Designing of Switched Mode Power Supply

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Abstract- *Switched Mode Power Supply (SMPS) is an integral part of the computer that converts ac to multiple numbers of suitable dc voltages to impart power to different parts of the PC.DC-DC converter is an intermediate stage in the power conversion. Poor power quality, slow dynamic response, high device stress, harmonic rich, periodically dense, peaky, distorted input current are the major problems which are frequently encountered in the conventional switched mode power supplies (SMPSs) . This violates the limits of international power quality (PQ) standards such as IEC 61000-3-2. Using Matlab tool, power factor of different DC-DC converters are analyzed in this paper and a better counterpart is suggested. In this paper Buck, Boost, Buck-Boost, SEPIC Cuk and Zeta converters are analyzed. The performance analysis is done using MATLAB/SIMULINK software. The proposed converters have been designed for achieving an improved power quality operation with low amount of total harmonic distortion (THD) of supply current.*

Keywords- Switched mode power supplies(SMPS), Power Factor correction(PFC) Converter, Power Quality, DC-to-DC Converters

I. INTRODUCTION

In recent years, the switching mode power supply (SMPS) system have been achieved the high power density and high performances by developed power semiconductor devices such as IGBT, MOS-FET and SiC. However, using the switching power semiconductor in the SMPS system, the problem of the switching loss and EMI/RFI noises have been closed up. This course produced the EMC limitation like the International Special Committee on Radio Interference (CISPR) and the harmonics limitation like the International Electro technical Commission (IEC). For keeping up with the limitation, the SMPS system must add its system to the noise filter and the metal and magnetic component shield for the EMI/RFI noises and to the PFC converter circuit and the large input filter for the input harmonic current. On the other hand, the power semiconductor device technology development can achieve the high frequency switching operation in the SMPS system. The increase of the switching losses have been occurred by this high frequency switching operation. Of course, the inductor and transformer size have been reduced by the high frequency switching, while the size of cooling fan could be huge because of the increase of the switching losses. Our research target is to reduce the EMI/RFI noises and the switching losses in the SMPS system by only one method. The solution method is the soft switching technique. Using LC resonant phenomenon, this technique can minimize the switching power losses of the power semiconductor devices, and reduce their electrical dynamic and peak stresses, voltage and current surge-related EMI/RFI noises under high frequency switching strategy. Thus, a new conceptual circuit configuration of the advanced forward type soft switching DC-DC converter which has the neutral point inductor connected auxiliary

The four major categories are:-

- AC to DC
- DC to DC
- DC to AC
- AC to AC

II. LITERATURE REVIEW

P. Vijaya Kumar and Dr. S. Rama Reddy[1] Explained that Switch mode power supply is an electronic power supply that incorporates a switching regular to convert electrical power . Switch mode power supply is an electronic device that converts power using switching devices that are turned on and off at high frequencies , and storage components such as inductors or conductors to supply power when the switching device is in its non conduction state. Switching power supplies have high efficiency and are widely used in a variety of electronic equipments including computers and other sensitive equipments requiring stable and efficient power supply.

Stephy Mathew , Nayana J. [2]Switched Mode Power Supply (SMPS) is an integral part of the computer that converts ac to multiple numbers of suitable dc voltages to impart power to different parts of the PC.DC-DC converter is an intermediate stage in the power conversion. Poor power quality, slow dynamic response, high device stress, harmonic rich, periodically dense, peaky, distorted input current are the major problems which are frequently encountered in the conventional switched mode power supplies (SMPSs) . This violates the limits of international power quality (PQ)

standards such as IEC 61000-3-2. Using Matlab tool, power factor of different DC-DC converters are analyzed in this paper and a better counterpart is suggested. In this paper Buck, Boost, Buck- Boost, SEPIC Cuk and Zeta converters are analyzed. The performance analysis is done using MATLAB/SIMULINK software. The proposed converters have been designed for achieving an improved power quality operation with low amount of total harmonic distortion (THD) of supply current.[1].

