

Performance of Isolated Soft Switching Current Fed Lcc-T Resonant Dc-Dc Converter for Pv/Fuel Cell Applications



V.Prabhakar Reddy, J.Siva Vara Prasad

Abstract: *In this paper, the design and evaluation of isolated soft switching current LCC-T Resonant DC-DC Converter for PV/Fuel cell applications. For the front end inverter switches, zero voltage switching (ZVS) is used for conversion. For voltage double diodes, Zero-Current Switching (ZCS) is used. Earlier, DC-DC converter provides high harmonic currents, so to overcome that, proposed converter is introduced. The proposed converter will improve the content of harmonic current based on the input variations and wide load. To get the required output voltage, transformer ration will be reduced. Because of the, for PV/ Fuel cell applications have better foot Print and high potential. The proposed converter operates in two modes mainly; they are constant frequency mode and constant duty cycle mode. These modes mainly depend on the load demand. At last from results it can observe that gives satisfying proposed theory.*

Key Words: *LCC resonance, Soft-switching, PV/Fuel cell, capacitive filter.*

I. INTRODUCTION

Power electronic based converters play a significant role in automotive application. These converters are used in some automotive applications like temperature control unit, power steering unit, headlamps, etc. The ever increasing electrical loads in an automobiles compel the use of higher voltage rating and higher power rated converters. With increased power rating, the challenges faced by converters designed for automotive application include high efficiency, compactness, cost effective and resilience to harsh environmental conditions [1]. In a soft switched quasi resonant inverter and a resonant dc link inverter were designed for a battery powered vehicle. Both these converters were designed to drive the main motor. In a two stage soft switched DC-AC inverter was proposed. In this converter, the initial stage was a voltage step-up mode which was incorporated using a push pull quasi resonant converter and the second stage was a conventional DC-AC inverter. Though the converter is highly efficient, the presence of transformer with large turns ratio makes the converter bulky.

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A magnetic less four level DC-DC converter for dual voltage bus was proposed. The converter had slightly complicated control to enable multilevel operation. A bi-directional DC-DC converter for a fuel cell based vehicle was proposed [2-3].

II. LITERATURE SURVEY

Furkan Dincer dissected photovoltaic vitality power frameworks as the most prevailing source among inexhaustible vitality innovations. Among different sun based vitality innovations of feasible vitality sources, photovoltaic (PV) shows up very appealing for power age since it is silent, no carbon dioxide discharge during activity, scale adaptability and rather straightforward activity and support. L.Fledgling et. al [11] analyzed breeze and sun based age sources and reasoned that a significant part of the variety in sun based vitality yield over the span of the day and the year can be broke down without any problem. Yet, the vulnerability and changeability sun powered age can present difficulties for lattice administrators. CIGRE B4-52 Working Group proposed DC matrix for transmission of vitality from sustainable power source assets, as the association of huge scope sustainable sources to the force matrix is an immense test for the conventional electrical hardware, framework structure and activity. Additionally, the age hardware of the sustainable power sources and vitality stockpiling gadgets normally contain DC transformation stages and the delivered electrical vitality is conveyed to the force lattice through DC/AC stages, bringing about extra vitality misfortune. The different strategies to separate key recurrence positive grouping voltages are utilizing indent channels, summed up fell defer signal crossing out based strategies and so forth This paper proposes control of UPQC by altered p-q hypothesis based procedure wherein the essential positive succession voltages are extricated utilizing strategy. The shunt VSC (Voltage Source Converter) makes up for part of burden responsive force and furthermore infuses genuine force got from the SPY cluster into network. The reference voltage for the DC transport is gotten from most extreme force point following calculation. The arrangement converter works with the end goal that a piece of receptive burden power is shared by the arrangement converter under list and ordinary working conditions in this manner diminishing VA stacking on the shunt VSc. The framework is recreated utilizing Matlab-Simulink and its dynamic execution is tried under states of illumination variety, voltage droops/swells, mutilations and so on.

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The force framework is exposed to stack changes frequently. The unexpected excursion or blackout of the heap may cause ascends in the voltage which is called as swell. A solitary Line to Ground issue is set in the framework to make unbalance in the source voltage and burden voltages also.

The arrangement converter is utilized primarily for voltage remuneration as it possibly it infuses the voltage in to the framework or draws the voltage from the primary framework and shunt converter is utilized for load side pay which either infuses the current into or takes the current from, the fundamental circulation framework. The shunt converter additionally controls the regular DC-interface voltage and furthermore it goes about as Active Power Filter which repays the present sounds. It adjusts the receptive force and improves the force nature of the dissemination framework. The nitty gritty depiction of control procedures is introduced.

