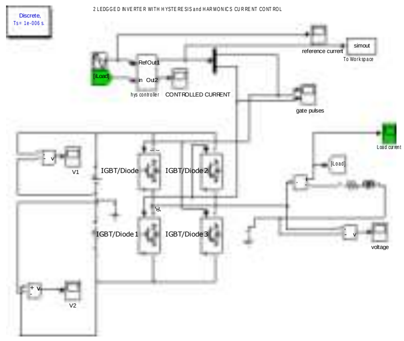


Fig. 3.simulation without filter

LOAD CURRENT WITHOUT FILTER

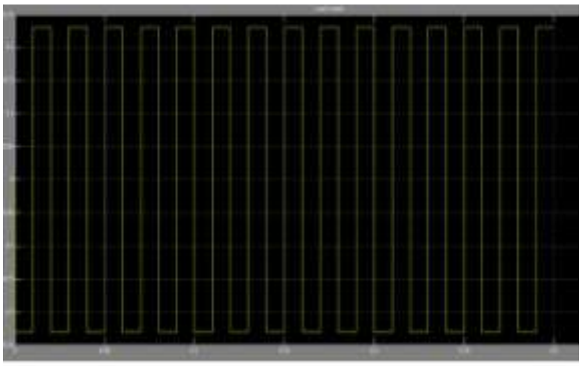


Fig. 4.waveform for without filter

The load current is exactly a square wave, that shows the wave contains infinite harmonics. The harmonics practically calculated is about 48.33%. The simulation models for both with and without harmonics are given in two different models.

THD OF 48.33%

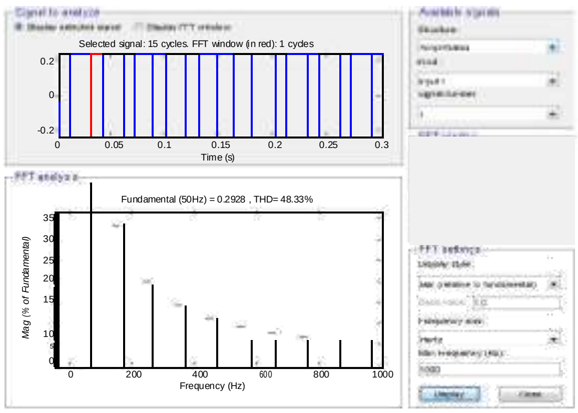


Fig. 5.value for THD without filter

SIMULATION

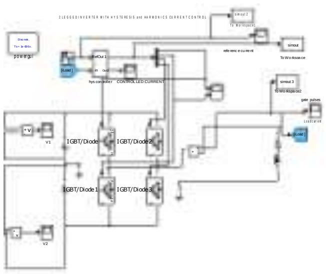


Fig. 6.simmulation of with filter

The diagram shown below is the simulation result of load current where the harmonics are dramatically reduced to 0.53%.

