POWER FACTOR CORRECTION USING INTERLEAVED BOOST CONVERTER BASED ON FUZZYLOGIC

N.Prasad, K.Muthuvel

Assistant Professor, Department of Electrical and Electronics Engineering, Nandha College of Technology, Tamil Nadu, India

Assistant Professor, Department of Electrical and Electronics Engineering, Nandha College of Technology, Tamil Nadu, India

ABSTRACT

Power factor is the major phenomenon for electrical engineers and for the consumer to maintain it near to the unity. Power factor is defined as the ratio of active power to the reactive power. Power factor is basically a cosine angle between voltage and current. It must be maintained near to unity. If power factor lags or lead behind the minimum and maximum value means it affects the consumer and the electricity board. In this paper, we proposed a system to improve the power factor nearly to unity. In this system, we use a interleaved boost converter to correct the power factor by providing duty cycle from the controller. From this we make the system after the supply to act as a resistive load, for which the power factor will be unity.

KEYWORDS:- *Interleaved boost converter, Fuzzy Logic, Power factor*

1. INTRODUCTION

This paper mainly designed to correct the power factor which is mainly affected by the use of electronic load in the circuit. The electronic load was mainly composed of rectifier to convert AC voltage waveform to DC voltage waveform. But the output of the rectifier will not be in pure DC form and it may have some ripple on its output. To obtain the pure DC, filter capacitor called as a reservoir capacitor was used after the rectifier in a circuit. Because of the use of reservoir capacitor in a circuit causes the distorted current waveform for the sinusoidal voltage waveform in the input side. To rectify the distorted current waveform, we are using the interleaved boost converter after the rectifier circuit. The duty cycle for the interleaved boost converter is given through the fuzzy logic controller, which compares the reference voltage from the rectifier output and output voltage from the output of the interleaved boost converter to produce the pulse as a duty cycle to the interleaved boost converter which maintains the power factor of the circuit in a good level with the change of the load.

In this system of Parallel Operation Modular Power Factor Correction Circuits proposed by Chin S. Moo, Hung L. Cheng, and Ping H. Lin has said that the parallel operation of modular power factor correction circuits is illustrated. The modular units using boost converters are operated at a constant frequency with variable duty ratio. Flexible load demand is met by changing the number of operating modules under the maximum current limit. The operating modules have the same frequency and duty-ratio, but are equally phase-shifted to each other by a fraction of the switching period to reduce the ripple content and to increase the ripple frequency of the input current. With this phase-shifted control strategy, balanced current sharing among modules can be achieved by operating the boost converters at discontinuous current mode, without the need of extra current control circuit**.**

Also in this existing system the Design of Boost Power Factor Correction Converter Using Optimization Techniques proposed by Sergio Busquets-Monge, Jean-Christophe Crebier, Scott Ragon, Erik Hertz, Dushan Boroyevich, Zafer Gürdal, Michel Arpilliere, and Douglas K. Lindner. This paper presents an approach to continuous variable design optimization of a power electronics converter. The objective of the optimization approach is to minimize the total component cost. The methodology is illustrated with the design of a boost power factor correction front-end converter with an input electromagnetic interference filter. The system design variables are first identified. The relevant system responses and component costs are then expressed as a function of these design variables. Finally, by using mathematical optimization techniques, the design variable values that minimize the total system component cost are obtained, given practical constraints on these design variables and system responses.

2. NEED FOR POWER FACTOR IMPROVEMENT

The low power factor results in

1) Increase of harmonics.
2) Increases the reactive power consumption.
3) Increases the electricity bill.
4) Current consumption is high.

It makes the consumer to pay bill for useless power, reactive power. Actually consumer will pay the bill for apparent power which is the addition of both the active and reactive power. Reactive power is a use less power which was increased by the use of capacitor in the circuits. If the reactive power consumption increased means the overall power consumption will also increases. This makes the consumer to pay amount for useless power. For this reasons power factor has to be improved.