III. ANALYSIS OF DC-DC CONVERTERS

The converter had huge transformers and inductors making it cumbersome. The presentation of some DC-DC converters for car application has been looked at. Be that as it may, these converters were intended for an electric vehicle and thus took care of the fundamental drive engine as it were. Furthermore, conventional delicate exchanged thunderous converters were not thought of. Because of the sinusoidal conduct of full converters, their exchanging misfortunes are tremendously decreased. Subsequently, it is conceivable to work these converters at high frequencies and in this manner decrease the size of their responsive parts. Therefore, a few of the present resounding DC-DC converters work in megahertz recurrence go. The arrangement and equal thunderous converters are fundamental resounding converter geographies. For the most part, the thunderous tank comprises of just two vitality stockpiling components. Contrasted and the traditional second request resounding converters, higher request converters are appeared to have more alluring attributes.

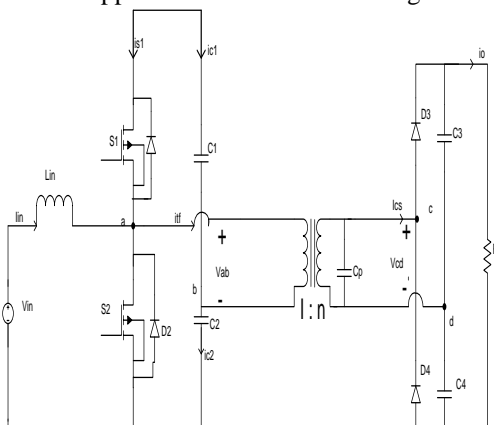


Fig 1.0 Schematic of proposed Isolated Soft switching Current fed LCC-T Resonant DC-DC converter

There has been an expanded enthusiasm for the utilization of sustainable power sources, which is because of the constraints in petroleum product holds and to planet contamination. The examination in the new wellsprings of vitality, for example, photovoltaic, wind and energy units

can be utilized to upgrade the wellbeing, dependability and manageability of the planet, since they are earth benevolent, profoundly proficient and sustainable cycles. Especially energy components show up in this setting as an appealing force source since they create power from hydrogen through an electrochemical cycle, which is basically liberated from outflows and clamor and just water and warmth are the side-effects. Likewise, they present a few focal points, for example, quiet, high potential for cogeneration applications, versatile to a wide scope of intensity and applications.

The principle reason for wind turbines is to produce vitality utilizing the breeze. Henceforth, the optimal design is a significant piece of wind turbines. The breeze turbine streamlined and drive train square contains both the whole mechanical portrayal of the breeze turbine including the pitch drive and the streamlined model that depicts the change of wind speed to mechanical force [1]. As indicated by the applications, there are a few DC to DC converters that are utilized to balance the information voltage. For the most part, there are two kinds of DC to DC converters which are confined DC to DC converter and non-segregated DC to DC converter. The information and yield of detached DC to DC converter are confined additionally relying upon the electrical hindrance.

This is finished by utilizing high recurrence transformer. Ensuring the touchy burden is the significant bit of leeway of disengaged DC to DC converter [4].

Either positive or negative extremity can be utilized for designing the converter yield. The issue is it has high impedance commotion capacity. The electrical obstruction is missing if there should arise an occurrence of non-secluded DC to DC converter. The non-segregated DC to DC converters are ease and basic structure contrast with the secluded DC to DC converters. Five sorts of non-disconnected DC to DC converters are introduced in this paper. To concerning solid exchanging procedures control, higher efficiencies and issue open minded arrangements, various topologies of DC to DC converters are created and they dependent on sustainable power source applications [5]. In this area a short correlation between the distinctive non disconnected DC to DC converters dependent on hypothetical execution utilizing MATLAB. There are diverse trademark properties for every converter in different angles. With most extreme force point following calculation, buck lift, DC to DC converters are read for photograph voltaic frameworks. In this area, singular exhibitions of DC to DC converters are introduced for ideal working point.

IV. PROPOSED SYSTEM

For a converter to be used in automotive application, the converter must be compact so that least space is occupied by the converter in an already limited volume. In converter technical terms, we know that the size of the converter is mainly dictated by the size of the reactive elements, especially inductor. Hence, for a converter to be as compact as possible, the number of inductive elements must be minimum.

