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Review of ZSI Based Solar Power

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Abstract:- This paper presents solar powered impedance source inverter uses LC impedance network. LC impedance network couple with main converter circuit to the power source which provides improves of input voltage. Environmental concerns, more Serious . For this we use distributed power like wind power, geothermal, fuel cells, and photovoltaic that directly uses the energy in the form of the sun to generate electricity. This PV cell solar powered ZSI will provide clean source of energy with highly efficient power conversion solution. The work presented here has profound implications of ZSI and help solve the problem of power conversion.

KEYWORDS:- *Impedance source inverter (ZSI), Solar Power.*

I. INTRODUCTION

Renewable energy is easily available and large. It is inexpensive technology and infrastructure improve. A lot of renewable energy sources such as Solar, Wind, Geo-thermal, Industrial Waste, Hydro, etc. are well known for power generation. The Solar power is environmental helpful, noiseless has longer life with little maintenance highly mobile and portable as compared to other sources of power generation. Z-source inverter is a type of power inverter. In this circuit that converts D.C.to A.C.. It functions as a buck-boost inverter without making use of Direct Current to Direct Current converter bridge due to its special circuit topology. Impedance Source networks provide power conversion between source and load in a wide range of electric power conversion applications. Z-source-related research has grown quickly. Z-source was first proposed in 2002. It was proposed by Prof. F. Z. Peng. In impedance source numbers of modifications and new Z-source topologies have grown exponentially. After that improvements to the impedance networks by introducing coupled magnetics. It have been proposed for achieving higher voltage boosting, while using a shorter shoot-through time. It include the T-source, I-source, trans-Zsource, LCCT-Z-source, TZ-source, high frequency transformer isolated, and Y-source network . It have been proposed in 2011 by Dr Marek Adamowicz. For utilizing high frequency transformer connected in series with two direct current-current-blocking capacitors. From this, the Y-source network was proposed in year 2013 by Dr Yam P. Siwakoti.Y-source network is more versatile from which the T-source, I-source and trans-Z-source networks are derived.

II. LITERATURE REVIEW

Fang Zheng Peng [1] in his paper *Z-source inverter*, presented an impedance-source power converter. Impedance source is also call as impedance-fed (abbreviated as Z-source converter) and its control method for implementing DC-to-DC, AC-to-DC, AC-to-AC, and AC-to-DC power conversion. The impedance source converter operate a unique impedance circuit to couple the converter main circuit to the power source. In this way providing unique features that cannot be obtained in the traditional voltage-source and current-source converters. For this capacitor and inductor are used. The impedance source converter overcomes the conceptual and theoretical barriers and limitations of the traditional voltage-source converter and current-source converter and provides a novel power conversion concept. The Z-source can be applied to all AC-to-AC, AC-to-DC, DC-to-AC, and DC-to-DC power conversion.

Sachin Jain and Vivek Agarwal [2] in their paper, *A Single-Stage Grid Connected Inverter Topology for Solar PV Systems with Maximum Power Point Tracking*, suggested a high performance, single-stage inverter topology for grid connected PV systems. Their configuration boost the usually low photovoltaic array voltage and can also convert the solar direct current power into high quality alternating current power for feeding into the grid, while tracking the maximum power from the PV array. Their topology has several desirable features such as better utilization of the PV array, higher efficiency, low cost and compact size. Further, due to the very nature of the proposed topology, the PV array appears as a floating source to the grid, thereby enhancing the overall safety of the system. A complete steady-state analysis, including the design procedure and expressions for peak device stresses have been proposed. Necessary condition on the modulation index "M" for sinusoidal pulse width modulated control. Proposed inverter topology has also been derived for discontinuous conduction mode operation.

Ishwar Singh, Chandra1, Tikeshwar Gajpal [3], in their work, *Impedance Source Converter for PV Application and Stand Alone System*, focused impedance source converter with the open loop control and without battery storage system. Their observation was that the condition of power developed in the renewable can be improved by increasing the stage efficiency of power converter with the help of the switching device and state. In their work study of PV and Impedance Source converter is presented. Also, the

inverter circuit with the two levels out in reduced THD is presented in their work.

Yi Huang, Miaosen Shen [4], in their paper *Z-Source Inverter for Residential Photovoltaic Systems*, proposes a Z-source inverter system for a split-phase grid-connected photovoltaic system. A Z-source inverter is utilized to realize inversion and boost function in one single stage. Various traditional voltage source inverter or current source inverter, the Z-source inverter employs a special impedance network with split inductors and capacitors connected in With the impedance network, the Z-source inverter can use the shoot through states to boost voltage. Also, with the ability to handle the shoot through state, the inverter shape system becomes more reliable. The inductors and capacitors in the Z-source are both energy storage devices, then their value can be optimally designed to ensure small size and low cost. All the advantages of the Z-sources inverter and the six-switch split-phase inverter are inherited and integrated together to create a highly reliable PCS system with minimized volume and cost.

