

Survey Paper on Low Harmonic Distortion on Single and Three Phase AC-DC Three Level Bridge Converter

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Abstract— This paper presents a single-stage circuit topology consisting of the association of a full-bridge isolated dc–dc converter and two input inductors and two input diodes connected to the mains network, in order to obtain an isolated ac/dc switch mode power supply, with sinusoidal input current. The proposed topology does not use an input bridge rectifier, common in similar applications. The current in the two input inductors can therefore, flow in both directions. Consequently, the proposed topology equally distributes the current by the four-bridge transistors that provide four input parallel boost power factor correctors (PFCs). The use of the four bridges permitting the accurate simultaneous regulation of output voltage and input current is hereby described.

Keywords: Full-Bridge Converters, Input Current Shaping, Low-Distortion Input Current, Single-Stage Power Factor Correctors (Pfc)

I. INTRODUCTION

AC to DC converters is generally utilized in numerous disconnected force supplies like SMPS. We ought to grow increasingly proficient, littler size and modest air conditioning to dc converters. Multi arrange converters present a profoundly contorted info current, bringing about a lot of odd music and a low force factor. So as to lessen input current contortions and to improve the force factor need an extra air conditioning to dc change phase of intensity factor redress (PFC) is ought to be clubbed before the dc to dc converter. It prompts give a two-arrange approach that incorporates a PFC stage to remake the info current into a sinusoidal shape and a dc to dc transformation organize for the guideline of yield voltage. Two phase converters have preferable execution over other multi arrange converters yet it requires more circuit parts and two force changes [4], bringing about higher segment cost and lower effectiveness. To conquer the disadvantages of the two-organize approach, single-arrange air conditioning/dc converters have been created by single stage PFC circuit with dc/dc converter. By sharing at least one dynamic switches and the control the general circuit along these lines diminished size. Despite these great characteristics this converters prompts hard-exchanging activity which brings about low circuit proficiency and limits the yield power rating. Utilization of higher changing recurrence to acknowledge littler attractive segments and capacitors gives better execution. So as to decrease exchanging misfortunes, different assistant circuits and wide scopes of snubbers are required. It will include the circuit multifaceted nature and generally part cost. So we require delicate exchanging qualities by utilizing thunderous topologies. We have to remember thunderous tanks for the converters to make oscillatory voltage or current waveforms with the goal that zero voltage exchanging (ZVS) or zero current exchanging (ZCS) conditions can be made for the

force switches. The thunderous progress converters are progressively effective group of delicate exchanging topologies. They incorporate the low exchanging misfortune qualities of the resounding converters and the consistent recurrence and low conduction misfortune attributes of the PWM converters under intermittent mode. These are normally square wave converters during their method of tasks, with the exception of during the resounding changes.

II. LITERATURE REVIEW

Many information current wave forming strategies have been proposed to defeat above weaknesses, which can comprehensively characterize as dynamic, detached and crossover techniques. Previously, fashioners have utilized three uninvolved wave molding techniques to improve the info power factor and diminish Total Harmonic Distortion (THD) of traditional air conditioning to-dc rectifiers K. C. Iseng et al. [1]. Numerous uninvolved procedures (for example circuits utilizing just inductors and capacitor) are accessible to improve power factor PF and diminish the degrees of music for single stage rectifier, including the association of arrangement supply reactor, tuned arrangement consonant channel, tuned equal symphonious channel. In these strategies the force factor is improved and symphonious twisting is diminished in correlation with regular topology. Among the latent wave forming strategies proposed before, the novel strategy proposed by R. J. Wai [2] in 2005 is better than others in diminishing the info current music and improving the information power factor. The tale strategy can effectively improve the force factor. In any case, further improvement of the information power factor is hard to accomplish, and the information current disservice of the novel topology. This technique is named as improved latent wave molding strategy by R. J. Wai in 2008 [3]. L. S. Yang et al. [4] planned a solitary stage rectifier with turning on AC side for high force factor and low complete symphonious bending in 2007. This technique utilizes a solitary MOSFET switch on the air conditioner side to give elective way to include current to stream and thus make it nonstop. The rectifier is associated with the air conditioner mains through an arrangement blend of inductor and capacitor, which keeps the information current smooth and in stage with the inventory voltage. The circuit proposed for current forming comprises of a Boost converter associated with the line and a Buck converter associated with the yield capacitor by F. L. Luo et al. [5]. F. L. Luo et al. [6], proposed another zero current exchanged (ZCS) high force factor rectifier for power figure rectification 2003. The proposed single stage rectifier empowers zero current exchanging activity of all the force gadgets permitting the circuit to work at high exchanging frequencies and high force levels. With the proposed control strategy, solidarity power factor and extraordinarily