3. BLOCK DIAGRAM OF OUR SYSTEM:

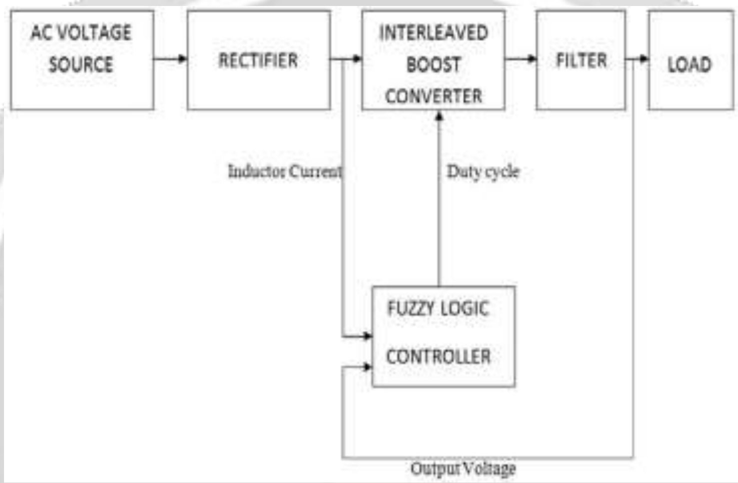

Fig-1: Block Diagram of the project

4. INTERLEAVED BOOST CONVERTER:

The interleaved boost converter is a dc-dc converter which is a parallel connection of two ordinary boost converter with the pulses 180° phase shifted between them. It consists of two MOSFET switches, two inductor and two diode circuitry. The 180° phase shift was provided to the MOSFET switches, by using pulse generator. This phase shift was attained by direct connection of pulse generator ton one switch and the inverse was connected to other switch. This interleaved boost converter was better than the ordinary boost converter because it produces the output waveform with fewer ripples than the ordinary boost converter and output gain from the interleaved boost converter is also high.

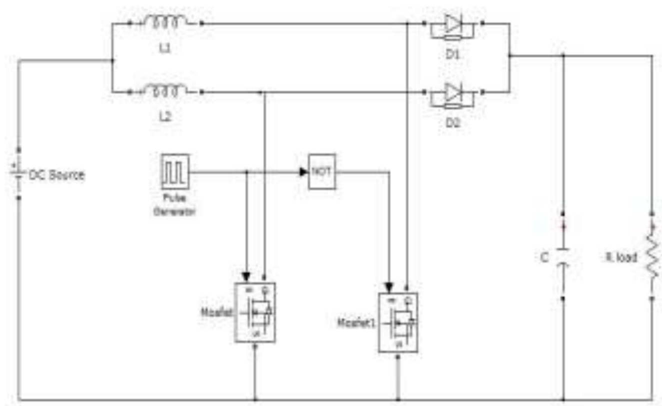

Fig-2: Interleaved Boost converter

4.1FIRST OPERATING STATE

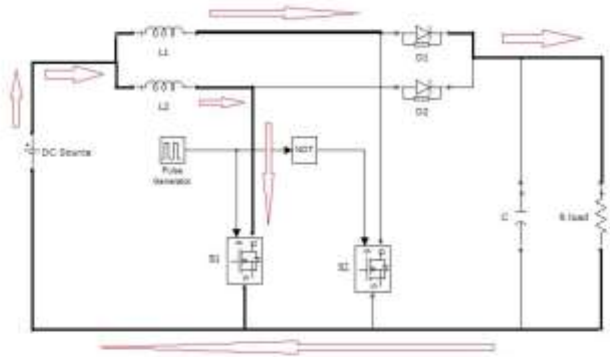

Fig-3: First operating stage

4.2SECOND OPERATING STATE:

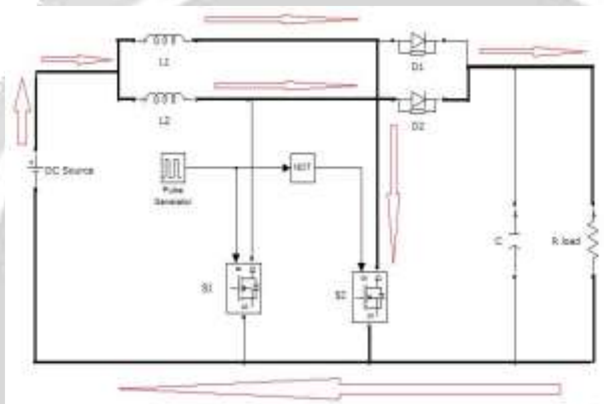

Fig-4: Second operating stage

5. FUZZY LOGIC CONTROLLER:

A fuzzy logic is a system of logic in which a statement can be true, false or any of a continuum values in between. The value may be lie between 0 to 1 and it may be any value. In the fuzzy logic controller the fuzzy input is given as the input to the fuzzy interface system. The fuzzy input is a confused state input. This fuzzy input is analyzed in the fuzzy interface system the crisp output is taken as the output. The purpose of the fuzzy logic controller is to provide a duty cycle to the interleaved boost converter to correct the power factor.

