

# Design and Implementation of Interleaved Converter Using Hybrid Energy for Irrigation Pump

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**Abstract**— Solar photo voltaic (SPV) array and wind energy system (HYBRID) based water pumping is receiving wide attention now a days because he everlasting solar and wind energy is the best alternative to the conventional energy sources. Interleaved Boost converter (IBC) has better performance characteristics when compared to a conventional boost converter due to its increased efficiency, reduction in size and greater reliability. IBC consists of a number of boost converters connected in parallel and controlled by the interleaved method which has the same switching frequency and phase shift. This paper deals with hybrid energy conversion using interleaved converter for water pumping. In previous paper solar power is used were power to power is not continuous but in hybrid converter uses both Solar and Wind energy so that generation power is continuous of power is provided to the irrigation pump. Interleaved converter is used because of its less conduction loss, used for high power application over Buck-Boost converter.

**Key words:** Solar photo voltaic (SPV), Wind Energy Conversion (WEC), Interleaved Boost converter (IBC)

## I. INTRODUCTION

The use of renewable energy increased greatly just after the first big oil crisis in the late seventies. At that time, economic issues were the most important factors, hence interest in such processes decreased when oil prices fell. The current resurgence of interest in the use of renewable energy is driven by the need to reduce the high environmental impact of fossil-based energy systems. Harvesting energy on a large scale is undoubtedly one of the main challenges of our time. Future energy sustainability depends heavily on how the renewable energy problem is addressed in the next few decades.

The wind turbine technology is one of the most emerging renewable technologies. Wind is an intermittent resource; it can be calm one day and howl the next. Wind is extremely variable and unpredictable over even a day's time. wind power production in the beginning did not have any impact on the power system control but now due to their size they have to play an active part in the grid. Wind speed varies with height above the ground. Wind moving across the earth's surface encounters friction caused by turbulence over and around buildings, mountains, trees, and other obstructions.

The intensity of the solar radiation energy reaching a PV array depends on the effect of the sun's angle on the array, the location of the array, the effects of the earth's orbit around the sun, and the effects of the earth's daily rotation around its axis. The principal geometric attribute of the PV array is the direction in which it faces. This direction can be characterized by a line perpendicular (normal) to the array surface.

The orientation of the array can be specified by the tilt angle  $\beta$  and the azimuth angle  $\gamma$ . A continuous reduction in the cost of the solar photovoltaic (SPV) panels and the power electronics devices has encouraged the researchers and the industries to utilize the solar PV array generated power for different applications. Water pumping has gained a broad attention as a crucial and cost effective application of the solar PV array generated power.

## II. BLOCK DIAGRAM EXPLANATION

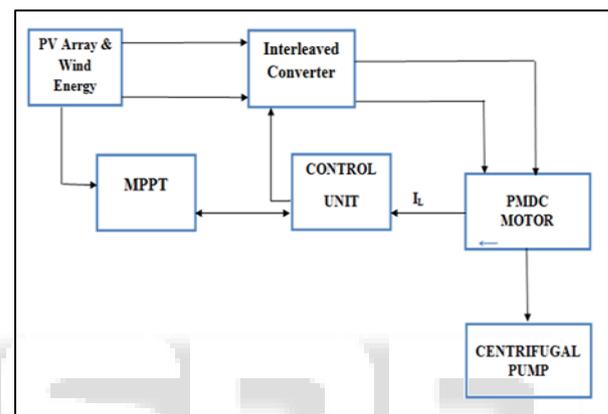


Fig. 2.1: Block Diagram

In the Fig.2.1the Interleaved converter is supplied by Wind mill and PV Array, where the switching pulse to the Interleaved block is given by the Pulse generator, which is the feedback pulse from load .The block diagram consist of input dc source, MPPT, Interleaved converter, Load and Pulse generator. MPPT devices are typically integrated into an electric power converter system that provides voltage or current conversion, filtering, and regulation for driving various loads, including power grids. solar power is used were power to load is not continuous but in hybrid converter uses both Solar and Wind energy so that generation power is continuous of power is provided to the PMDC motor drive for the irrigation pump system.