LOAD CURRENT WITH LESS HYSTERESIS AND HERMONICS

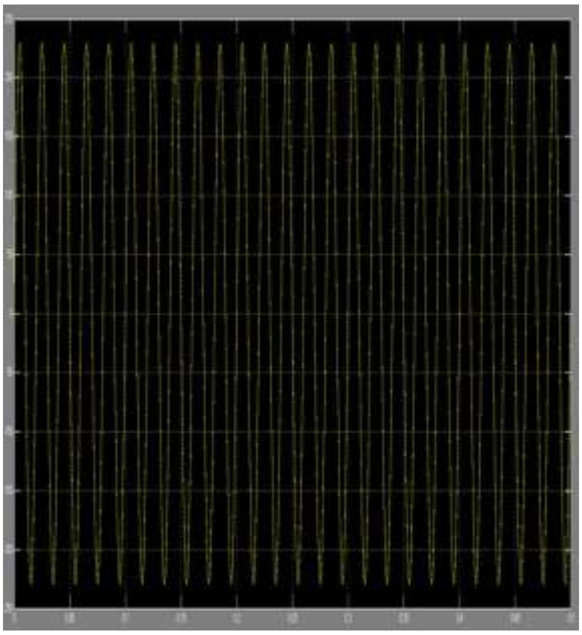


Fig. 7.waveform of with filter

THD OF 0.53%

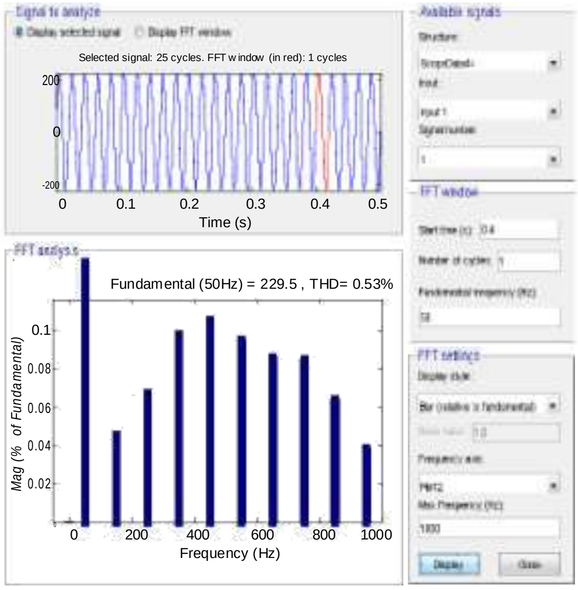


Fig. 8.value for THD with filter

PRACTICALLY IMPLEMENTED CIRCUIT DIAGRAM

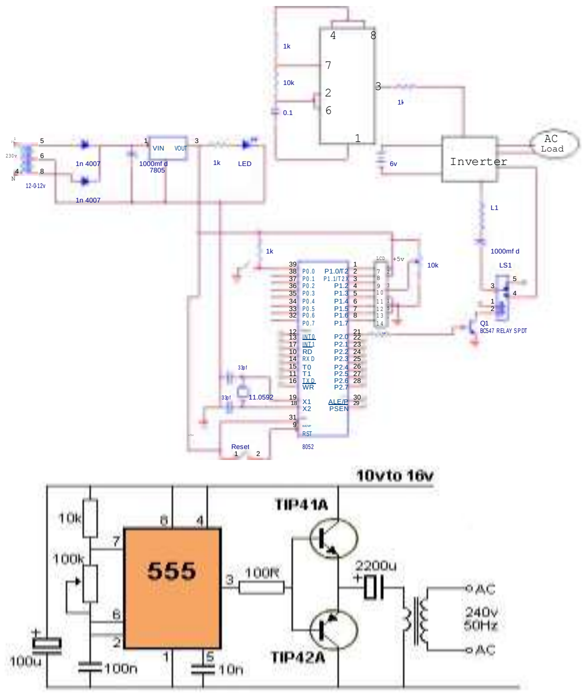


Fig. 7.Experimental circuit diagram

HARDWARE

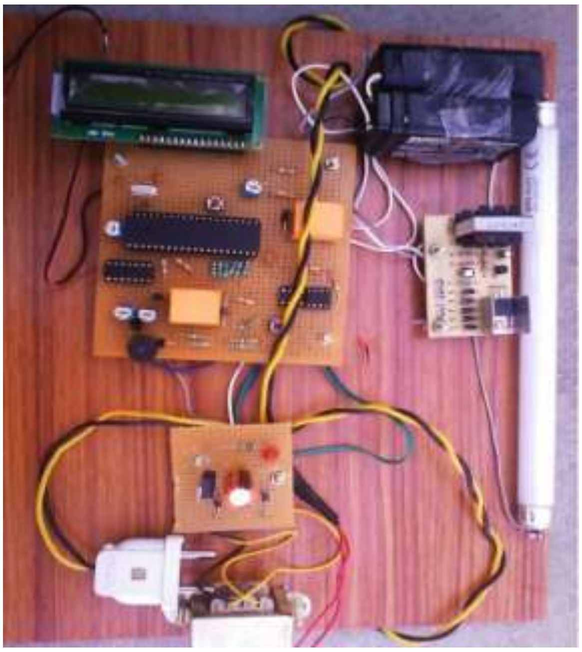


Fig. 9.Hardware setup.

APPLICATIONS

For all solar based power generations. MPPT control designs for other form of energy saving systems like hydro electric power and wind power generation systems.

RESULT AND CONCLUSION

In this proposed work, we made a data survey and obtained the completed the simulation part and proved the harmonics are less with less number of elements, without input and output LC filter gives pure sine wave. The following are the advantages in this proposed work.

Since the practical performance is optimized, VCM algorithm will be effective So that the power at the load will be available without fluctuations, distortions and deviations fairly.

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