decreased line current music can be acquired. T. F. Wu. et al. [7], proposed Asymmetrical Pulse Width Modulated (APWM) control procedure for the air conditioner choppers to improve the information power factor. The exchanging capacity for the proposed chopper is inferred. The proposed procedure is streamlined to an inexact APWM which can be acknowledged by the simple circuit. The proposed converter works in spasmodic conduction mode, and requires just a solitary control circle. The quantity of switches (a couple) is an element of the addition of the converter. The info flows of the converter have a little wave, and the yield voltage is liberated from low request consonant substance. The yield stage can be confined. R. I. Wai et al. [8], proposed a Soft-exchanging three-stage PWM-PFC converter in 2005. Right now PWM converter accomplishes the delicate exchanging for all exchanging gadgets without expanding their voltage and current anxieties. In 2008, T. F. Wu et al. [9], proposed a green-mode work is to improve the proficiency of a pre/post-exchanging controller at light loads. In 2002, D. C. Lee et al. [10], exhibited the utilization of fluffy rationale to infer a reasonable control conspire for Boost rectifier with dynamic force factor adjustment. The system coordinates fluffy rationale control procedure in the criticism way and straight programming rule on controlling the obligation cycle of the switch for molding the information current waveform. In 2005 J. Rodriguez et al. [11], proposed a novel direct current controlled PWM. The operational standard of the four-switch BLDC engine drive and the created control plot are hypothetically investigated and the presentation is shown by both recreation and exploratory outcomes. In 1995, N. Zargari et al. [12], exhibited another present control technique for double Boost single-stage power-factor-revision (PFC) converters. The proposed current control technique depends on detecting of the dc yield current, which can be effectively practiced by utilizing a detecting resistor embedded on the negative rail of the dc yield. This valley fill SEPIC-determined PFC topology is then proposed for LED lighting application. In 2003, I. Agiman et al. [13], introduced an irregular exchanging strategy which changes exchanging recurrence while holding steady examining recurrence. The proposed strategy can adequately decrease size of PWM music. Trial results got from a FPGA-based controller are displayed for affirmation.

Converters constrained by previously mentioned control procedures has a disentangled control structure with one unequivocal voltage criticism circle, and one controller to keep up dc transport voltage at an ideal level. Yield of the voltage controller is utilized to create saw-tooth bearer, which is contrasted and the detected info current, the understood circle, to produce gating signals for the dynamic gadgets. The controller structure can be actualized utilizing basic simple and advanced circuits. Thus, this control strategy is a more qualified for minimal effort applications. The controller usefulness required for the proposed technique can be coordinated into application explicit incorporated circuits (ASIC) which can prompt economical arrangements when contrasted with minimal effort microcontrollers [14].

Here observed tooth bearer is contrasted and detected information present and rearranged detected info current to create gating signals for the dynamic gadgets. Thus both the pinnacle and the valley of the current is contrasted

and the transporter [15]. This is logically appeared to guarantee that the normal current is equivalent to network voltage scaled by copied opposition, in a transporter cycle. Consistent state dc counterbalance is likewise tended to in [16], however it requires either detecting of info voltage or two extra integrators, making the control technique increasingly mind boggling.