## III. INTERLEAVED BOOST CONVERTER

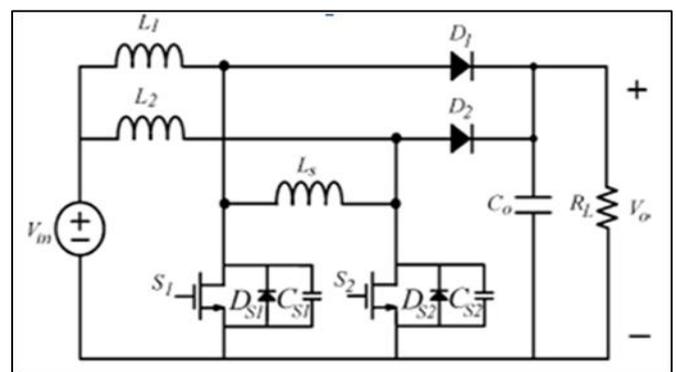


Fig. 3.1: Interleaved Boost Converters

In Figure.3.1 shows the functional diagram of a two-phase interleaved boost converter, which comprises two boost converters operating 180° out of phase. The input current is the sum of the two inductor currents,  $I_{L1}$  and  $I_{L2}$ . Because the inductor's ripple currents are out of phase, they cancel each other out and reduce the input-ripple current that the boost inductors cause. The best input-inductor-ripple-current cancellation occurs at 50% duty cycle. The output-capacitor current is the sum of the two diode currents,  $I_{D1}+I_{D2}$ , minus the dc-output current, which reduces the output-capacitor ripple,  $I_{OUT}$ , as a function of duty cycle. As the duty cycle approaches 0, 50, and 100%, the sum of the two diode currents approaches dc. At this point, the output capacitor has to filter only the inductor-ripple current.

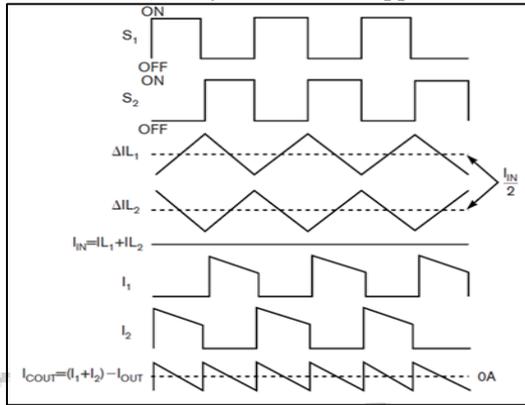


Fig. 3.2: Interleaved Boost Converters

The most popular topology pre-regulators is the boost converter, which has continuous input current that you can manipulate with average-current-mode-control techniques to force input current to track changes in line voltage.

