High-Power-Factor Buck Converter Using Fuzzy Control

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Abstract- *A buck power factor correction rectifier that substantially improves efficiency at low line of the universal line range is introduced. The proposed rectifier's efficiency is further improved. Moreover, the rectifier doubles its output voltage, which extends useable energy of the bulk capacitor after a dropout of the line voltage. The operation and performance of the proposed circuit was verified on a 700-W, universal-line experimental prototype operating at 65 kHz. The measured efficiencies at 50% load from 115 and 230 V line are both close to 96.4%. The efficiency difference between low line and high line is less than 0.5% at full load. A second-stage half-bridge converter was also included to show that the combined power stages easily meet Climate Saver Computing Initiative Gold Standard. In this method by using fuzzy logic control system, so improve the output voltage and also reduce the losses. Existing methods by using only PWM methods, PWM methods sometimes produce the noise. But Fuzzy logic control system does not produce any noise and also PWM methods only to operate at particular variables only. But Fuzzy logic control system operates at all variables. So when the fuzzy logic controls system using to improve the output efficiency.*

Keywords- buck converter, power factor correction (PFC), voltage doubler.

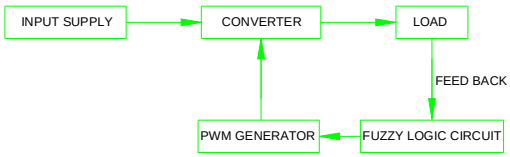
I. INTRODUCTION

T Driven by economic reasons and environmental concerns, maintaining high efficiency across the entire load and input-voltage range of today's power supplies is in the forefront of performance requirements. Specifically, meeting and exceeding U.S. Environmental Protection Agency's (EPA) Energy and Climate Saver Computing Initiative (CSCI) efficiency specifications have become a standard requirement for both multiple- and single-output offline power supplies. Generally, the EPA and CSCI specifications define efficiencies at 100%, 50%, and 20% of full load with peak efficiency at 50% load. For example, for the highest performance tier of single-output power supplies with a 12-V output, i.e., for the Platinum level power supplies, the required efficiencies at 100%, 50%, and 20% load, measured at 230 V line, are 92%, 94%, and 91%, respectively. The universal-line at 90–264 V applications.

Maintaining a high efficiency across the entire line range poses a major challenge for ac/dc rectifiers that require power factor correction (PFC). For decades, a bridge diode rectifier followed by a boost converter has been the most commonly used PFC circuit because of its simplicity and good PF performance. However, a boost PFC front-end exhibits 1%–3% lower efficiency at 100 V line compared to that at 230 V line. Environmental Protection Agency's (EPA) Energy and Climate Saver Computing Initiative (CSCI) efficiency specifications have become a standard requirement for both multiple- and single-output offline power supplies. Existing system by using rectification, buck converter, power factor correction (PFC), voltage doublers. By using Power factor correction equipment to improve the power factor. By using voltage doublers circuit to doubles its output voltage. Existing system by using PWM generator only, so PWM generator produce noise its one of the losses.

This drop of efficiency at low line can be attributed to an increased input current that produces higher losses in semiconductors and input electromagnetic interference filter components. So eliminating In this problem means by using fuzzy logic circuit to apply the input pulse at switches. When the fuzzy logic circuit using to improve the output voltage. Fuzzy logic control system does not produce any noise.

II. BLOCK DIAGRAM OF FUZZY CONTROL BASED BUCK CONVERTER

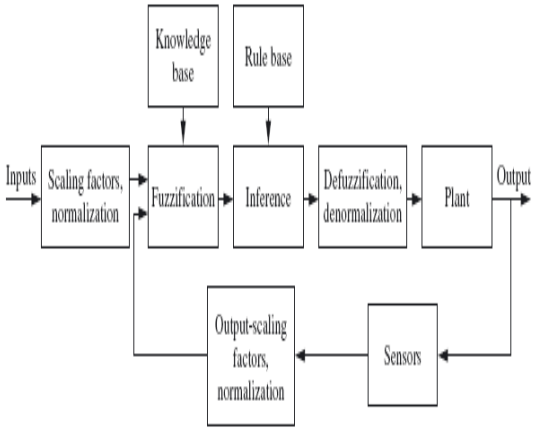


Buck converter also called as step-down converter produces a lower average output voltage then the input voltage, it is main application is in regulated DC power supply and DC motor speed control. Load will be a purely resistive load. Fuzzy logic is based on natural language. Main advantage of Fuzzy logic circuit is operate at all the single variables, input supply given to the converter circuit and

converter output to connected in load, at any variation of output voltage means suddenly to sense the variation in fuzzy logic circuit and Fuzzy output to connected in PWM generator.

