ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

The Analysis of a Modified Version of the SEPIC Dc-Dc Converter Used as Pre-Regulator Operating in Discontinuous Conduction Mode

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ABSTRACT:
The hypothetical and trial examination ofa adjusted form of the SEPIC DC-DC converter utilized as pre-controller working as a part of irregular conduction mode (DCM) is exhibited in this paper. The proposed converter introduces a low info current swell working in DCM and the switch voltage is lower than the yield voltage. The switch voltage lessening builds the converter unwavering quality and a low deplete to-source on-resistance (RDSon) MOSFET can be utilized relying upon the converter determination. Also, an advanced control strategy is connected to the proposed converter to decrease the third consonant information current contortion resultant of the operation in DCM. At last, a 100W model was produced working with productivity equivalent to 95.6%.

Index Terms:
AC-DC power conversion, Rectifiers, Digital control.

I. INTRODUCTION:

The standard answer for the execution of a powerful variable (HPF) pre-controller for a low yield power application (Po<200W) is to utilize a support converter working in irregular conduction mode (DCM) [1]-[2]. This is a basic and practical arrangement on the grounds that the outline of the rectifier in DCM permits the converter to work as a voltage devotee, where the info current normally takes after the Information voltage profile without the utilization of a present control circle. The operation in DCM decreases the substitution misfortunes since the switch turn-on happens with zero-current-exchanging (ZCS) and the yield diode does not present converse recuperation current. This arrangement is restricted for low power applications because of an expanded converter conduction misfortunes working in DCM. Since the info inductor of the help converter works in DCM, a high recurrence channel made by an inductor Lf and capacitor Cf should be utilized as a part of the pre-regulator input in order to reduce the input current ripple, as presented in Fig. 1.

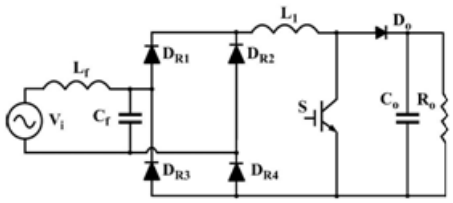

Fig. 1.Classical boost pre-regulator operating in DCM.

Be that as it may, an issue exhibited by the support pre-controller working in DCM is the information current contortion, showing a third consonant part. The voltage connected over the information inductor amid its demagnetization is equivalent to the yield voltage less the info voltage, consequently, the present bending increments when the distinction between the yield voltage and the pinnacle info voltage is decreased. In this manner, the yield voltage can be expanded,

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
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lessening the third symphonious information current twisting and enhancing the force component. Likewise a variable obligation cycle control can be utilized as a part of request to lessen the info current mutilation as displayed in area V. The support converter can work with unitary force consider freely of the contrast between the yield and info voltage working at the limit of the DCM and constant conduction mode (CCM) with a variable exchanging recurrence regulation.The traditional SEPIC converter, appeared in Fig. 2, shows a stage up/venture down static increase and for the most part is utilized as a HPF pre-controller in applications where the yield voltage must be lower than the pinnacle of the AC information voltage [3]-[4]. The usage of the pre-controller utilizing the traditional SEPIC converter as a part of DCM presents two extra operation attributes. Firstly, the converter works as a voltage devotee when planned in DCM with a low esteem for the inductor L2 and utilizing a high esteem for the inductor L1, yet the info current displays a low current swell pretty much as a support rectifier working in CCM with current control circle. Therefore, the Lf-Cf channel utilized as a part of the support converter info working in DCM is a bit much utilizing the SEPIC converter working as a part of DCM.

Thusly, the amount of parts for both converters working in DCM is proportionate. Nevertheless, in a sensible application, an electromagnetic impedance (EMI) divert is key as in any rectifier topology.The second vital trademark utilizing the SEPIC converter as a part of DCM is that the info current takes after the information voltage waveform without information current mutilation. The third consonant mutilation is not introduced on the grounds that the inductor L2 is demagnetized with the yield voltage. All things considered, the support converter is the favored topology utilized for the pre-controller application where the yield voltage must be higher than the pinnacle of the information voltage, given that the switch voltage of the SEPIC converter is equivalent to the entirety of the info and yield voltages.