Danjiang Chen and Qiaowen Zhang[3]In some cases the input voltage of a switching mode power supply (SMPS) is lower than a normal value. Therefore, a new SMPS with wide range input voltage based on boost and flyback converters is presented in this paper. There are two working modes include low-voltage-mode and universal-voltage-mode. In low-voltage-mode where the input voltage is lower than a given value, this input voltage will be stepped up by a boost converter controlled by L6561 firstly, and then a flyback converter which is controlled by TOPSwitch will convert this voltage to an expected one. In universal-voltage-mode where the input voltage is higher than the given value and in a universal range, this voltage will be connected to flyback converter directly. Which working mode is selected as the current mode is determined by a hysteresis comparator. The experimental result shows that when input voltage is about 25 to 265 AC voltage, the output voltage of this SMPS is stable with good electrical performance.

III. PROBLEM FORMULATION

There are lots of problems comes in our project. Like find out the elements used in our project, Research paper , format editing ,etc. SMPS - Switched Mode Power Supply. An SMPS is a Device to efficiently provide a regulated output voltage, from different level of the input voltage.S MPS transfers power from a source like the electrical power grid to a load (Eg: Computer).Stability is the main problem which comes in our project . In stability the problem come is to stable the power supply. Controllability is also the main problem .

A. MOTIVATION

There are several good reasons for developing a SMPS but for us our motivation is to make a good ,stable SMPS(Switched mode power supply)and easy to buy . We motivated after watching youtube videos. We also talked with our teachers. They always motivate us to do something new.The benefit of creating the SMPS is to convert AC into DC voltage.

B. OBJECTIVES

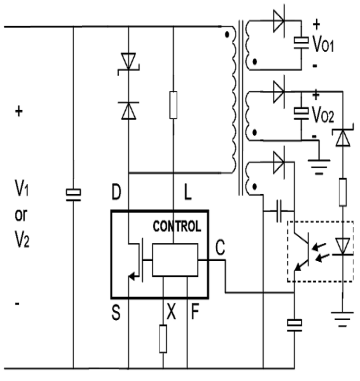
The main objective of the project are :-

- It can be used for controlling the voltage.
- It can be used for converting the AC into DC.
- It has small size and easy to use.
- It has greater efficiency.
- It is used for the improvement of power factor.

IV. METHODOLOGY

A. HARDWARE

Design of flyback converter. When the input voltage VAC is lower than 90V, the input voltage of flyback converter is the output voltage of Boost converter, which is 140VDC constantly. When the input AC voltage is higher than 90V, the flyback converter works alone, so the input range of the flyback converter can be set 90-265V. As a result, when the range of input AC voltage is 25-265V, the flyback converter can always work properly[4]. The flyback converter adopts PI's fourth-generation single-chip switching power supply TOPSwitch-GX, whose maximum output power is about 290W. The chips integrated high-voltage power MOSFET, PWM control, fault protection and other control circuits. Figure1 shows the circuit diagram. And it also has function of soft start to eliminate overshoot and reduce the stress of the device, small EMI, under-voltage protection and over-voltage shutdown, programmable current limit and the unique technique of automatic frequency down when light-load.



Flyback converter schematic

Figure1: circuit diagram

B. COMPONENT USED

1. **Rectifier and Filter:** Rectifier is an electrical device which converts an alternating current into a direct one by allowing a current to flow through it in one direction only and filter is used to reduce the interference from the electromagnetic and other

electrical noises present in the ac lines. The filters are also used to ensure that the power supplies comply with government regulations and agency standards.

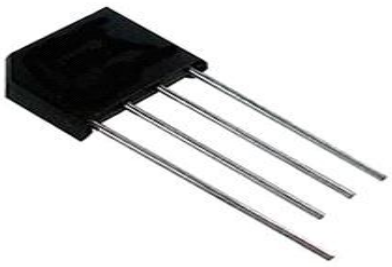


Fig1:- Rectifier

2. **High Frequency Switch :**Switching power loss increases with output current and input voltage level, and is proportional to switching frequency. High frequency switch is used to switching the frequency.

Fig2:- high frequency switch

3. **Transformer:** A step down transformer has less turns on the secondary coil that the primary coil. The induced voltage across the secondary coil is less the applied voltage across the primary coil or in other words the voltage is "stepped-down".