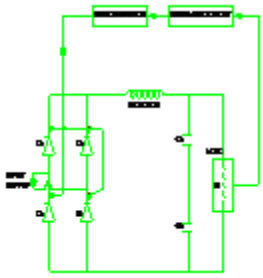
Main advantage of the Fuzzy logic circuit to maintain the output voltage of converter maintain constant.

III. FUZZY LOGIC CONTROLLERS



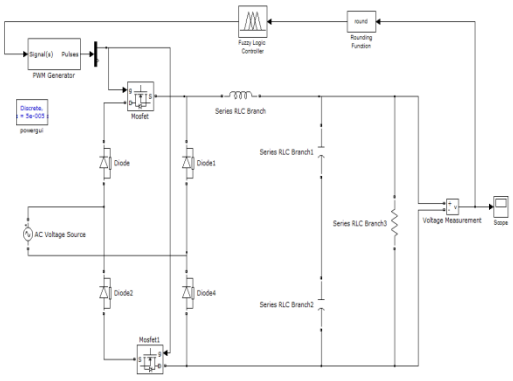
Fuzzy logic is based on natural language. The basis for fuzzy logic is the basis for human communication. This observation underpins many of the other statements about fuzzy logic. The last statement is perhaps the most important one and deserves more discussion. Natural language, that which is used by ordinary people on a daily basis, has been shaped by thousands of years of human history to be convenient and efficient. Sentences written in binary language represent a triumph of efficient communication.

IV. CIRCUIT DIAGRAM OF FUZZY CONTROL BASED BUCK CONVERTER



In this circuit by using C1 and C2 two capacitors, normally capacitor is leading power factor, so improve power factor at some level. From this circuit output voltage fully depends on the input voltage. Implemented Fuzzy logic control, to eliminate the voltage variation problems. By using C1 and C2 capacitor to doubles out put voltage and to improve the power factor. In this method the efficiency of around 98%.The voltage across capacitors C1 and C2 so that the voltage imbalance by the mismatched output inductor can be completely eliminated.

V. ANALYSIS OF SIMULATION CIRCUIT



Proposed circuit by using soft switch at (s1snd s2)MOSFET, the MOSFET is a voltage control device and requires only a small in put current. In this device, the control signal is applied to a metal electrode that is separated from the semi conductor surface by an intervening insulator.

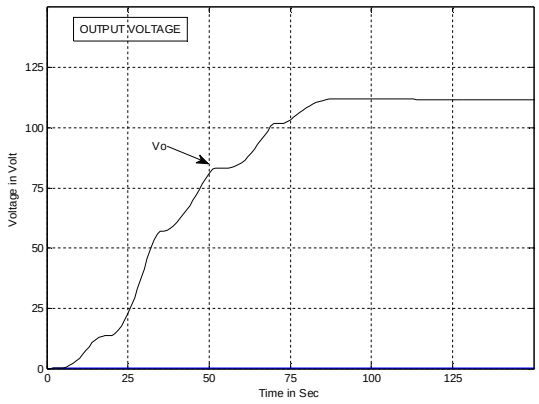
The power MOSFET is a unipolar device, the power MOSFET having operating frequencies are well above 100KHZ, the power MOSFET switching timing is in order of 50-100 nanoseconds and can generate many kilowatts of power at frequencies to 500KHZ, MOSFET is high switching time so reduce the unbalanced level of voltage. Some technical advantages of MOSFET is, over load and peak current handling capability are high . its easy to parallel for higher current, its able to operate in hazardous radiation environment ,its fast switching speed permit much higher switching frequencies , much better efficiency at high frequency. Much smaller overall circuit size and weight.

The input of the MOFET is output of PWM circuit ,the proposed circuit the out put to be sensing the fuzzy logic circuit and fuzzy logic out put is connected to the PWM circuit ,so output will be fully depend on the input of the circuit. In this condition losses to be reduce from the circuit and also improve the efficiency.

