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Power Factor Improvement Through ZETA Converter

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ABSTRACT

From the previous research reference about zeta converters which has been studied are summarized in this paper. This paper represents the basic knowledge of converts and its application which has been designed and simulated by pulse width modulation. The application zeta converts such as power factor correction and power grid application are explained in the paper and we came near to the ideal condition.

I. INTRODUCTION

As we have came from Stone Age to the smart phone age. Helicopter to the quad copters, from the huge size computer to the palmtops, which proves that only slight change in the electronics can brings the huge change in the generation. This same concept is applicable in the field of converts which is not limited to the only three,i.e buck boost & buck-boost only the slight charges in the combination of the capacitor & inductors have given us many new variety of converts which is uncountable.

II. CONVERTER

A DC to DC converter is an electronic circuit or electromechanical device that converts a source of dc from one voltage level to the another voltage level. it is a type of electric power converters, power level range from very low (small batteries) to very high (high voltage power transmission).

III. POWER FACTOR

The cosine of angle between voltage & current in an ac circuit is known as power factor. In a ac circuit, there is generally a phase difference between voltage & current. The term coos $\emptyset$ is called power factor of the circuit. If the circuit is inductive. The current lags between the voltage and the power factor is referred to as lagging, however . in a capacitive circuit current leads the voltage & power factor is said to be leading.

IV. ZETA CONVERTER

A Zeta converter performs a non-inverting buck-boost function similar to the of a SEPIC. But in application which implies high power, the operation of a converter in discontinuous mode is not attractive becuse it result in high rms values of the currents causing high leels of stress in the semiconductors. In this paper ,an active power factor correction (PFC)is performed by using a zeta converter operating in continuous **conduction mode**

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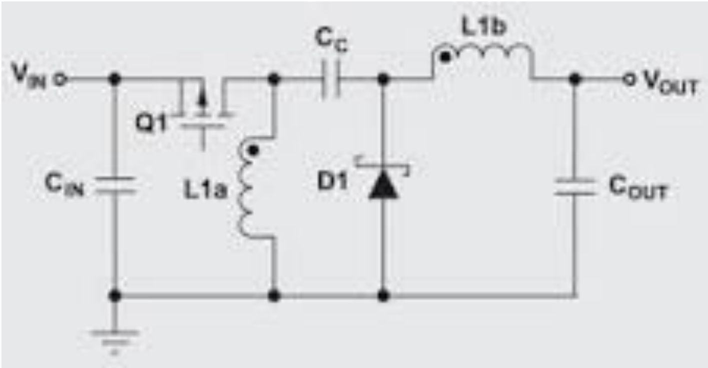
(CCM), where the inductor current must follow a sinusoidal voltage wavefrom. This method provides nearly unity power factor with low THD.

V. PRINCIPAL OF OPERATION

When analyzing zeta waveforms it shows that at equilibrium,L_1 average aquals I_{IN} andL_2 average current equals I_{OUT}, since there is no DC current though the flying capacity C_{FLY}.also there



The switch M_1 is in on state , so voitages V_{L1} and V_{L2} are equal to Vin. in this interval diode D_1 is OFF with a reverse voltage equal to-(vin+vo).inductor L_1 AND L_2 get energy frome the voltage source and their respective currents I_{L1} and I_{L2} are increased linearly by ratio V_{IN}/L_1 and V_{IN}/L_2 respectively. consequently by which current $I_{M1}=I_{L1}+I_{L2}$ increased linearly by a ratio VIN/L, where $L=L_1.L_2/(L_1+L_2)$>At moment,discharging of capacitor C_{fly} and charging of capacitor C_o take place.

is no DC voltage across either inductor. Therefore, C_{FLY} sees ground potential at its left side and V_{OUT} at its right side , resulting in DC voltage across C_{FLY} bing equal to V_{OUT}.

in this stage, the which M_1 turns OFF and the diode D_1 is forward biased starting to conduct . the voltage across L_1 and L_2 become equal to-VO and inductors L_1 and L_2 transfer energy to capacitor C_{fly} and load respectively. The current of L_1 and L_2 decreases linearly now by a ratio-V_0/L_1 and $-V_o/L_2$, respectively. The current in the diode $I_{D1}=I_{L1}+I_{L2}$ also decreases linearly by ratio-V_o/L_1.At this moment ,the voltage across which M is $V_M=V_{in}+V_O$. Figure 4 shows the main waveforms of the ZETA converter, for one cycle of operation iin the steady state continues mode.

