# Implementation of Digital Controlled Dual Active Bridge DC-DC Converter

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***Abstract***

*This paper Proposes a bi-directional DC/DC converter on the secondary side of which an active clamp branch is added.Input DC bus of the photovoltaic power generation system .Bi-directional DC/DC converters can enable the charging and discharging process between the bus and storage battery By applying the microcontroller, seamless switch between charge mode and discharge mode can be achieved. Buck mode, parasitic parameters of rectifier diodes may lead to the spurious resonance.Boost mode, the leakage inductance of the transformer may cause pretty high voltage spike across the MOSFET.*

**Keywords —** *bi-directional, active clamp, DC/DC,ZVS*

## I. INTRODUCTION

This Renewable energy power generation systems, as being more and more widely used, are suffering from issues such as randomness and intermittency of renewable energies. For example, a solar power generation system cannot perform well without sunlight. To address these issues, micro-grid systems are deployed with energy storage devices represented by storage batteries which can get charged in daylight and discharge at night to ensure the system stability.

A typical photovoltaic power generation system equipped with a storage battery. The power generated by the PV panel is boosted to 400v via the boost converter, and then connected to the AC power grid or supplied to the AC load after isolation from the isolated DC / DC converter. The storage battery is connected to the DC bus through a bidirectional DC/DC converter. Bi-directional DC/DC converters can enable the charging and discharging process between the bus and storage battery in a cost and space effective manner [3]. However, there are some intractable issues in bi-directional DC/DC converters. For example, in buck mode, parasitic parameters of rectifier diodes may lead to the spurious resonance;

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while in isolated boost mode, the leakage inductance of the transformer may cause pretty high voltage spike across the MOSFET. The challenge lies in that the solution of one issue in buck mode may cause other issues in boost mode. A solution without system performance deterioration in either mode is poorly needed.

## II. EXISTING CONVERTER SYSTEM

The boost converter can operate in Continuous Conduction Mode or Discontinuous Conduction Mode for PFC, however at high power levels the CCM boost converter is preferred . Many methods can be used to increase the efficiency of the standard boost converter PFC as well as the efficiency of other topologies. One such method is soft switching techniques using snubbers to reduce switching losses . These techniques and others while important to increasing efficiency are only additional components that control turn off and turn on states within the basic PFC converters. For simplicity, the converters themselves with their advantages and disadvantages will be addressed to better understand what is present in PFC techniques today.

The buck converter PFC is another method which has its advantages over the previous boost converter. The buck converter is fundamentally different than the boost in that it steps down the voltage, which allows its lower DC voltage at the output to not be required to be above the peak input line voltage. Since the voltages are lower for the buck, voltage stresses on components are also lower than that of the boost.

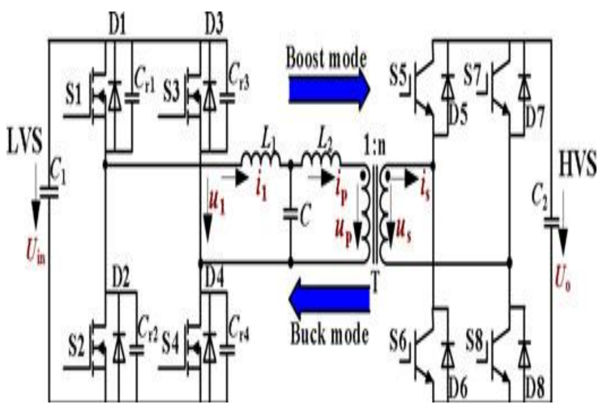


**Fig 1.Equivalent circuit**

*Some Common Mistakes*

- The word “data” is plural, not singular.
- The subscript for the permeability of vacuum □$_0$, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o.”
- In American English, commas, semi-/colons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a

While each of these converters mentioned have their benefits and drawbacks in specific applications depending on the trade offs, one area of DC-DC converters that has a major advantage is isolated converters used for PFC. Isolation of the circuit is attributed to a transformer or multiple transformers in the converter . Converters of this type are fly back, forward, and push pull converters. Of these three, the push pull converter is derived from a forward converter and for sake of argument, focus will be on the push pull converter, with details of the push pull inherently addressing the forward converter.

### *A. Simulation Of Existing System*

The single stage converter connected withBridge system and it is simulated using MATLAB/Simulink.and the simulation results are shown in the fig 2, fig 3.

