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An Multi-Input ZCS DC-DC Front-End- Converter Based Multilevel Inverter for the Integration of Renewable Energy Sources

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ABSTRACT

This paper dealt with current fed front end current switched DC chopper interfaced with multilevel inverter posses multiple inputs. The converter holds two switches only to accept two inputs. Then the switching stress becomes low and simple in structure. Reduced number of active and passive components makes the circuit becomes convenient for high power applications, intensive to prevent the entire circuit from losses. The ZCS turn-off is enabled through proposed Artificial Neural Networks (ANN).In the proposed work, Function Fitting Neural Network technique is considered. The proposed structure is simulated using MATLAB. The simulation result shows that the proposed inter combined network avoids switching losses.

KEYWORDS:*Boost converter, Multilevel Inverter, Artificial Neural Network.*

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I. INTRODUCTION

In accordance with eco system balancing and reduction in capital cost, enhancement of power production through renewable resource brings more attention. However a lot of renewable power production available, but the combination of two or more renewable resource become huge popular; it extend production to a wide range and avoids interruption in power supply.This system can adopt less number of semiconducting devices. Such action avoids higher losses accompanied by switches. The proposed system could interface solar and wind energy to functioning themselves as stand-alone system. Normally shades and severe climatic changes across panel affect high voltage gain. This could be avoided through maximum power point tracker.The amount of power generated from solar panel significantly depends on temperature and irradiation where irradiation levels have a dramatic effect on the maximum power of the solar panel. Wind occurs through revolution of earth which is converted into electricity by wind blades (i.e.) kinetic energy into mechanical; mechanical to electrical energy.

II. OBJECTIVE

A. To reduce the number of conversionstages.

B. Minimizing the switchinglosses.

C. Overall efficiency is said to high.

III. BLOCKDIAGRAM

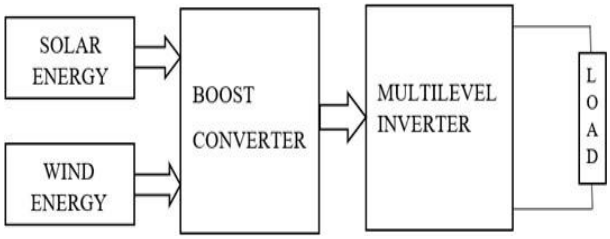

Fig. 1 Multiple renewable resource with inter combined stand alone system

IV. DESCRIPTION

The PV array transfers light energy from the sun into electrical energy. To perform power manipulation Maximum power point tracking (MPPT) algorithm plays a major role in it. The specified incremental conductance MPPT brings more power from PV. The output voltage is boosted up by DC chopper and fed to inverter as input.Artificial neural network controls the boost converter and multilevel inverter and improves its performance. The multilevel inverter feeds AC load efficiently.The objective ofANNcontrollerisrapid detection of the disturbance signal with high accuracy and performance. The conventional one did not perform well under parameter variation, load disturbance, nonlinearity. Under various operating conditions ANN provide fast dynamic response and more stable.

V. ANN TRAINING DATASET

MATLAB workspace stores collected data. This prevails offline training of controller. Thus performing function through tansigmoid input layer, hidden layer and pure linear for output layer. The training algorithm was Levenberg Marquardt back propagation.

ANN is trained by using the input variable as error voltage and output variable as duty cycle. The training data set are as follows:

Input = Error
voltage Target=Duty cycle

Table1 Training data set for DC-DC converter

INPUT	TARGET
-100	0
-80	0.1
-60	0.2
-40	0.3
-20	0.4
0	0.5
20	0.6
40	0.7
60	0.8
80	0.9
100	1

Table2 Training data set for multilevel inverter

INPUT	TARGET
1	1
0.5	2
0	3
-0.5	4
-1	5

Thetable1and2showsthetrainingdataset of DC-DC converter and multilevel inverter in which the input variable is voltage and output variable is duty cycle. These datas are trained in ANN to provide fast dynamic response while maintaining stability over wide operating range.

VI. BOOSTCONVERTER

The proposed boost converter is used to stepup the output from the PV panel and wind energy system. The input and output of the boost converter is DC. This DC is given to the cascaded H-bridge multilevel inverter. A modified unipolar sinusoidal pulse width modulation (SPWM) technique is used and a feedback loop is designed to regulate the DC output voltage with ANN controller.

ON-STATE

During On-state, the inductor stores charge as much as possible when switch is closed.

OFF-STATE

During off-state, the multi level inverter gains voltage from inductor via fly back diode and capacitor. These action continues and voltage is maintained continuously at output port.

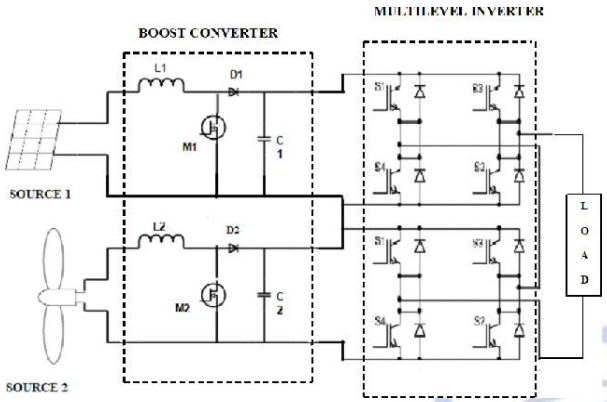

Fig. 2 Proposed Boost Converter and Multilevel Inverter

VII. MULTILEVELINVERTER

In each H-bridge individual DC voltage is given and differential voltage signs are +, 0, -. The MLI converts DC into an AC. The converted AC is given to the load. The switching sequences of multilevel invertershown

Table3 switching sequences for multilevel inverter

S/NO	SWITCHING SEQUENCES						VOLTAGE LEVELS
	S1	S2	S3	S4	S5	S6	
1	0	1	0	1	0	1	+2Vdc
2	0	0	1	1	1	0	+1Vdc
3	0	0	0	1	1	1	0 Vdc
4	1	1	0	0	0	1	-1Vdc
5	1	0	1	0	1	0	-2Vdc

7.1 COMMON MODE VOLTAGE

The multilevel inverter produces common mode voltage, decrease stress behind components. Multilevel inverter can Bring low distorted input voltage. The inverter performs well at low and switching frequency. It should be noted that there is low loss and high gain at output.