Ghulam Rabani, Shekhar Verma [5], *A Review Study of Grid-Connected SVPWM System Analysis and Control of Quasi-Z Source Inverter: Comparative Analysis of MPPT in Solar Panel with Respect to Power* proposed an altered space vector modulation (SVPWM) method for the QZSI is connected to perform high voltage usage, power variable change, high effectiveness , low noise,. A quasi Z-source inverter with battery for photovoltaic power generation framework was proposed. In their work the battery was paralleled with one of the capacitors particularly to discharge or store energy, with no supplementary parts. The power change circuit of QZSI with battery framework was broke down. The connections with inverter power, PV power, battery power, from this two inductor streams and battery current were consider.

Dong Cao [6], proposed *Low-Cost Semi-Z-source Inverter for Single-Phase Photovoltaic Systems* presented several non isolated semi-Z-source inverters for a single-phase photovoltaic (PV) system with low cost and doubly grounded features. These semi-Z-source inverters use the impedance source or quasi impedance source network. In this only two active switches to achieve the same output voltage as the traditional voltage inverter and full-bridge inverter does. The two active switches of the semi-Z-source inverter are controlled complementarily, which are different from the traditional single-phase Z-source or quasi impedance source inverter. In semi impedance source inverter shoot-through zero state is not convenient to semi impedance source inverter. In semi impedance source inverter has input direct current source and output alternating current voltage of the semi impedance source inverter share the same ground. Therefore, leading to less leakage ground current advantages over other non-doubly grounded inverters, such as voltage-fed full bridge inverter. This is a preferred feature for non isolated grid-connected inverters, especially in PV application. In semi-impedance source inverter revised nonlinear pulse width modulation method is proposed. By using this method, output of sinusoidal voltage is generated using desired duty cycle.

Shuai Jiang, Fang Z. Peng [7] in their paper, *Modular single-phase trans-Z-source inverter for multi-input renewable energy system* presented a modular single-phase trans-Z-source inverter for the multi-input grid-connected renewable energy (photovoltaic or fuel cell or wind) system in order to explain the system structure and reduce the cost. The proposed modular single-phase trans-Z-source inverter evolves from the original Z-source inverter by incorporating coupled inductors and center-tapped capacitors and so making the system neutral available. By utilizing the extra shoot-through state which is prohibited in the conventional voltage-source inverter to avoid short circuit, the proposed inverter can perform DC-AC inversion and DC-DC boost conversion simultaneously based on the single-stage structure.

Amitava Das, Debasish Lahiri, A. K. Dhakar [8], in *Residential solar power systems using Z - source inverter*, proposed a residential solar power system using Z-source inverter. The Z-source inverter uses a particular impedance network couple with the solar cell and inverter main circuit.

Mihai Ciobotaru, Remus Teodorescu, Frede Blaabjerg [9], in *Control of Single-Stage Single-Phase PV Inverter*, presented the use of control strategies for single-stage photovoltaic inverter is addressed. A complete control structure for the single phase photovoltanic system is presented. In this two different current controllers, which are the classical proportional-integral (PI) and the novel proportional-resonant (PR) controllers. Two different current controller and an experimental and implemented. The PR controller is determine with respect to the PI controller. While harmonic current rejection and the capability to remove the steady-state error without using the voltage feed forward. The control strategy was successfully tested on a real photovoltanic inverter.

T. Lakhmi kanth, CH. Rambabu, R. Punyavathi [10], in *Z - Source Multi Level Inverter Based PV Generation System* proposed a technique of Z-Source multilevel inverter based PV generation system is simulated and implemented using MATLAB-Simulink simulation software. For increasing the performance of the system, Z-Source multi level inverter can be used in place of traditional VSI in Solar Power Generation System. It is design to understand increases direct current to Alternating current conversion the Z source inversion is used with low THD. In photovoltanic cell model use mathematical circuit equations.

Omkar Ellabban , Haitham Abu-Rub [11], proposed article *Z- source Inverter Topology Improvement Review* focuses on the topology modifications of the two-level voltage-fed ZSI. It has some drawbacks that causes in decreasing the converter efficiency, such as unidirectional power flow, a discontinuous input current, higher Z-network

capacitor voltage, high inrush current during starting, isolated source, light-load operation and inverter dc rail. For solving drawbacks in basic ZSI topology, there many modifications in the structure. In this article presented an intensive overview of the ZSI's different topology improvements and different arrangements.

Yu Tang, Linlin Li [12], Proposed *Single-phase buck-boost Z-source inverter*. This paper proposes a novel single-phase Buck-Boost Z-source inverter topology. This topology performs the Buck-Boost conversion and inversion ability in single stage by using the unique feature of the Z-source network. Compared to traditional two stage realization, it is simple in structure and only utilizes three switches to get the required output voltage lower or higher than input, while, the input current keeps continuous. Operating principle and switching modes are explained.

Uthane Supatti and *Fang Z. Peng* [13], in *Z-source Inverter Based Wind Power Generation System*, present Z-source inverter with maximum boost control using the wind turbine generation system. The system can generate the desired output voltage and boost efficiently at the time low voltage of the generator is establish according to the low wind speed. However, when the wind speed is high, providing higher voltage and system can work like the conventional inverter without the boost condition. The system has high performance, minimal component count, increased efficiency and reduced cost.

III. CONCLUSION

ZSI overcome limitation of traditional voltage source inverter and current source inverter which improves performance significantly having buck and boost operation of inverter with increases the efficiency with low cost and less power loss. Z Source inverter has attractive power conversion.

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