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A NOVEL ZCS FRONT END DC-DC CONVERTER BASED MLI FOR SIMULTANEOUS POWER MANAGEMENT OF VARIOUS RENEWABLE ENERGY SOURCES

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Abstract: A new isolated current-fed zero-current switched (ZCS) front-end dc/dc converter based multilevel inverter is proposed for multi-input applications. The proposed front-end converter with only two controllable switches integrates two different renewable energy sources, resulting in an advantageous compact structure and low conduction losses. The ZCS turn-OFF is achieved in both the controllable switches with the proposed modulation scheme. The converter maintains ZCS turn-OFF under a wide load, as well as input voltage variations by employing frequency modulation along with a variable duty ratio technique. Simple structure, soft switching, high gain, and automatic load regulation make the converter structure novel for simultaneous power management in multi-input renewable energy applications. Converter operation and design guidelines have been outlined. A laboratory prototype of the proposed converter is developed and tested at 300-W power level. Simulations and experimental results demonstrate the robust performance of the converter under load, as well as input source voltage variations.

Keywords: DC/DC converter, multi-input converter (MIC), multilevel inverter, renewable energy (RE) source integration, zero current switching (ZCS)

I.INTRODUCTION

A voltage converter changes the voltage of an electrical power source and is usually combined with other components to create a power supply. The term "voltage converter" is sometimes used as a generic term for a power supply. A voltage converter or a power supply may be called a "transformer" even if it does not contain an actual transformer as the term is used in electronics. A common use of the term voltage converter is for a device that allows appliances made for the voltage of one geographical region to operate from the power outlets of another area.[1] Most single phase alternating current electrical outlets in the world supply power at 210 to 230 volts or at 100 to 125 volts. Converters usually can only double or halve the voltage, but some can do both.

Often these are sold with plug end adaptors that provide physical compatibility of normally-incompatible plugs and sockets. There are a number of methods for converting voltage. For Alternating current (AC) a transformer [2]can be used to decrease or increase the voltage. The common power supplies for small electronics usually have a transformer that drops the voltage down to relatively small voltage ranging from 4.5 to 12 volts, a full-wave rectifier to convert the AC to a pulsed Direct Current and some additional components to flatten the wave. Some devices have only a transformer in the external power supply with any rectifier or additional power conditioning provided inside the appliance.

A) DC to DC converter

DC to DC converters are essential in versatile electronic gadgets, for example, phones and PCs, are supplied with power from batteries fundamentally. Such electronic gadgets frequently contain a few sub-circuits, each with its very own voltage level necessity not quite the same as that supplied by the battery or an outside supply (once in a while higher or lower than the supply voltage, and perhaps even negative voltage). Furthermore, the battery voltage decreases as its put away power[7] is depleted. Changed DC to DC converters offer a strategy to expand voltage from an incompletely brought down battery voltage in this way sparing space as opposed to utilizing different batteries to achieve a similar thing. The idea of throbbing source cells is first presented in [24], in which throbbing current-source cells are incorporated into a similar scaffold before the seclusion arrange. Be that as it may, it prompts underutilization of the changes because of a three-level structure. A multi-winding dc/dc converter is introduced in [26] for double info applications. The primary advantages of this converter are a different controller for each information voltage source, probability of extension to n number of data sources, and the converter is operational notwithstanding for a solitary information. Be that as it may, by expanding the information sources, the quantity of transformer windings, part check. A further methods for DC to DC change in the kW to numerous MW extend is displayed by utilizing redox stream batteries, for example, the vanadium redox battery, in spite of the fact that this procedure has not been connected monetarily to date.

B) Step-down DC/DC converter input swell and commotion

This application note talks about the best possible strategies for estimating info and yield clamor of a high recurrence DC/DC converter. Without legitimate estimation strategies, the high recurrence clamor part can undoubtedly be overestimated. Whenever fundamental, straightforward techniques are accessible to diminish input clamor and the effect it might have on different gadgets. At the point when a step-down converter imparts a typical information voltage to different gadgets, the information commotion created by the step-down converter might be adequate to cause impedance with alternate gadgets. Straightforward channel techniques can be utilized to lessen the info clamor, and basic models can be created portray the circuit. Two circuit models&#mdash;one for the principal exchanging recurrence swell segment and one for the high recurrence noise&#mdash; streamline the examinations. By and large, a fired detour capacitor set near gadgets that share the normal info voltage is adequate. A ferrite dab set between the converter input and different gadgets fueled from a similar source constricts the converter input commotion.