7.2 REDUCED HARMONIC DISTORTION

Thus selective harmonic elimination incorporated with multilevel inverter topology decrease harmonics enrolled with the input voltage by providing filter at the end port.

VIII. RESULTS AND DISCUSSION

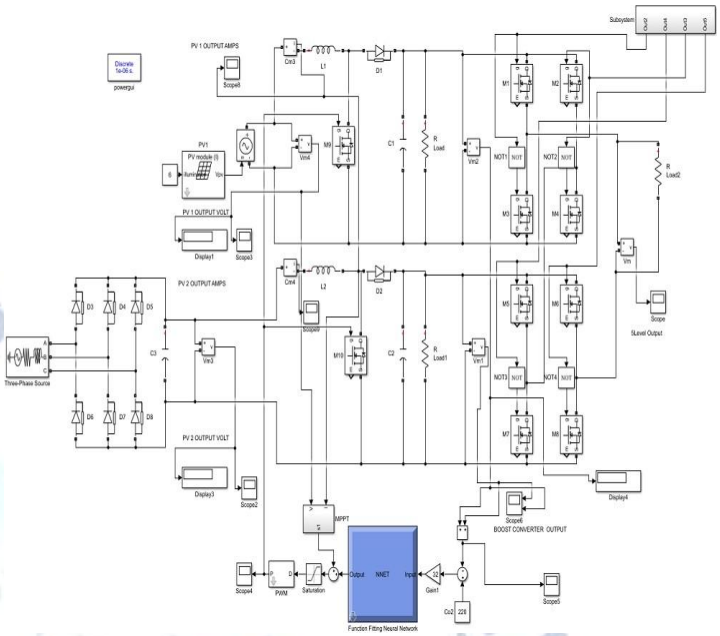

Fig.3 Matlab Simulink Circuits

The above circuit is designed with MATLAB laboratory. The PV panel out becomes 16 V and MPPT employing incremental conductance feature to track maximum power from PV array. The output voltage from the wind energy system is 25 V. The DC chopper increase the voltage from 16 V and 25 V to 227 V DC and functioning of controller is high and it has quick response capability due to the involvement of ANN. The output from DC - DC converter is fed to multilevel inverter. The multilevel inverter converts 227 V DC to an 227 V AC. The multilevel inverter feeds AC load efficiently.

8.1 Simulation Waveforms

BOOST CONVERTER

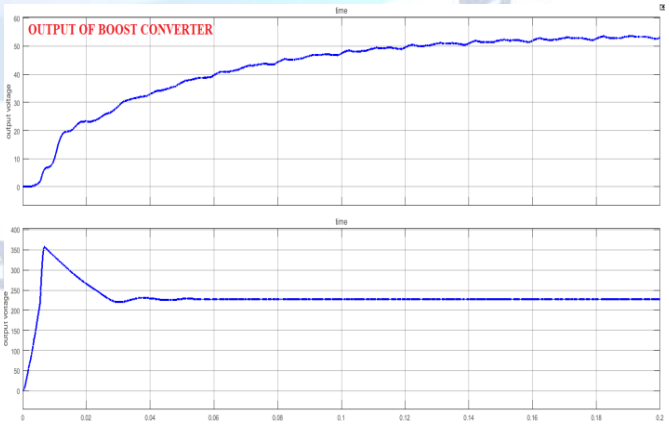

Fig. 4 Output of DC-DC converter

The figure 4 shows DC chopper's output value. Nearly 16 V from PV panel is tracked by MPPT. And the input voltage of 25 V from the wind energy

flown through DC-DC converter is boosted to 227 V. DC which feeds the multilevel inverter.

MULTILEVEL INVERTER:

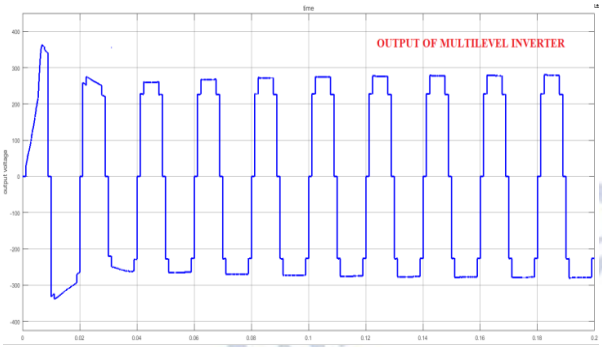

Fig. 4 Output of Multilevel inverter

A DC output voltage of 227 volt is stepped up in AC port. Then resultant voltage is to be 227 V AC. This 280 V AC is used to operate the load.

IX. CONCLUSION

The proposed converter interfaced with multilevel inverter is well suited for multiple inputs and it is experimentally verified through simulink results and discussion. The reduction in conversion not only improves the voltage; apart from this it reduce high switching stress. If variation in input voltage is noted, the converter would boost up the voltage without any implementation of high frequency transformer. The simulink output waveform visualizes five level AC output voltage attained from multilevel inverter. Further results examine the chopper operation under severe changes in input; also satisfies the differential load condition under differential load requirement. Moreover the above statement, the performance of the system is defined through how much it brings attention towards load; in this case if effectively operates.

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