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A Review of Analysis of Boost Converter Based Multilevel Inverter

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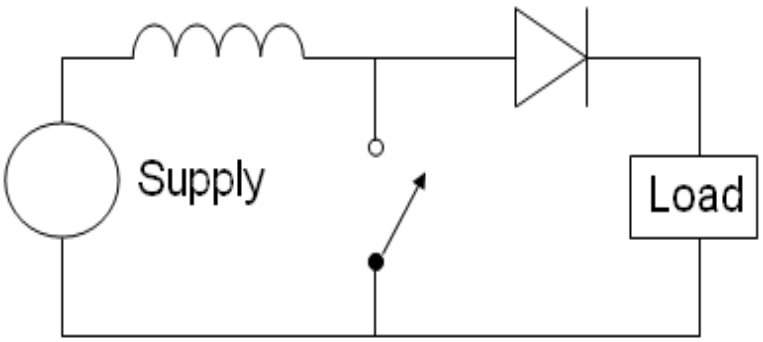
Abstract —**The review of multilevel inverter utilization has been increased since the last decade. These new type of inverters are suitable in various high voltage and high power applications due to their ability to synthesize waveforms. In the proposed methodology the design tool provides simultaneously the controller tuning and BBC design parameters in such a way that some closed loop pre-specified static and dynamic behavior is obtained. An optimization procedure is used to obtain the electronic components of the BBC and the tuning parameters of the controller, minimizing an objective function that considers the set of performance specifications. Although the methodology can be applied to any converter and any control strategy, in this particular case an ideal BBC and a Sliding Model Control (SMC) strategy are used. Some simulation results show the advantages and principally the flexibility that can be obtained with this approach.**

Keywords-Multi level inverter, MPPT, process optimization, sliding mode control, boost converter etc.

I. INTRODUCTION

Multilevel power conversion has become increasingly popular in recent years due to advantages of high power quality waveforms, low electromagnetic compatibility (EMC) concerns, low switching losses, and high-voltage capability. However, it increases the number of switching devices and other components, which results in an increase of complexity problems and system cost. For a medium voltage grid, it is troublesome to connect only one power semiconductor switch directly. As a result, a multilevel power converter structure has been introduced as an alternative in high power and medium voltage situations. A multilevel converter not only achieves high power ratings, but also enables the use of renewable energy sources. Renewable energy sources such as photovoltaic, wind, and fuel cells can be easily interfaced to a multilevel converter system for a high power application. A boost converter (step-up converter) is a DC-to-DC power converter that steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) containing at least two semiconductors (a diode and a transistor) and at least one energy storage element: a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter).



"Figure1. Boost converter"

There are different types of multilevel circuits involved. The first topology introduced was the series H-bridge design. This was followed by the diode clamped converter, which utilized a bank of series capacitors. A later invention detailed the flying capacitor design in which the capacitors were floating rather than series-connected. Another multilevel design involves parallel connection of inverter phases through inter-phase reactors. In this design, the semiconductors block the entire dc voltage, but share the load current.

The key issue in designing an effective multilevel inverter is to ensure that the total harmonic distortion (THD) of the output voltage waveform is within acceptable limits. Basically, there are four types of control methods for multilevel converters. They are the fundamental frequency switching method, space vector control method, traditional PWM control method and space vector PWM method .The fundamental frequency switching and space vector control methods have the benefit of low switching frequency, although they have high low-order harmonics at low modulation indices as compared to the other two control methods. Generally, the traditional PWM method is widely used for harmonic elimination. But PWM techniques are not able to eliminate low-order harmonics completely. Another approach is to choose switching angles so that specific lower order dominant harmonics are suppressed.

II. LITERATURE REVIEW

The many researchers have been done significant work in the field of boost converter based multilevel inverter Technique problem some of the work is described in this paper.

Rout, S. Samantara, G. K. Dash, S. Choudhury, R Sharma, B. Dash, this paper presents Modelling and simulation of MPPT based stand alone system with 25 level Multilevel with and without boost converter ,this paper gives comparative study of 25 level multilevel inverter with and without boost converter, that is

1.when MPPT based standalone PV system 25 level multilevel inverter uses with boost converter its THD(Total Harmonic Distortion) is12.14% but on without boost converter THD is 3.21%.

2. when MPPT based standalone PV system 25 level multilevel inverter uses with boost converter rating of PV system decreses but without boost converter rating of PV system is higher.

In this paper MLI uses 4 dc source and 12switches which is very less compare to other MLI**[1].**

B. Anjanee Kumar, in this paper design of multilevel inverter configuration with boost converter in a photovoltaic system, the proposed a single phase multilevel inverter arrangement that conjoins three arrangement associated full extension inverter and a single half bridge inverter for renewable vitality particularly photovoltaic framework. It is arrangement of the multilevel inverter decreases the estimation of aggregate symphonious bending. The half extension inverter used in the proposed arrangement builds the yield voltage level to almost double the yield voltage level of a customary fell H-connect multilevel inverter. The utilizing MATLAB/Simulink based reproduction with different illumination and temperature conditions. The transient operation of the framework is checked with results portrayed utilizing step change in standard test condition. add up to symphonious mutilation of the yield voltage is 9.85% without utilizing aloof channels and 3.91% with channel inductance. Hypothetical estimation of the power misfortunes and aggregate consonant twisting with scientific conditions are talked about. The proposed multilevel inverter has lesser % THD and power misfortunes when contrasted with the customary CHBMLI. Hypothetical figuring of % THD and estimation of control misfortunes are talked about with numerical conditions. All together to confirm the reenactment aftereffect of the whole framework, the research facility based exploratory setup was created and tried **[2].**