C) CUK Converter

The buck, lift and buck-support converters all exchanged vitality among info and yield utilizing the inductor, examination is based of voltage balance over the inductor. The CUK converter utilizes capacitive vitality exchange and examination depends on current equalization of the capacitor. Since the steady state expect no net capacitor voltage rise ,the net current is zero which suggests The inductor currents coordinate the info and yield currents, consequently utilizing the power preservation rule In this way the voltage proportion is equivalent to the buck-help converter. The benefit of the CUK converter is that the info and yield inductors make a smooth current at the two sides of the converter while the buck, lift and buck-support have no less than one side with beat current.

II.RELATED WORK

Multi-level voltage source inverters offer several advantages such as a better output voltage with reduced total harmonic distortion (THD), reduction of voltage ratings of the power semiconductor switching devices and also the reduced electro-magnetic interference problems etc. This paper presents the application of simplified space vector modulation (SVM) method for three-level, five-leveland seven-level diode clamped inverters feeding a three-phase Induction motor. The space vector diagram of the multi-level inverter is decomposed into six space vector diagrams of two-level inverters. This paper compares total harmonic distortion values of voltage and current waveforms of Induction motor to the conventional two-level inverter drive using diode clamped multi-level inverter (Three, five and seven level). An isolated multiport converter proposed in uses only one control switch in each port to which a source is connected. Therefore, it has lesser number of switches, thus lower conduction loss but hard switched. Similarly, a multi-input three-level dc/dc converter proposed in uses four switches and four diodes on the primary side of a high-frequency (HF) transformer leading to huge power loss due to hard switching. a multiport full-bridge bidirectional dc/dc converter (BDC) has been presented by combining full-bridge converter and BDCs. Single-stage power conversion and zero voltage switching (ZVS) turn-ON of all the full bridge switches have been attained in the proposed multiport converters (MPCs). These MPCs are considered as good candidates where isolation and bidirectional conversion are vital. But, the converter Suffers from considerable turn-OFF losses. Greater circuit complexity compared to the linear power supplies, High Electromagnetic Interference (EMI). It can only be used as a step down regulator, Each regulator is limited to only one output, and Low efficiency when compared to other switching regulators

III.PROPOSED SYSTEM

The proposed multi-input ZCS boost dc/dc converter operates in three stages, namely, power transfer stage, charging stage, and resonant stage. These three stages of operations are conveniently divided into ten operating modes in one full switching cycle. As mode six to mode ten are similar to the first five modes, hence only the first five operating modes in a half-cycle are analyzed and explained. Proposed circuit, two active switches are operated with more than 50% duty ratio to make the two switches conduct simultaneously for a small duration of time, during which circuit operates in a resonant mode. During this resonant mode, switches turn-OFF with ZCS. For maintaining the load voltage constant and ZCS at different load conditions, frequency modulation along with a variable duty ratio technique is employed.

Advantages

Simplicity in design, no electrical noise in its output, fast dynamic response time, and low cost. Reduced component stresses, which in turn results in an increased power efficiency and an increased switching frequency. Switching losses are reduced and Isolations provided.

The proposed model can avoid complexity of the circuit. The voltage stress on each power device due to the utilization of multiple levels on the DC bus can be reduced. Total harmonic distortion is less

Applications

Multilevel inverters have been developed for electric utility applications.

- Generate almost sinusoidal waveform voltage while only switching one time per fundamental cycle.
- STATIC VAR generation
- Battery based applications
- Hybrid electric vehicle (EV) motor drive

III.BLOCK DIAGRAM

Proposed circuit, two active switches are operated with more than 50% duty ratio to make the two switches conduct simultaneously for a small duration of time, during which circuit operates in a resonant mode.

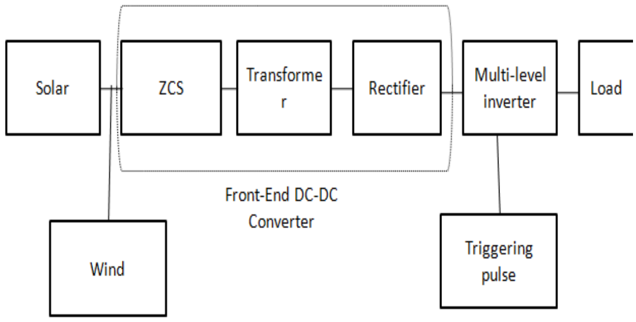


Figure 1: Block Diagram of propose system

During this resonant mode, switches turn-OFF with ZCS. For maintaining the load voltage constant and ZCS at different load conditions, frequency modulation along with a variable duty ratio technique is employed.