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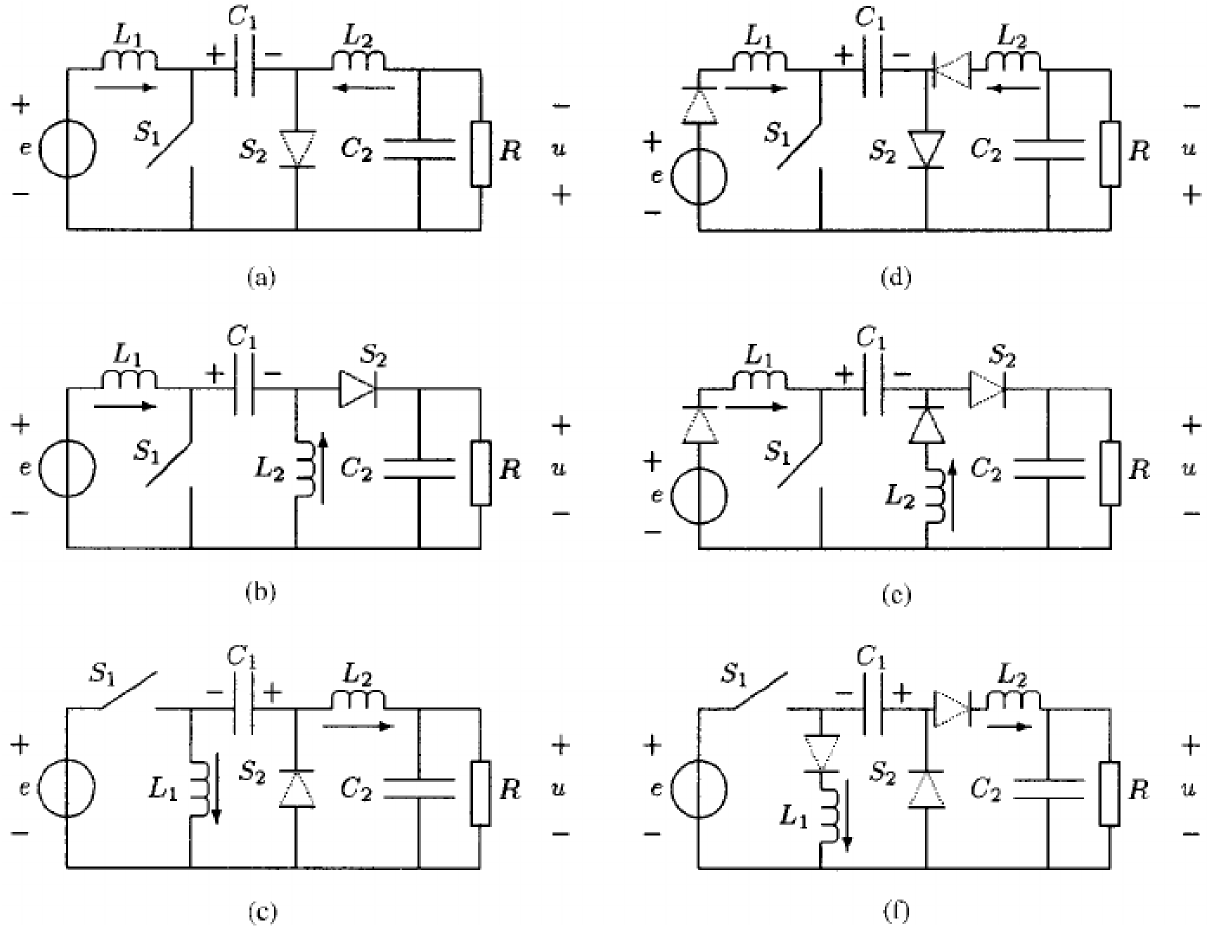

Figure :- Working of ZETA Converter

VI. DESIGN OF COMPONENTS OF ZETA CONVERTER

A ZETA converter performer a non-invertiing buck-boost fuction. for a ZETA converter operating in CCM, the duty cycle is defined as

to determine the value of inductances L1 and L2 the peak-to-peak ripple current is taken approximately 10-20% of the average output current. the value of these inductances may be expressed as,

the coupling capacitor (C1) is designed on the basis of its ripple voltage. the maximum voltage handled by a coupling capacitor (C) is equal to input voltage .It can be estimated as.

The output capacitor (Co) must have enough capacitance to maintan the dc link voltage and must have to provide continues load current at high switching frequency. it can be calculated as.

where, Did duty cycle Vo is dc link voltage,vin is rms value of the input voltage ,LO is output rated current,fs is switching frequency, AVc1 is the ripple voltage of the coupling capacitor,AVco is the ripple volage of the output capacitor.

VII. CONCLUSION

This paper presents the analysis of the ZETA converter operating in discontinuous conduction mode (DCM) for power factor correction. The main attraction of the ZETA converter is that it is a naturally isolated structure, which allows a regulated output voltage with only one power processing stage. The principle of operation,

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mathematical analysis, design procedure and experimental results obtained from a laboratory prototype are presented.

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