K. Dhineshkumar, in this paper proposed analysis of multilevel inverter with boost converter for single phase system, medium voltage engine drives and utility applications require medium voltage and megawatt power level. A diminished switch level converter accomplishes high power evaluations, as well as empowers the utilization of renewable vitality sources. Subsequent to the two included levels are acquired by the release of the two capacitors of the DC Link, the adjusting of the midpoint voltage is gotten with a particular PWM methodology. Boost converter used to venture up the Voltage level. The experimental results by giving an information voltage of 100V,and yield of fi ve level inverter as 200V,100V,0V,- 100V,- 200V and yield current of 2A,1A,0A,- 1A,- 2A is obtained. The total Harmonic distortion = 40.78%.when contrasted and 41.2% of the current method. The converter topology utilizes the midpoint voltage of the DC Link to give two more yield voltage levels, diminishing exchanging power misfortunes and EMI **[3].**

Hussam Ai-Atrash, The proposed MPPT algorithm based measurement noise on DSP. The probabilistic characteristics of noise signals, a statistical model is constructed that allows quantitative analysis of the behavior of method both during transients and in steady-state. This system is then used to classify tracking problems into those presented by noise signal, and others resulting from other nonidealities measurement bias. The results arrived at are then experimentally verified and confirm the predictions of the statistical model.Several anti-noise measures were analyzed and their effectiveness was evaluated. It provides insight to the cause of different tracking non-idealities and the effect of various anti-noise measures on the transient and steady-state performance of the system **[4].**

Khalid. H. Mohamed, this paper boost converter design with stable output voltage for wave energy conversion, presents the design and simulation of the boost converter for a Wave Energy Conversion System (WECS). The system consists of wave energy conversion device, boost converter and DC Load. They have design converter to ensure that the output voltage of WECS will be boosted up from a variable input voltage to a stable output voltage. The simulation models have been developed and tested in the MATLAB / SIMULINK. Simulation result has proven that, the proposed design is able to produce a constant output voltage from variable input voltage **[5].**

P.Muthukrishnan, in paper DC-DC boost converter for solar power application**,** try to prove that Conventional Boost Converter is not capable for obtain a high voltage gain even extreme duty cycle maintain the triggering circuit diagram. In order to increase the voltage gain for the new Boost converter from the solar power application. In their paper boost converter they achieved 10 times that of input voltage and more than 10 times of input voltages possible from output side by using coupled inductor and parallel capacitor. The proposed boost converter output voltage is obtained 600V from source input of 60V and output power is 900 watts. In this paper the high power rating from low

input voltage rating of the input source and also capable to go for AC power application whenever adding the inverter circuit to the main circuit diagram **[6].**

R. Dave, Their paper explains about the boost converter and control algorithm to reduce harmonics. For the improvement of the functionality of the boost converter there are many methods available among which they consider PI controller in voltage mode control path. Initially they discussed the basic function of the boost converter. Then they derived the transfer function of the complete system, after that they considered model and simulate into matlab without PI controller. Finally they used PI controller in which the values of and has been derived using the Ziegler-nichols method and loop shaping method. At last the output response of the both methods is compared and conclusion made upon that comparison. Boost converter used with PI controller applying loop shaping method removes steady state error faster and also removes oscillation **[7].**

"Table 1. Comparative Method"

S.No.	Author	Titel	Method
1	**Rout, S. Samantara , G. K. Dash, S. Choudhury, R Sharma, B. Dash**	Modeling and Simulation of Hybrid MPPT Based Standalone PV System with Upgraded Multilevel Inverter.	This paper presenting PV system with Boost converter using 25 level inverter. Its THD(Total Harmonic Distortion) is12.14% but on without boost converter THD is 3.21%.Rating of system also decreases when multilevel inverter uses with boost converter.
2	**B. Anjanee Kumar**	Design of Multilevel Inverter Configuration with Boost Converter in a Photovoltaic System.	In this paper single stage pv based multilevel inverter. Total harmonic distortion 18.57% without filter and with filter THD 3.91%.
3	**K. Dhineshkumar**	Analysis of Multilevel Inverter with Boost Converter for Single Phase System.	This paper presenting five multilevel inverter and total harmonic distortion 40.78%.
4	**Hussam Ai-Atrash**	MPPT algorithm based measurement noise on DSP.	Proposed MPPT algorithm based measurement noise on DSP. The probabilistic characteristics of noise signals, a statistical model is constructed that allows quantitative analysis of the behavior of method both during transients and in steady-state.
5	**Khalid. H. Mohamed**	Design and simulation of the boost converter for a Wave Energy Conversion System (WECS).	This paper present boost converter design with stable output voltage for wave energy conversion, the result of simulation proposed design is able to produce a constant output voltage from variable input voltage.
6	**P.Muthukrishnan**	DC-DC boost converter for solar power application.	The boost converter used in this paper result in high voltage gain than conventional boost converter. In their paper boost converter they achieved 10 times that of input voltage and more than 10 times of input voltages possible from output side by using coupled inductor and parallel capacitor. The proposed boost converter output voltage is obtained 600V from source input of 60V and output power is 900 watts.
7	**R. Dave**	Boost converter and control algorithm to reduce harmonics	This paper presents comparative study of boost converter with PI controller methods Ziegler-nichols method and loop shaping method. On applying loop shaping method removes steady state error faster and also removes oscillation

III. CONCLUSION

The DC/DC boost converter only needs four external components: Inductor, Electronic switch, Diode and output capacitor. The converter can therefore operate in the two different modes depending on its energy storage capacity and the relative length of the switching period. In above paper we have seen that Total Harmonic Distortion can be reduced by increasing level of Multilevel Inverter. This is required in solar panel input voltage vary up and down from set output voltage of system.

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