PFC CONTROLLER FOR DC APPLICATION USING SEPIC CONVERTER

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ABSTRACT-SEPIC converter with a new active snubbed cell is proposed. This snubbed circuit provides ZVT turn on and ZVS turn off for the main switch. Also the auxiliary switches turn on with ZCS and turn off with ZVS this snubbed cell.SS operation conditions are maintained at very wide line and load range and no semiconductor component has an additional voltage stress .The current stress of the auxiliary switch is reduced through transferring of SS energy to the output.There is no additional current stress on the main switch. In this study the operating principle of the new ZVT PWM DC-DC converter presented and its operation is verified with is piece simulation software for a 1kw and 100 KHZ modal.

I . INTRODUCTION

Energy consumption has been increasing by the effect of technological developments and rising prosperity, therefore energy should be used more efficiently and economical. The increasing nonlinear loads draw harmonic currents which causes failures and corruptions on sensitive devices which connected to the grid. Thus, energy should be used in a quality manner, too. There are international mandatory standards about power factor and harmonics in terms of the use of energy with high quality and efficiency.

Therefore, to cope with these standards, device manufacturers use various techniques known as Power Factor Correction (PFC) circuits. Power factor can be improved by means of bulk passive filter or very complex and expensive active filters, but nowadays academic and industrial applications focused on high frequency AC-DC converter based PFC circuits. Different approaches have been proposed to improve efficiency and quality of energy by using PFC.

In order to solve the problems of the boost converter operating in CCM, a lot of papers have been proposed in the literature .Although these studies are successful and provide most of the desired properties, they still have some drawbacks. When MOSFET is used as a power switch, discharge loss of the parasitic capacitor becomes important in basic ZVT technique providing the recovery of parasitic capacitor energy an anti-parallel diode to the main switch, an auxiliary switch and an inductor are used for the aim of active suppression. In this circuit, main switch is turned-on perfectly with ZVT and main diode is turned off with ZCS.

II . EXISTING SYSTEM

A new SEPIC converter with an active snubber cell is proposed. The active snubber cell provides main switch to turn ON with zero-voltage transition (ZVT) and to turn OFF with zero-current transition (ZCT).

The converter incorporating this snubber cell can operate with soft switching at high frequencies. Also, in this converter all semiconductor devices operate with soft switching. There is no additional voltage stress across the main and auxiliary components.

DRAWBACKS

High current is required by the equipment due to which the economic cost of the equipment increases.

At power factor correction the current is high which gives rise to high copper losses in the system.

Therefore the efficiency of system is reduced

III . PROPOSED SYSTEM

A new SEPIC converter with an active snubber cell is proposed, in the proposed circuit, a lower current stress on the auxiliary switch and ZVT operation of the main switch is achieved.

However to reduce the current stress on the auxiliary switch a transformer with a high magnetizing inductance is used and so the auxiliary switch turns off hardly, under this magnetizing current.

`Also a high valued capacitor and a resistance is used to reset the is magnetizing energy and th auxiliary switch and the auxiliary diode has b additional voltage stress.

Most of the SS energy stored in the snubbe inductance is transferred to the output through transformer and so current stress of the auxiliar switch is also reduced.

ADVANTAGES

Reduced demand charges.

Increased load carrying capabilities in existin circuit.

Improve voltage. Reduce power system loss.

Reduce carbon foot print.

IV . BLOCK DIAGRAM

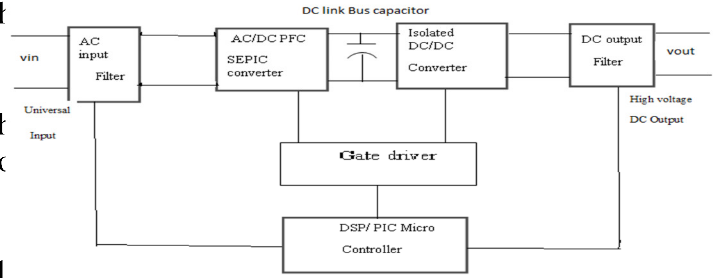

Fig: Block Diagram

The input line filter consists of an electronic circuit connected between the ac mains and the rectifier input stage of the switching power supply. All the input ac an effective filter should therefore attenuate all the higher frequencies and only let the mains 50Hz or 60 Hz pass through to the next stage. Voltage must pass through the filter before reaching the rectifier. The input line filters are incorporated in most switched mode power supplies to reduce the interference from the electromagnetic and other electrical noises present in the ac lines.