In 2015, Revarth V. I. et al. [17], dynamic rectifiers constrained by customary OCC (C-OCC), displays contortion in input current when converter is stacked daintily and a consistent state dc counterbalance in current drawn by the converter under all stacking conditions. In 2014, Revarth V. I. et al. [18], the twisting at light loads is demonstrated in to be a result of the little sign precariousness of the converter under C-OCC control. Answers for evacuate bending of information current tended to in [19], [20] includes prerequisite of higher estimations of channel inductors or option of an imaginary current term in the controller utilizing extra information voltage sensors [21]. It is scientifically indicated that the proposed technique is steady under all heap conditions. It likewise doesn't show contortion in current at light loads that is seen in C-OCC [22]. In 2004, A. G. V. Anand et al. [23], Marcelle Merhy et al. introduced a nonlinear model starting with one point of perception then onto the next. Investigation of this model shows that turmoil and bifurcations may happen alongside the changing estimations of some framework parameters [24]. In 2008, D. Ghodke et al. [25], displayed in a novel PFC topology is proposed by embeddings the valley fill circuit in the SEPIC-inferred converter, which can diminish the voltage worry of capacity capacitor and yield diode to half under a similar force factor condition [26]. To accomplish the zero voltage exchanging, the proposed converter is developed by utilizing a full system in corresponding with the switch of the regular PWM converter [27, 28, 29, 30, 31].

Felix Jauch et al. [32], this paper displays a joined stage move and recurrence balance plan of a double dynamic extension (DAB) air conditioning dc converter with power factor revision (PFC) to accomplish zero voltage exchanging (ZVS) over the full scope of the air conditioner mains voltage. The DAB comprises of a half scaffold with bidirectional switches on the air conditioner side and a full extension on the dc side of the disconnection transformer to achieve single-organize power transformation.

Sin-Woo Lee et al. [33], the adjustment conspire is depicted by methods for investigative equations, which are utilized in an enhancement methodology to decide the ideal control factors for least switch recompense flows. Moreover, an air conditioner current controller appropriate for the proposed tweak conspire is depicted. A misfortune model and estimations on a 3.3-kW electric vehicle battery charger to interface with the 230 Vrms/50-Hz mains considering a battery voltage scope of 280-420 V approve the hypothetical investigation.

III. SINGLE STAGE FULL BRIDGE CONVERTER

These topologies can perform input current wave molding and yield voltage control, at the same time, without utilizing any extra transistors. Be that as it may, these topologies are not upgraded regarding extra segments and current

circulation in the scaffold transistors. For instance, in the topologies exhibited, just two equal info support converters are given utilizing the low-side transistors, which prompts uneven current conveyance in the scaffold transistors causing, in these transistors, a high current pressure. An info connect rectifier is additionally required for these topologies. For the topologies proposed, just one information inductor is utilized, yet this inductor and the two low-side transistors need to help the most extreme info current. Then again, the topology exhibited utilizes two inductors for half of the most extreme info current, which implies that, each low side lift transistor needs just to help half of the greatest information current, accordingly diminishing the present worry in these transistors. Be that as it may, the topology utilizes six extra diodes, in this way expanding the expense and lessening the productivity. While trying to tackle the alluded issues, this task displays a streamlined and improved single stage full-connect air conditioning/dc converter, where the information connect rectifier was supplanted by two rectifier diodes.

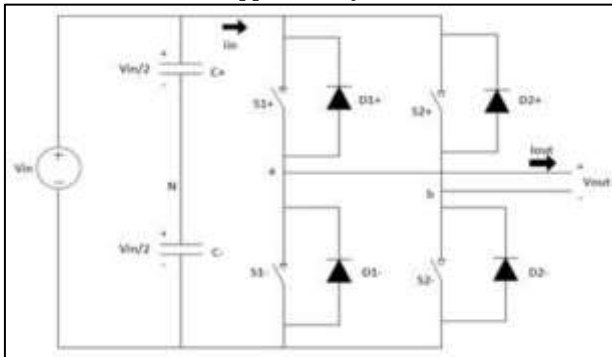


Fig. 1: High-efficiency full-bridge single stage topology

This fact obviously allows, by itself, a slight improvement in the converter efficiency. In addition, it also guarantees the improvement of the converter by performing four input boosts, to accomplish the PFC function, instead of two as it is common in other existing topologies. This way, the operation of the proposed topology will result symmetric, with all the inherent advantages in terms of current and voltage switches' stress reduction. Full analysis and design criteria are completely described in this project.