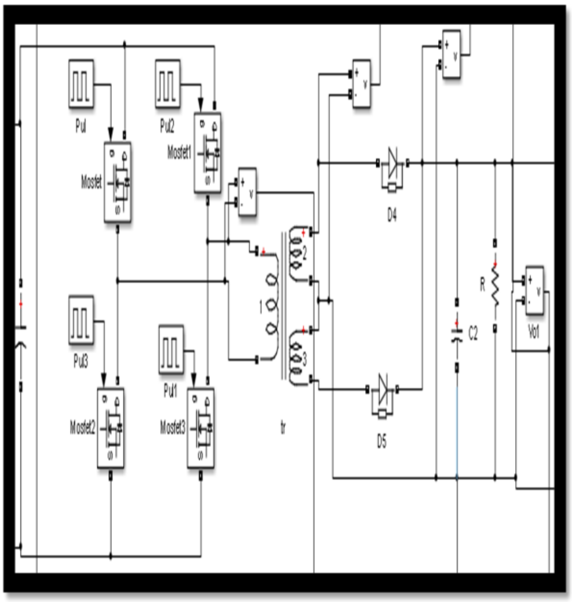

**Fig 2.Simulink of Existing system**

### *B. Simulation Result*

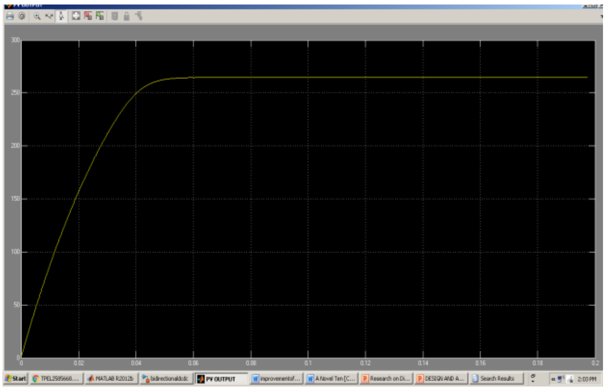

**Fig 3.Output voltage**

## III. PROPOSED PHOTOVOLTAIC SYSTEM

Renewable energy power generation systems, as being more and more widely used, are suffering from issues such as randomness and intermittency of renewable energies. For example, a solar power generation system cannot perform well without sunlight. To address these issues, micro-grid systems are deployed with energy storage devices represented by storage batteries which can get charged in daylight and discharge at night to ensure the system stability.

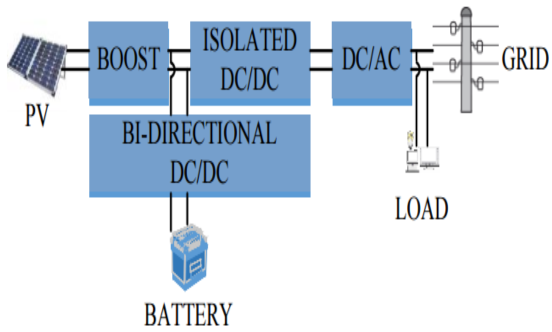


**Fig. 4 Block diagram of photovoltaic power generation system**

Shown in Fig.4 is a typical photovoltaic power generation system equipped with a storage battery. The power generated by the PV panel is boosted to 400v via the boost converter, and then connected to the AC power grid or supplied to the AC load after isolation from the isolated DC / DC converter. The storage battery is connected to the DC bus through a bidirectional DC/DC converter then the isolation from the isolated DC / DC converter.