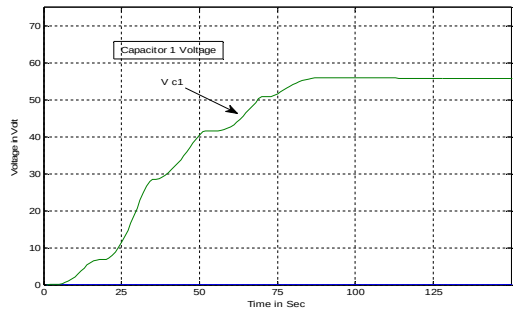
In this circuit when the switch s1 will be closed that condition switch s2 will be open ,so input supply flow through the diode D3,D4. In this condition diode D1 and D2 will does not conduction. After switch S1 is open and S2 will be closed in this condition input supply flow through the diode D1 and D2 ,but D3 and D4 does not conduction. Switching time is fully depends on the fuzzy control based , in the fuzzy logic control to operate at all variables .and also in this circuit to

using two capacitors ,so act as a voltage doublers. Its used to produce a DC voltage equal to two times of the value of the AC peak input voltage, so capacitor is to improve the power factor from the circuit.

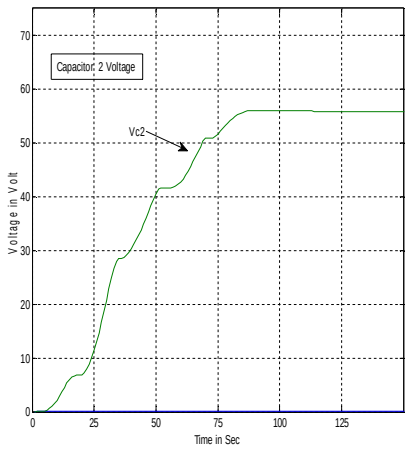
VI. RESULT AND ANALYSIS



Output voltage = 110 V



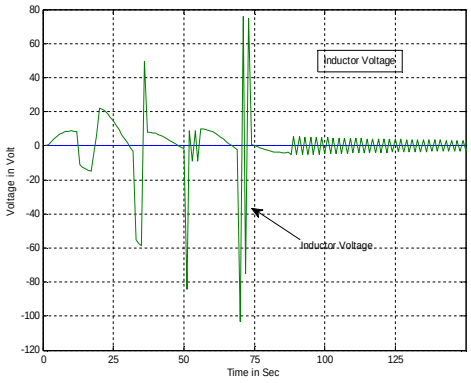
Capacitor 1 Voltage =55 V



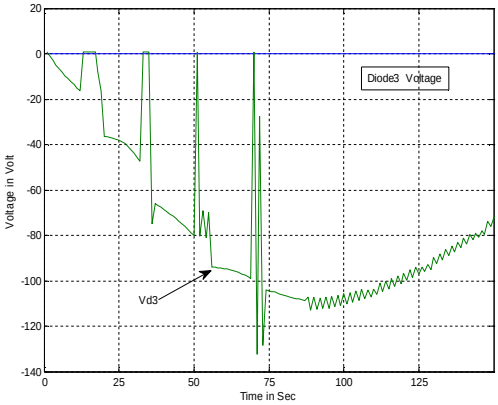
Capacitor 2 voltage = 55V

Total output voltage = capacitor 1Voltage + capacitor 2Voltage

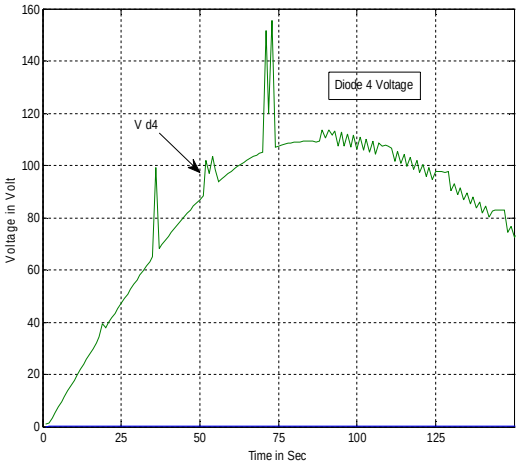
V_0= 110 V



Inductor voltage wave form



Diode 3 output voltage



Diode 4 output voltage

VII. CONCULSION

In this paper, a bridgeless buck PFC rectifier that substantially improves the efficiency at low line has been introduced. The proposed rectifier doubles the rectifier output voltage, which extends useable energy after a dropout of the line voltage. Moreover, by eliminating input bridge diodes,

efficiency is further improved. The operation and performance of the proposed circuit was verified on a 700-W, universal-line experimental prototype operating at 65 kHz.

In this project a new method of converter is proposed in which the buck converter is implemented without using bridge and also power factor correction is enhanced by using fuzzy logic technique. By using this technique output efficiency of the converter is increased. a hardware will be developed with the help of above said component and a complete project work would help to eliminate the problems.

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