IV.SIMULATION AND RESULTS

Simulation Diagram

Electrical power frameworks are blends of electrical circuits and electromechanical gadgets like engines and generators. Engineers working in this control are always improving the execution of the frameworks. Prerequisites for definitely expanded productivity have constrained power framework creators to utilize control electronic gadgets and modern control framework ideas that assessment customary examination apparatuses and systems. Further entangling the expert's job is the way that the framework is regularly so nonlinear that the best way to comprehend it is through simulation .Land-based power age from hydroelectric, steam, or different gadgets isn't the main utilization of intensity frameworks. A typical attribute of these frameworks is their utilization of intensity hardware and control frameworks to accomplish their execution goals. SimPower Systems is a cutting edge configuration apparatus that enables researchers and engineers to quickly and effectively manufacture models that mimic power frameworks. SimPower Systems utilizes the Simulink condition, enabling you to fabricate a model utilizing straightforward snap and drag strategies. Not exclusively would you be able to draw the circuit topology quickly, however your investigation of the circuit can incorporate its cooperations with mechanical, warm, control, and different orders. This is conceivable in light of the fact that all the electrical pieces of the simulation cooperate with the broad Simulink displaying library. Since Simulink utilizes MATLAB® as its computational motor, planners can likewise utilize MATLAB tool kits and Simulink blocksets. SimPower Systems and Sim Mechanics share a

unique Physical Modeling square and association line interface

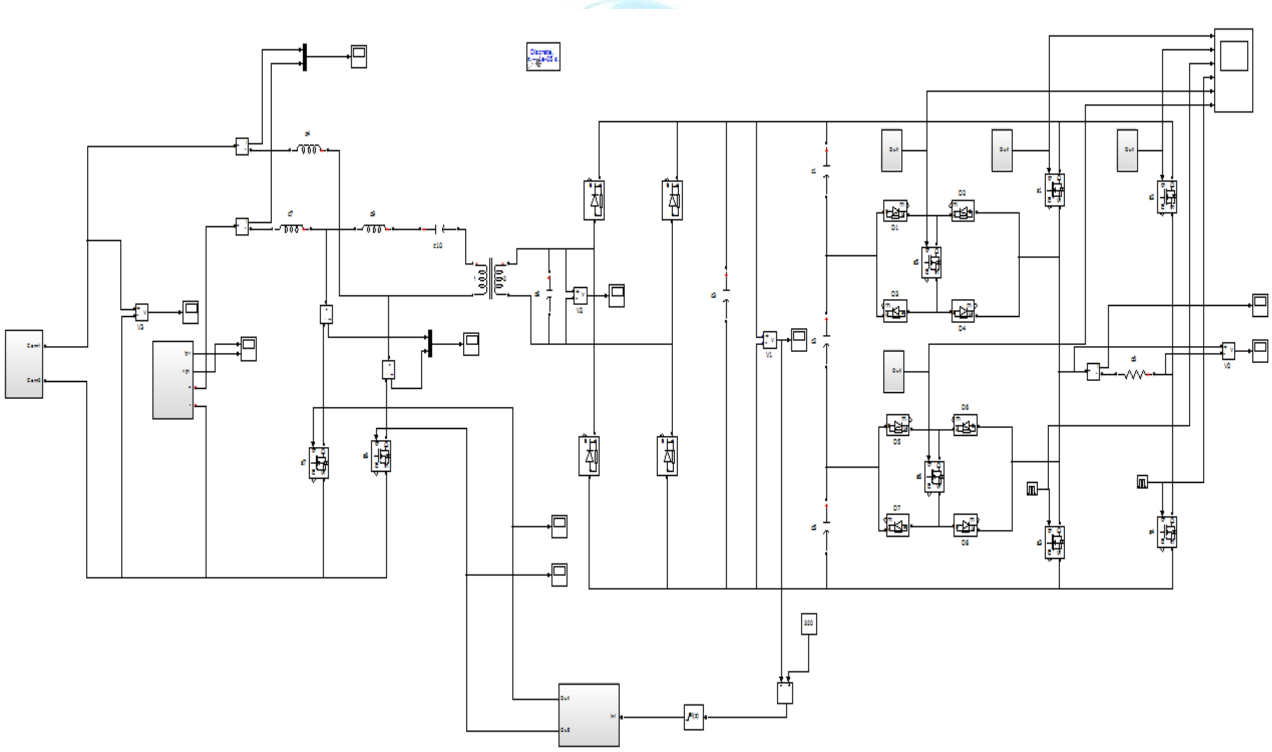
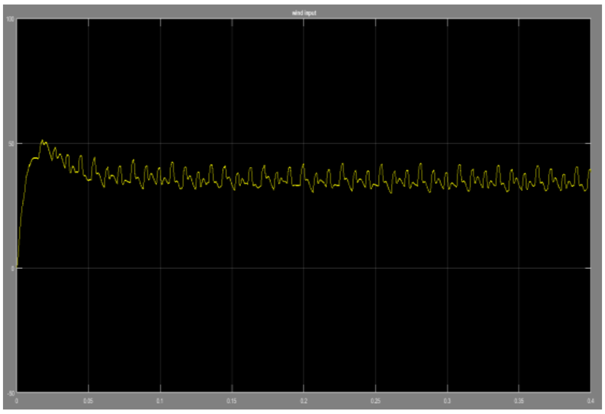