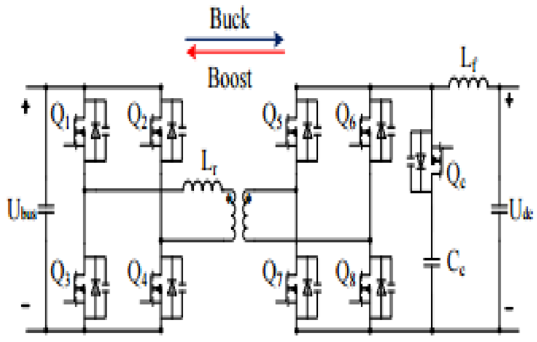


**Fig 5. Equivalent Circuit diagram**

### *A. Simulation Of Proposed System*

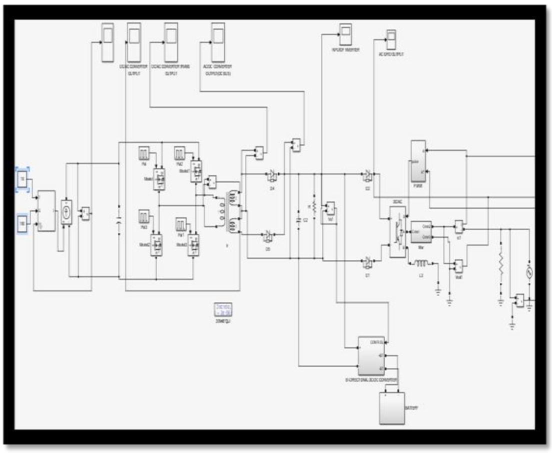

**Fig 6.Simlink of Proposed System**

### *B. Simulation Results*

The Bi-directional DC-DC converter is coupled with Grid and it is simulated using MATLAB/Simulink.and the simulation results are shown in the fig 7, fig 8 & fig9.

a.

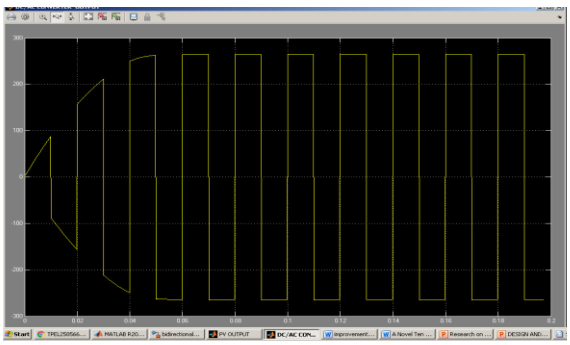

**Fig 7.BUCK DAB output**

This paper proposes a bi-directional DC/DC converter on the secondary side of which an active clamp branch is added. Fig.3 shows the topology of the proposed converter, Ubus is the DC bus of the photovoltaic power generation system, Udc is the battery, closed-loop control for both direction is realized using TI microcontroller TMS320F28335 in this implementation. By applying this microcontroller, seamless switch between charge mode and discharge mode can be achieved

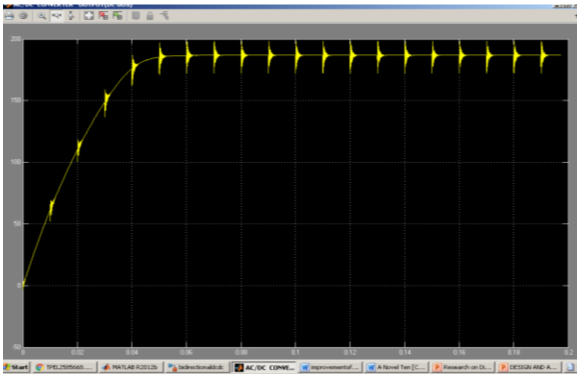

**Fig 8.DC bus output**

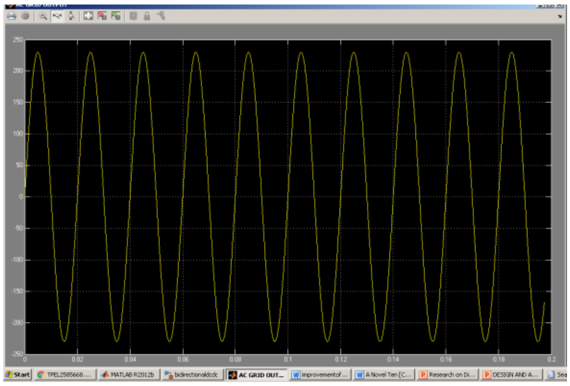

**Fig 9.GRID output**

## V. CONCLUSION

The This paper proposes a bi-directional DC/DC converter which is implemented between the 400V DC bus of the photovoltaic generation system and the 48V energy storage battery. By adding an active clamp branch on the secondary side of the converter, the ZVS can be realized both under the BUCK mode and the BOOST mode, the switching loss will decrease so that the efficiency of the converter can get higher.It proves that this kind of bi-directional DC/DC converter has many advantages, for example, no parasitic resonance and ZVS without any extra lossy component which make the converter suitable for high voltage high power applications.

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