Therefore, all LLC and isolated topologies which use transformers are not considered. Thus, only LLC topologies are considered for analysis and implementation. Arrangement of one inductor and two capacitors in various possible combinations results in 18 possible topologies. The analysis of LLC topologies is well documented in literature. However, only one topology has been analyzed in all the references quoted and hence the motivation behind the analysis of remaining LLC topologies is particularly for their suitability in automotive application.

$$V_{ab} = \{V_{c1} = d \cdot \frac{V_{in}}{1-d}; S1_{on} \& \dots(1)$$

$$V_{c2} = -V_{in}; S2_{on} \dots(2)$$

$$V_{ab} = \frac{2 \cdot V_{in} \cdot \sin(\pi d)}{\pi(1-d)} \dots(3)$$

$$\phi = -\frac{\pi}{2} + \pi d + \phi \dots(4)$$

The primary objective of this dissertation is to give a thorough and systematic analysis of the operation of the resonant converter, particularly the LLC resonant converter, whose topology has the potential to achieve high power density and high power efficiency for wide input range applications. Therefore, all LLC and isolated topologies which use transformers are not considered. DC interface voltage can be controlled utilizing corresponding proportional-integral (PI) controller, relative basic subordinate controller and fuzzy logic controller. DC interface is taken care from isolated voltage which is used to balance the DC-side voltage inside a specific range.

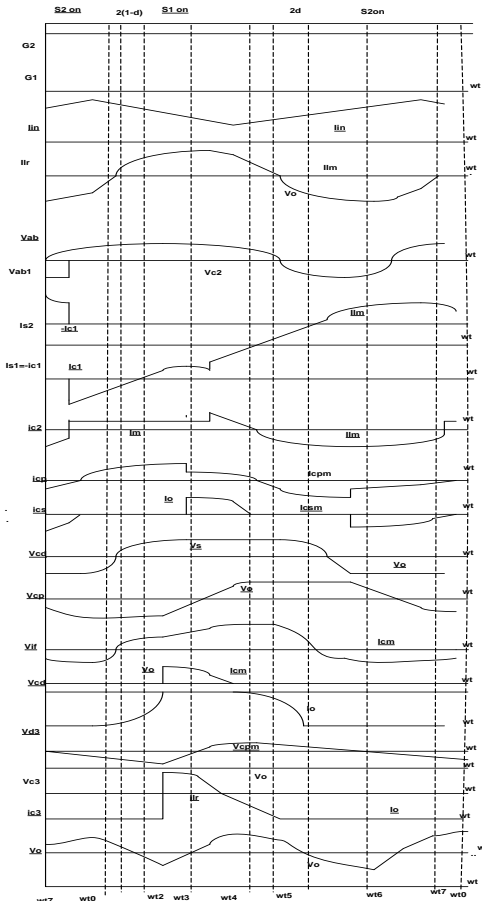


Fig 2.0 Operating modes of proposed current fed isolated LLC-T Resonant converter

In spite of the fact that the full converter is unrivaled in numerous angles with respect to control proficiency and force thickness, it isn't great. In light of its reverberation, which necessitates that the exchanging recurrence is practically identical to the thunderous recurrence, the resounding current and voltage waveforms display enormous waves inside exchanging cycle, though for PWM converter such varieties are moderately little. Accordingly, the pinnacle estimations of current or voltage swells decide the current/voltage worries over the converter parts, and in this way should be considered in choosing the segments.

$$V_{cdal} = -n \frac{I_{lm}}{\pi \omega C_p} [\pi + \sin \theta \cos \theta - \theta] \dots(5)$$

$$V_{cdb1} = n \frac{I_{lm}}{\pi \omega C_p} [\sin^2 \theta] \dots(6)$$

$$V_{csb1} = \frac{I_{lm}}{(1+\theta)\pi \omega C_s} [\sin \theta \cos \theta - \theta] \dots(7)$$

$$V_{csb1} = -\frac{I_{lm}}{(1+\theta)\pi \omega C_s} [\sin^2 \theta] \dots(8)$$

$$V_{cpa1} = I_{lm} \left[\frac{I}{wcp} + \frac{\sin \theta \cos \theta}{\pi wcp(1+\theta)} \right] \dots(9)$$

$$V_{cpv1} = I_{lm} \left[\frac{\sin^2 \theta}{\pi wcp(1+\theta)} \right] \dots(10)$$

$$V_{cp} = V_{cpcos}(\omega t) + V_{cpb1} \sin(\omega t) \dots(11)$$

The huge variety of the reverberation additionally builds the current flowing in the resounding tank, which expands the conduction misfortunes and may balance the upside of low exchanging misfortunes. This weakness will especially influence the effectiveness in light burden condition, which makes it hard to enhance the converter for a wide burden extend.