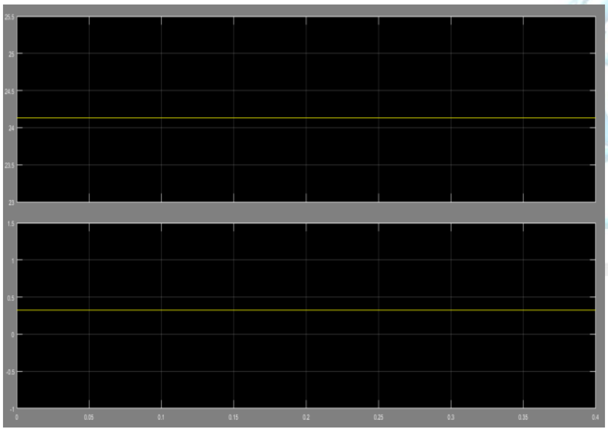
Figure 2: Simulation Diagram for Proposed System

V.SIMULATION RESULTS

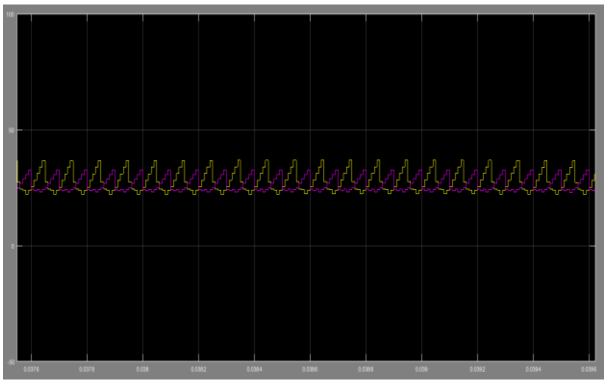
WIND INPUT1:



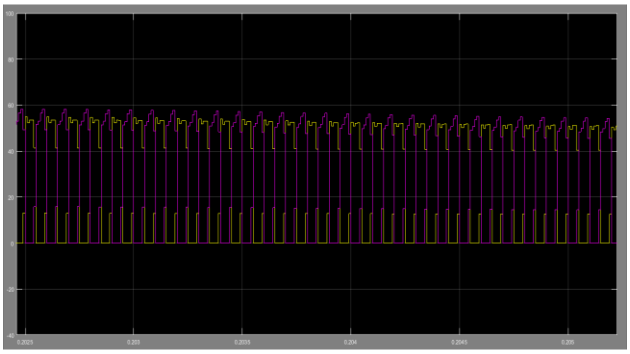
SOLAR INPUT2:



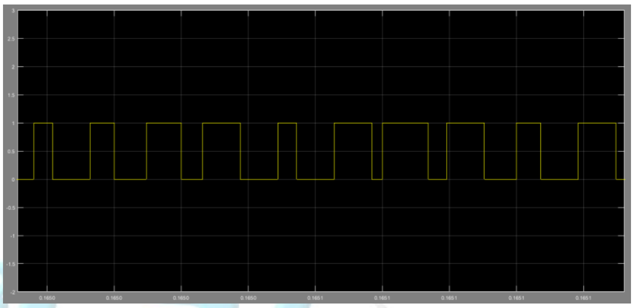
IL1,IL2:



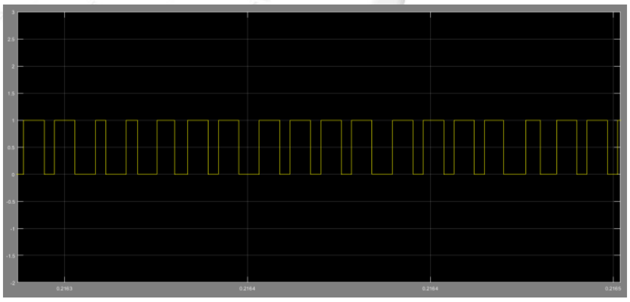
IS1,IS2:



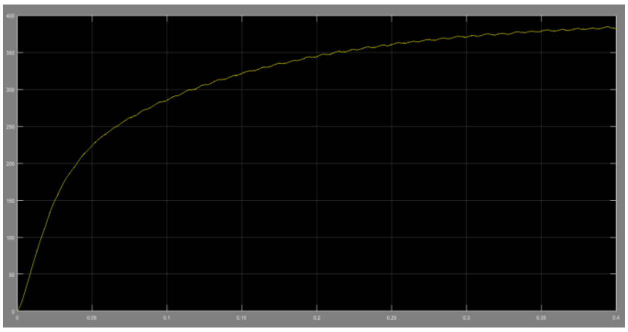
S1 PULSE:



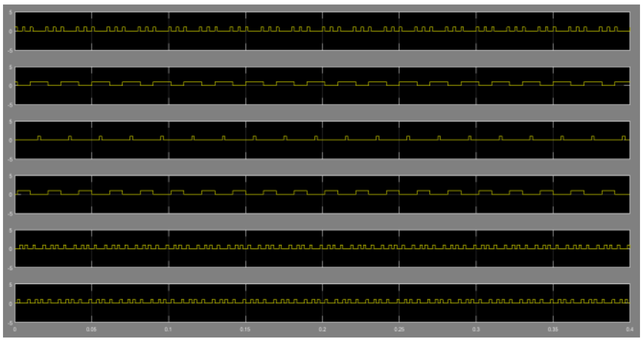
S2 PULSE:



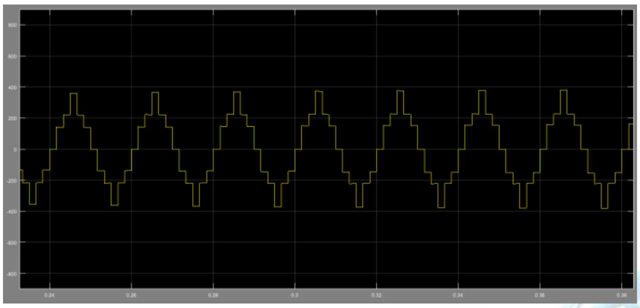
DC VOLTAGE:VDC



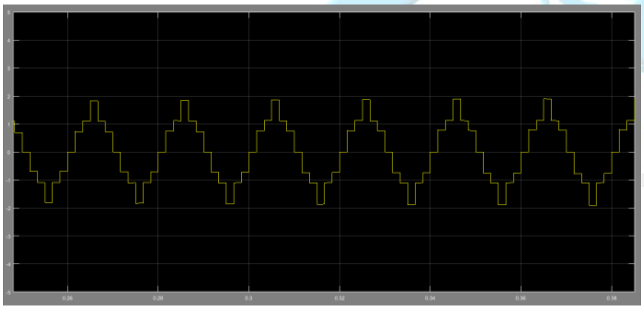
INVERTER PULSES:



OUTPUT VOLTAGE:



OUTPUT CURRENT:



VI.CONCLUSION

Multi-input isolated current fed ZCS frontend dc/dc converter based multilevel inverter is proposed. The steady-state operation, analysis, and closed-loop control scheme are presented. Design guidelines of front-end dc/dc converter are outlined. The simulation and experimental results with the five level inverter are presented. Even for unequal input voltages at the input side, converter draws nearly equal currents, which reduces transformer saturation related issues. The results show that the ZCS is achieved under variations in the load as well as input voltage for the integration of different voltage sources to power the local ac loads.

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