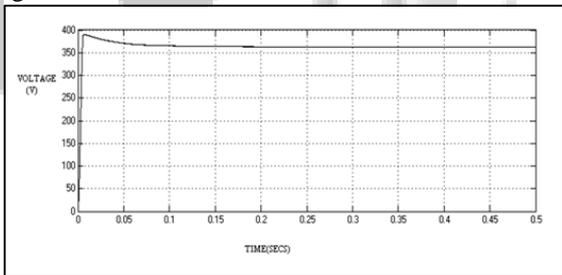


Fig. 3.3: Output Voltage of Interleaved Boost Converter

#### IV. SIMULATION CIRCUIT

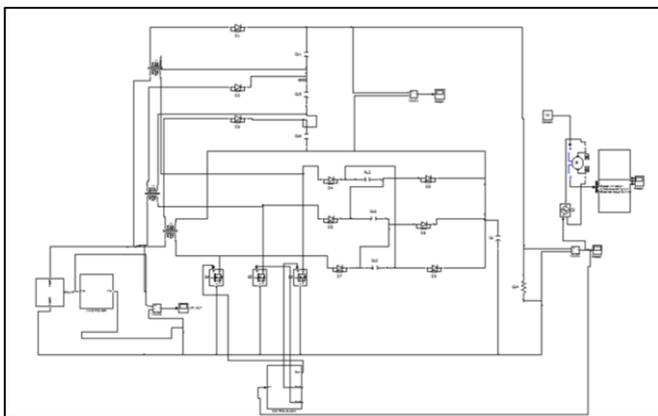


Fig. 4.1: Simulation Circuit

#### V. SIMULATION OUTPUT

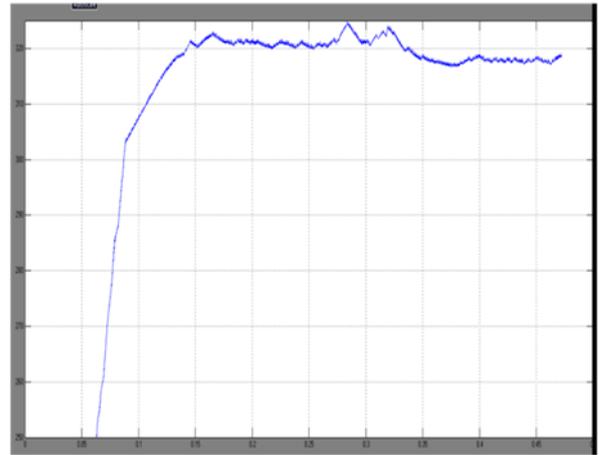


Fig. 5.1: Solar and Wind Output

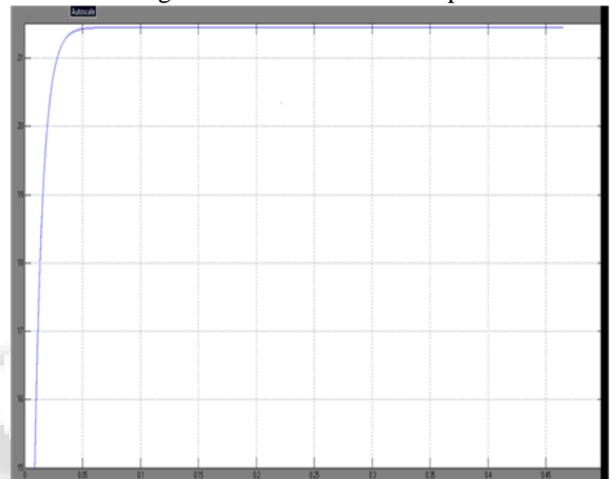


Fig. 5.2:

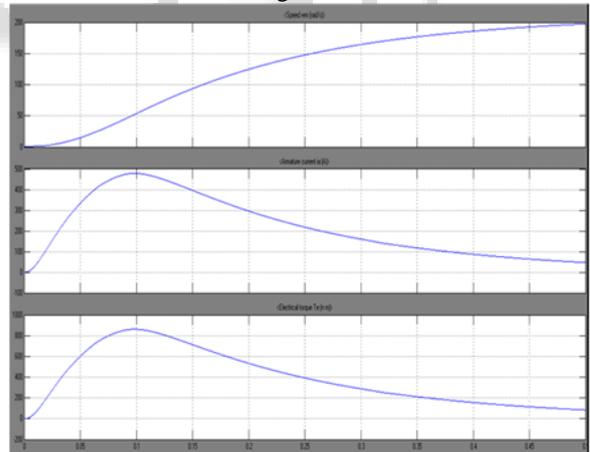


Fig. 5.3: PMDC Motor Drive Output

The MPPT technique is mostly used to optimize the efficiency in solar PV based applications. An INC type of MPPT technique is used in this paper because of its high precision of tracking even under the rapid change in the atmospheric conditions. Wind energy is converted to electrical energy it's given the ac to dc converter. PV array output and (ac to dc) converter output is given to the IBC converter. IBC interleaved boost converter is used to boost the input voltage with (CCM) continuous conduction mode (24v to 380v) and given to PMDC motor. PMDC permanent magnet DC motor is used to drive the centrifugal pump.

## VI. CONCLUSION

Solar photo voltaic (SPV) array and wind energy system (HYBRID) based water pumping. solar power generated is not continuous but in hybrid converter uses both Solar and Wind energy so that generation power is continuous of power is provided to the irrigation pump. Interleaved converter is used because of its less conduction loss, used for high power application over Buck-Boost converter. Compatibility of the proposed system regardless of the weather condition has been demonstrated using the MATLAB based simulation results.

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