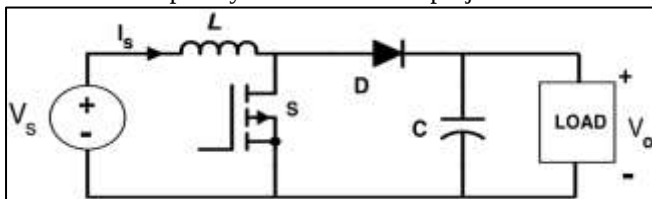


Fig. 2: Block Diagram of Boost Converter

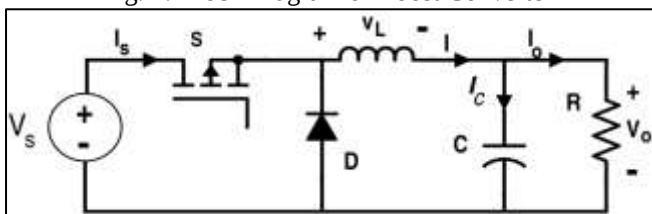


Fig. 3: Block Diagram of Buck Converter

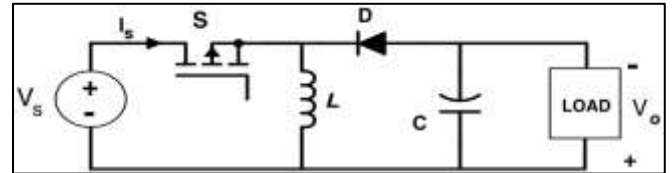


Figure 4: Block Diagram of Buck-Boost Converter

This fact obviously allows, by itself, a slight improvement in the converter efficiency. In addition, it also guarantees the improvement of the converter by performing four input boosts, to accomplish the PFC function (see Fig. 2), instead of two as it is common in other existing topologies. This way, the operation of the proposed topology will result symmetric, with all the inherent advantages in terms of current and voltage switches' stress reduction.

IV. AC-DC CONVERTER

The applications of high step up AC-DC full bridge converters are intensity discharge lamp ballasts for automobile headlamps, fuel-cell energy conversion systems, solar-cell energy conversion systems, battery backup systems for uninterruptible power supplies (UPS) etc. Here proposing a new single stage high step up AC-DC full bridge converter topology that features simple power and control circuitry. PWM control is used to control the switching action of the switches. Performance of the proposed converter under steady state analysis in continuous conduction mode is discussed in detail. Emphasis is given on demonstrating the operating principle, modes of operation, and derives circuit equation. The contents of this paper includes Proposal of a new single stage high step up AC-DC full bridge converter topology that features simple power and control circuitry.

- 1) Full Bridge AC-DC converter (FB) which consists of four MOSFET switches that are built-in anti-parallel diodes
- 2) Performing the steady state analysis of the proposed converter in continuous mode of operation.
- 3) Analyzing the open loop and c10 seed loop simulation results of AC-DC full bridge converter.

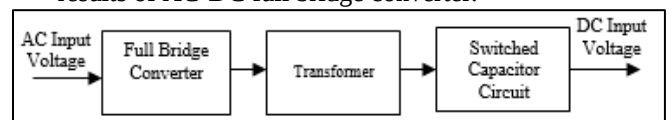


Fig. 5: Block Diagram of Proposed AC-DC Convert

The block diagram of AC-DC converter is shown in Figure 3, gives a constant ac input voltage to the MOSFET full bridge circuit, and that output is given to the primary side of the coupled inductor with low magnetizing inductance. The secondary side of the coupled inductor is fed to the switched capacitor circuit and obtains high voltage dc output voltage. Driver circuit is essential due for giving power to control signal for driving MOSFET.

V. PROPOSED METHODOLOGY

The circuit is composed of sinusoidal mains voltage V_{in} , four switches S1, S2, S3 and S4, coupled inductors N_p and N_s , diodes Da, Db, De, Dd, D1, D2, D3 and D4, two capacitors C, and C2, two secondary diodes D5 and D6, output diode Do, and output capacitor Co and load Ro are shown in Figure 3. The turn's ratio of the coupled inductor n is equal to N_s/N_p .

However a known delay is introduced between turn-off of one switch and the turn on of the other switch of the same leg to avoid simultaneous conduction of any two switches from the same leg. The gate drives of both legs, S¹S⁴ or S², S³ are complementary.