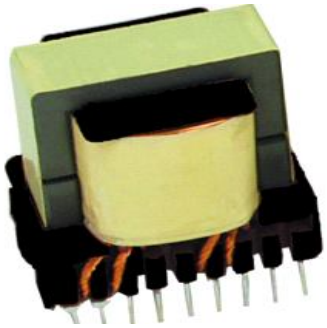


Fig3:- transformer

4. **PWM Oscillator:** The simplest way to generate a PWM signal is the intersective method, which requires only a sawtooth or a triangle waveform (easily generated using a simple oscillator) and a comparator.

C. PROCEDURE

Step 1. Determine system requirements: VACMAX, VACMIN, fL, VO, PO, η, Z

- Maximum AC input voltage, VACMAX: in volts.
- Minimum AC input voltage, VACMIN: in volts.
- Line frequency, fL: 50 H
- Output voltage, VO: in Volts.
- Output power: PO: in Watts.

Table1: Shows VACMIN/VACMAX

Input (VAC)	VACMIN (VAC	VACMAX (VAC)
Universal	85	265
230 or 115 with doubler	195	265

Step 2. Choose feedback circuit and bias voltage VB based on output requirements

- Use primary feedback for lowest cost (for low power applications only).
- Use Opto/Zener for low cost, good output accuracy.
- Use Opto/TL431 for best output accuracy.
- Set bias voltage VB according to Table 2.
- Choose optocoupler from Table 2.

Table2: Shows feedback circuit parameters

Feedback Circuit	VB (v)	Circuit Tolerance	Load Reg.	Line Reg.	Total Reg.
Pri./Basic	5.8	±10%	±5%	±1.5 %	±16.5 %
Pri./Enhan.	27.8	±5%	±2.5 %	±1.5 %	±9%
Opto/Zener	12	±5%	±1%	±0.5 %	±6.5%
Opto/TL431	12	±5%	±0.2 %	±0.2 %	±1.4%

Step 3. Determine minimum and maximum DC input voltages VMIN, VMAX and input storage capacitance CIN based on AC input voltage and PO.

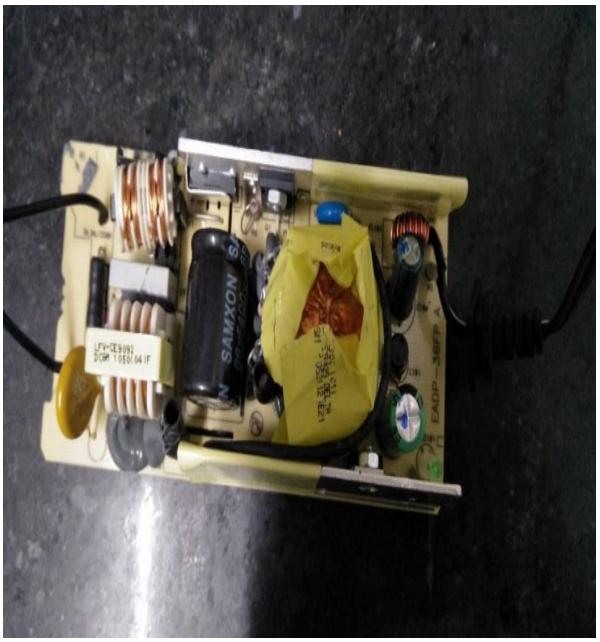
- Set bridge rectifier conduction time, tC = 3 ms.
- Derive minimum DC input voltage VMIN.

- Calculate maximum DC input voltage VMAX:
  Vmax= √2*Vacmax.

V. RESULT

In this project we studied the stability and control of the SMPS. The main advantages of smps is greater than the linear regulator. It help us to improve the power factor. The main use of SMPS is converting the AC voltage into DC voltage. SMPS has lower weight , smaller size. Etc. After completing our project look like this.

ACTUAL VIEW OF PROJECT



VI. CONCLUSION

A kind of novel switching power supply was presented with wide range of input voltage. When the input voltage is low, the Boost converter and the flyback converter work together. And when the input voltage is high, only the flyback converter works. The experiment results show that the input AC voltage in the range 25-265V, and the output voltage has remained stable, which proves the method is correct.

VII. ACKNOWLEDGEMENT

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