Preventing the EMI signals generated within the power supply from reaching the input ac power line and affecting other equipment connected on the same line. Preventing high frequency voltage and EMI on the power line from passing through and reaching the supply's output. The design and component selection of the input filter is important in ensuring that it does not unnecessarily increase the volume and cost of the supply or compromise the power supply performance. Even though there are various filter designs with different characteristics and effects on power supply performance, the passive L-C filter achieves both the filter functions above while still offering the best balance between size, cost and performance. However, passive filters may introduce undesirable effects, it is therefore important to understand the load and use the appropriate filter design. The L-C passive filters may father be classified according to the design and characteristics. The common types include the undamped LC filter, parallel damped filter and serie damped filter.

TRANSFORMER

The potential transformer will step down th power supply voltage (0-230) to(0-6v) level .The the secondary of the potential transformer will b connected to the precision rectifier, which the help c op-amp. The advantages of using precision rectifie are it will give peak voltage output as DC; rest of th circuits will give only RMS output.

BRIDGE RECTIFIER

When four diodes are connected as shown i figure, the circuit is called as bridge rectifier. Th input to the circuit is applied to the network, and th output is taken from the remaining two corners. Le us assume that the transformer is working properl and there is a positive potential, at point A and negative potential at point B. the positive potential a point A will forward bias D3and reverse bias D4.Th negative potential at point B will forward bias D1an reverse D2.At this time D3 and D1 are forwar biased and will allow current flow to pass throug them ; D4 and D2 are reverse biased and will bloc current flow. The path for current flow is fror point B through D1, up through RL, Though D3 through the secondary of the transformer back t point B. this path is indicated by the soli arrows.(1)and (2) can be observed across D1and D2

One-half cycle later, the polarity across th secondary of the transformer reversed, it forwar bias D2 and D4 and reverse bias D1and D3.currer flow will now be from point .A through D4 u through RL through the secondary of T1,and back t point A. This path is indicated by the broken arrow Waveform (3) can be and (4) observed arrows D and D4.The current flow through RL is always in th direction. In flowing through RL this currer develops a voltage corresponding to that show waveform (5).Since current flows through the load (RL) during both half cycle s of the applied volt this bridge rectifier is a full-wave rectifier. One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produce a voltage output that is nearly twice that of the convention full-wave.

The maximum voltage that appears across the load resistor is nearly-but never exceeds-500volts, as result of the small voltage drop across the diode .In the bridge rectifier shown in B, the maximum voltage that can be rectified is the full secondary voltage which is 1000 volts. Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

IC VOLTAGE REGULATORS

Voltage regulator comprises a class of widely used ICs. Regulator IC units contain the circuitry for reference source ,comparator amplifier control device, and overload production all in a single IC.IC units provide regulation of either a fixed negative voltage ,or an adjustably set voltage. The regulator can be selected for operation with load currents form hundreds of mille amperes to tens of ampere, corresponding to power rating from mille watts to watts. A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, form a second terminal, with the third terminal connected to ground.

The series 78 regulators can be selected for positive regulated voltage form 5to24 volts. Similarly, series79 regulator provides fixed negative regulated voltage form 5to24 volts. The regulators can be selected for operation with load currents form hundreds of mille ampere to tens of ampere, corresponding to power rating form mille watts to tens of watts.

DC-AC SEPIC CONVERTER

In DC-DC switching converters of the single-ended primary inductance (SEPIC) type, using a high frequency transformer to isolate the load from the AC power line is difficult because its leakage inductance causes serious circuit problems. In this invention, an additional coupling capacitor provides the required DC isolation without affecting circuit performance. The total coupling capacitance may be chosen to limit the power line frequency leakage current to a safe value.

DISCRIPTION

FIELD OF THE INVENTION This invention pertains to DC--DC switching power supplies and, in particular, to obtaining power line isolation between input and output in SEPIC power supply.

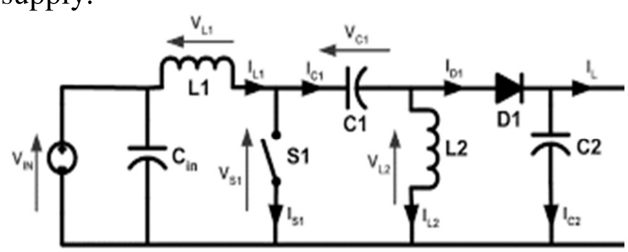

Fig: Sepic converter

A very common need in electronics is converting AC power line energy to DC power to supply an electronic circuit as a load. In addition, it is often necessary to regulate the DC power: that is, to maintain the load voltage approximately constant in spite of variations in the power line voltage and the load current. Series regulators--in effect, controllable resistances in series with the load--have given place, in many applications, to switching regulators. In these regulators, the power line voltage is rectified to DC, which is then switched into various inductors and capacitors at a frequency hundreds or thousands of times higher than the power line frequency. Theses reactance alternately absorbs power line energy and delivers it to the load in a manner which is controlled to provide a constant load voltage.