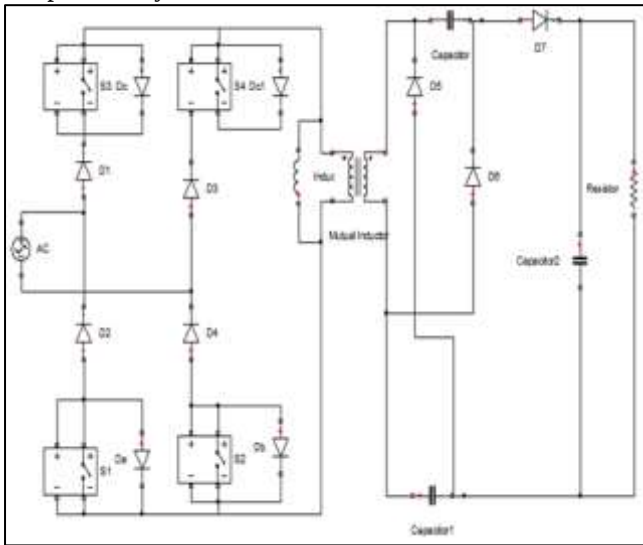


Fig. 6: Circuit of Proposed Converter using Switching Capacitor Technique

The use of switches with low resistance R_{DS} (ON) is to reduce the conduction loss of the entire circuit. The parallel charged current is not inflow. The proposed converter utilized the concept of switched-capacitor technique i.e., two capacitors can be charged in parallel and discharged in series to achieve a high step-up gain. Thus, capacitors on the secondary sides C₁ and C₂ are charged in parallel and are discharged in series by the switches are turned OFF and turned ON is shown in Figure 4. Duty cycle D is defined as the time when S₁ and S₂ are both ON during the first half cycle or when S₃ and S₄ are both ON during the second half cycle. The principle is that, when the switches are turned ON, the energy stored in magnetic inductor and the coupled-inductor-induced voltage on the secondary and the induced voltage makes VL₂, V_c' and V_{C2} release energy to the output in series.

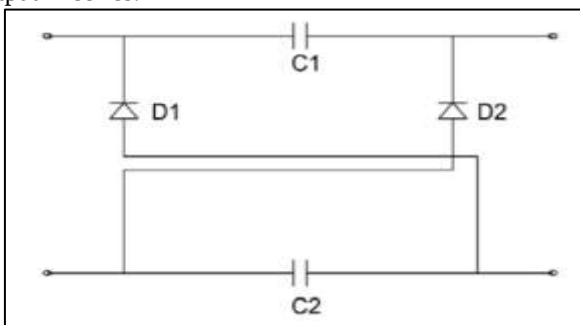


Fig. 7: Switched Capacitor Technique

The features of proposed AC-DC converter are:

- 1) 1. Reduced switch voltage ratings.
- 2) 2. The applicability is for low-medium power ranges.
- 3) 3. Light converter and easy control circuitry.
- 4) 4. It has only lesser components making it less weight, low cost and compact

So many applications are developed on the basis of full bridge converter. The full bridge converter has significant

role in power electronics and drives application compares to other power electronic converters. High voltage dc power supplies have widely applied in the industries, science, military, X-ray systems, dust-filtering, insulating test, and electrostatic coating etc.

VI. CONCLUSION

Right now, the investigation of strategies used to improve the voltage gain in DC-DC converter and AC-DC converters in the early writing, another single stage AC-DC converter will be proposed dependent on exchanged capacitor method, this paper proposes a novel single stage high advance up full scaffold AC-DC converter dependent on the idea of exchanged capacitor topology, actualized in high advance up DC-DC converter. In exchanged capacitor procedure, capacitors on optional side are charged in equal during the switch-OFF period, by the vitality put away in the coupled inductor, and are released arrangement during the switch-ON period to accomplish a high advance up voltage gain. The proposed AC-DC full extension converter changes over the information AC voltage into DC and lift with a high voltage gain in single stage. For high voltage gain AC-DC converters numerous strategies are proposed in writing. Right now, capacitor system is utilized in AC-DC converter is a novel technique for achieving high voltage gain.

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