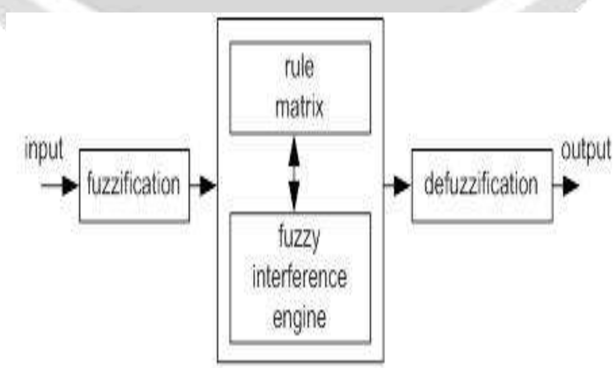

Fig-5: Fuzzy Inference System

6. VOLTAGE MODE CONTROL:

To frame rules for the fuzzy logic, the voltage mode control was used. In the voltage mode control, the output from the rectifier circuit is taken as a reference voltage is taken and compared with the output voltage of the load to produce a duty cycle. This duty cycle is provided to the interleaved boost converter to correct the power factor.

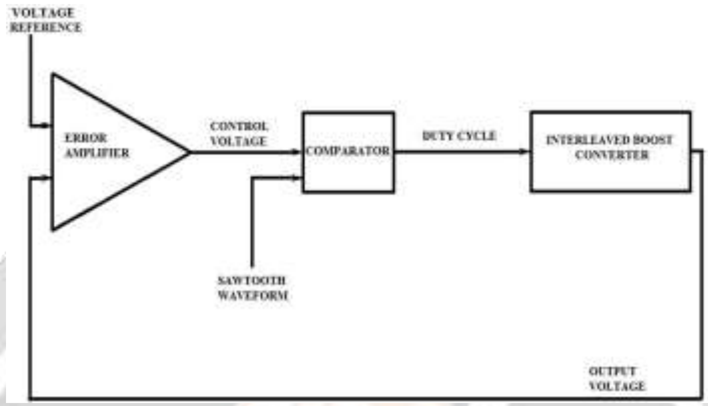

Fig-6: Voltage Mode control

Rectifier is a electronic device used in a circuit to convert the AC to DC voltage. The output of the rectifier will have a lot of ripple and the output will be not in pure DC. To get a pure DC waveform, filter called as a reservoir capacitor was used after the rectifier circuit. But this reservoir capacitor made the input current waveform to get distorted for the sinusoidal voltage waveform. This will affect the power factor and also increases the Total Harmonic Distortion value (THD). The problem identification was shown in fig.

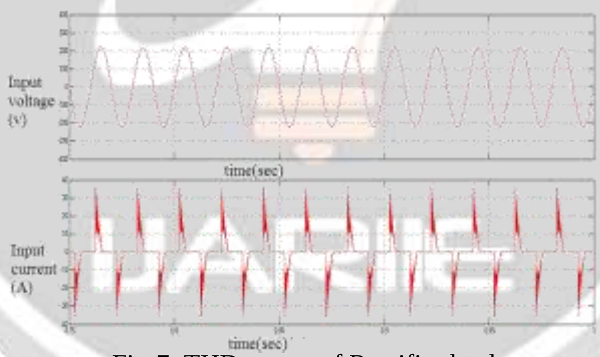

Fig-7: THD output of Rectifier load

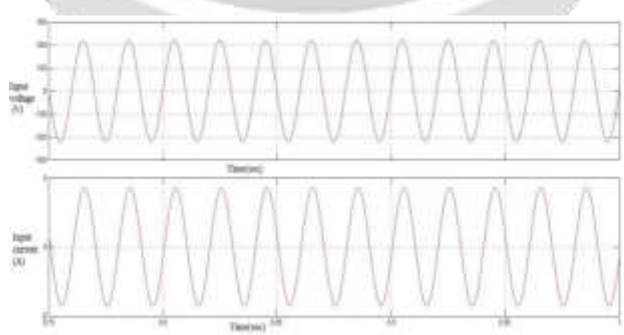

Fig-7: THD after Power factor Correction

This is the input voltage and current waveform of improved power factor by using interleaved boost converter based on fuzzy logic. This improves the power factor to 0.98.

7. CONCLUSION

As power factor is to be maintained near to unity because the poor power factor will made the consumer to pay extra amount to the electricity board and it also increases the losses. So our project is to correct the power factor improves the power factor to 0.98 which is near to the unity by using dc-dc boost converter based on fuzzy logic. This makes the output voltage ripple to be in minimum and also the stress in the switching is also increased.If this system is implemented then the power factor improves which in turn makes the input current to get in phase with the input voltage.

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