Isolated DC-DC Converter

This "isolation" refers to the existence of an electrical barrier between the input and output of the DC-DC converter. The simplest example of a non isolated "converter" is the popular LM317 three terminal linear regulators. One terminal for unregulated input, one for the regulated output and one for the common

A rectifier can take the shape of several different physical forms such as solid-state diodes, vacuum tube diodes, mercury arc valves, silicon-scontrolled rectifiers and various other silicon-based semiconductor switches.

Rectifiers are used in various devices, including:

- DC power supplies
- Radio signals or detectors
- A source of power instead of generating current
- High-voltage direct current power transmission systems
- Several household appliances use power rectifiers to create power, like notebooks or laptops, video game systems and televisions.

Almost all rectifiers contain more than one diode in particular arrangements. A rectifier also has different waveforms, such as:

- Half Wave: Either the positive or negative wave is passed through or the other wave is blocked. It is not efficient because only half of the input wave form reaches the output.
- Full Wave: Reverses the negative part of the AC wave form and combines it with the positive

V. CIRCUIT DIAGRAM:

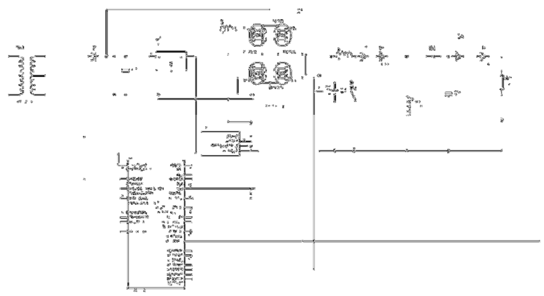

Fig: Circuit diagram

POWER SUPPLY

The present chapter introduces the operatio of power supply circuits built using filters, rectifiers and then voltage regulators. Starting with an a voltage, a steady dc voltage is obtained by rectifyin the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed d voltage , the regulation is usually obtained from a IC voltage regulator unit, which takes a dc voltag and provides a somewhat lower dc voltage, whic remains the same even if the input dc voltage varies or the output load connected to the dc voltag changes. A block diagram containing the parts of typical power supply and the voltage at variou points in the unit in shown in fig. the ac voltage typically120 v RMS, is connected to a transforme which steps that ac voltage down to the level for th desired dc output. A diode rectifier then provides full-wave rectified voltage that is initially filtered by simple capacitor filter to produce a dc voltage .this resulting dc voltage usually has some ripple or ac voltage variation .A regulator circuit can use this dc input to provide a dc voltage that not only has much less ripple voltage but also remains the same dc value even if the input dc voltage varies somewhat ,or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of a number of popular voltage regulators IC

TRANSFORMER

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VI . SEPIC CONVERTER

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GATE DRIVER

A gate driver is a power amplifier that accepts a low-power input from a controller IC and produces a high-current drive input for the gate of a high-power transistor such as an IGBT or power MOSFET. Gate drivers can be provided either on-chip or as a discrete module.

MICROCONTROLLER

A microcontroller is a complete microprocessor system built on a single IC. Microcontrollers were developed to meet a need for microprocessor to be put into low cost products. Building a complete microprocessor system on a single chip substantially reduces the cost of building simple products, which use the microprocessor's power to implement their function, because the microprocessor is a natural way to implement many products. This means the idea of using a microprocessor for low cost products comes up often. But the typical 8-bit microprocessor based system, such as one using a Z80 and 8085 is expensive. Both Z80 and 8085 system need some additional circuits to make a microprocessor

VII. CONCLUSION

In this paper, a sepic converter is presented for PFC applications. In the proposed new converter, the main switch is turned-on perfectly with ZVT and turned-off under ZVS. The auxiliary switch is turned-on under ZCS and turned-off with ZVS. All diodes are operating under SS. By using a transformer, during ZVT operation the switching energies are transferred to the output, and so the current stresses of the auxiliary components are significantly decreased. Also, this transformer ensures the usage of sufficient capacitors for ZVS turning off of the main and auxiliary switches. The main switch and the main diode are not subjected to any additional voltage and current stresse.

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