V. EXPERIMENTAL RESULTS

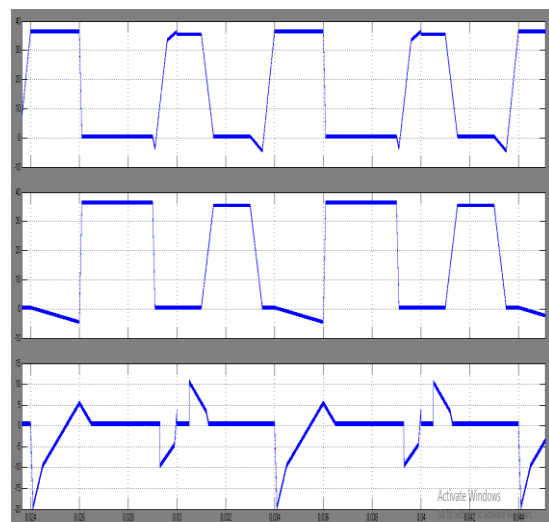


Fig.3 simulation results for converter subjected to wide load variations and input voltage variations

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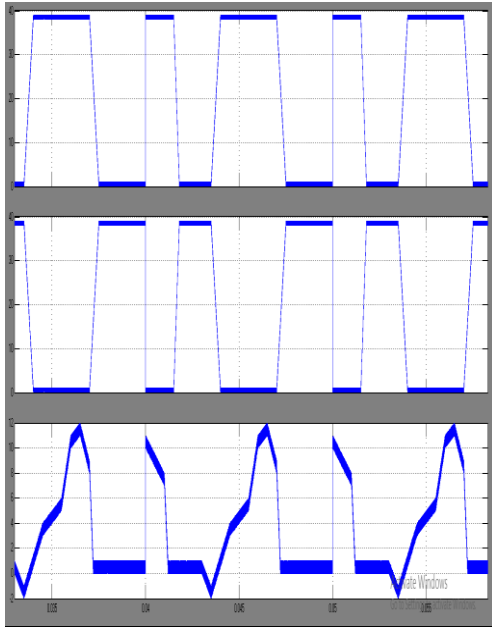


Fig.4 simulation results for converter subjected to wide load variations and input voltage variations

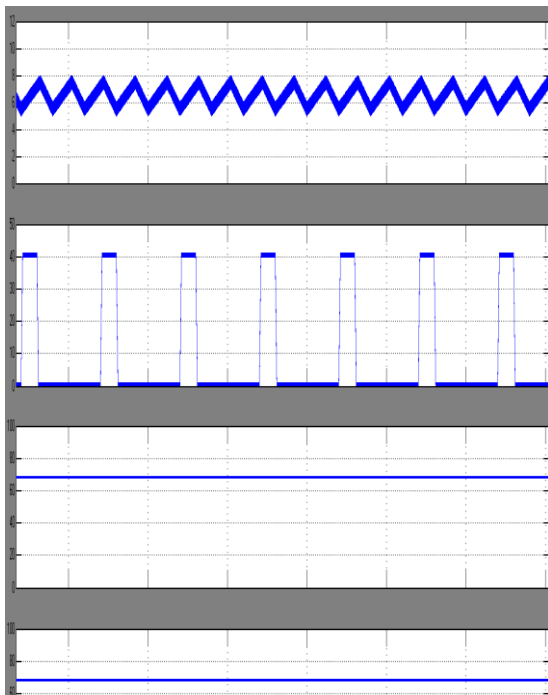


Fig.5 simulation results for converter subjected to full load variations and light load variations

VI. CONCLUSION

Hence in this paper, the design and evaluation of isolated soft switching current LCC-T Resonant DC-DC Converter for PV/Fuel cell applications was implemented. For the front end inverter switches, zero voltage switching (ZVS) is used for conversion. For voltage double diodes, Zero-Current Switching (ZCS) is used. Earlier, DC-DC converter provides high harmonic currents, so to overcome that, proposed converter is introduced. The proposed converter will improve the content of harmonic current based on the input variations and wide load. To get the required output voltage, transformer ration will be reduced. Because of the, for PV/ Fuel cell applications have better foot Print and high potential. The proposed converter operates in two modes

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AUTHORS PROFILE



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