The SEPIC converter can be effectively utilized as a part of uses where the yield voltage is lower than the info voltage. A few high-productivity bridgeless arrangements utilizing the SEPIC and CUK converters are exhibited in [5]-[10].

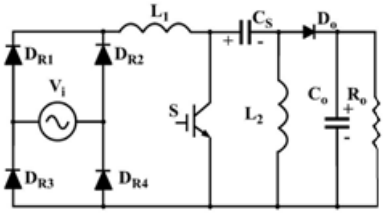

Fig. 2.Classical SEPIC pre-regulator operating in DCM.

The adjusted SEPIC converter utilized as pre-controller working as a part of DCM is appeared in Fig.3. An altered SEPIC DC-DC converter was proposed in [11] with the incorporation of an extra diode (DM) and capacitor (CM) at the established SEPIC converter, changing a few qualities, for example, the operation with a switch voltage lower than the yield voltage. Be that as it may, just the operation as DC-DC converter in CCM was broke down in [11]. This converter was additionally utilized as a part of [12] as a pre-controller working in CCM displaying a few favorable circumstances when contrasted and the traditional support pre-controller working in CCM for all inclusive line info application (90Vrms - 260Vrms).

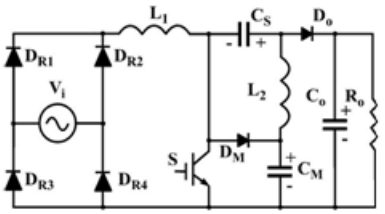

Fig. 3.Modified SEPIC pre-regulator operating in DCM.

Regardless, the hypothetical and trial investigations of the changed SEPIC converter working in DCM as a DC-DC converter and pre-controller were not introduced yet, which is center of this paper. The proposed topology shows the same impediments of the traditional support converter when contrasted and the established SEPIC converter since its operation is

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International Journal & Magazine of Engineering, Technology, Management and Research
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exclusively conceivable as a non-secluded converter with venture up static addition. Uniquely in contrast to the established SEPIC converter, a helper inrush impediment circuit must be incorporated for the rectifier start-up. Additionally, the force element is lower than the traditional SEPIC converter because of the third symphonious part in the info current. In any case, the force element and the info current contortion of the altered SEPIC converter can be essentially enhanced applying a straightforward open circle activity utilizing the information and yield voltage data. The utilization of the help and adjusted SEPIC rectifiers are just conceivable in applications with a yield voltage higher than the pinnacle of the info voltage and proposals rectifiers are more appropriated than the SEPIC converter with the same specification, since the SEPIC converter displays a high switch voltage. The lowest switch voltage level is presented by the modified SEPIC topology. The adjusted SEPIC converter works as a voltage supporter and the information current shows low current swell, for example, an established SEPIC converter, planning the converter in DCM and utilizing a low esteem for the inductor L2 and a high esteem for the inductor L1. The fundamental converter attributes and investigations are introduced in the accompanying, with the hypothetical operation improvement of the proposed converter.

II. THEORETICAL ANALYSIS:

The circuit of the pre-controller utilizing the adjusted SEPIC converter working in DCM is introduced in Fig. 3. The principle contrast from the pre-controller displayed in [12] is the operation mode and the control framework that is formed by just a voltage control circle due to the DCM operation. Additionally, the non-dissipative current snubbed utilized as a part of [12] is a bit much on the grounds that the converse recuperation current of the diodes and the turn-on exchanging misfortunes working in CCM are diminished with the DCM operation.

The altered SEPIC DC-DC converter working in DCM presents three operation stages. The hypothetical investigation is at first created considering the operation as a DC - DC converter at unfaltering state and all circuit parts are viewed as perfect. The voltages over all capacitors are viewed as steady amid an exchanging period, as a perfect voltage source. The DCM operation happens when there is the third operation stage, where the force switch is killed and the streams in all diodes of the circuit are invalid. Consequently, the DCM operation happens when Do and DM diodes are obstructed before the switch turn-on. The investigation and configuration method is likewise created for the operation as a pre-controller with a diode span at info and an AC information voltage, taking into account the study as DC-DC converter. The circuit presents two inductors, in this manner, diverse inductor values mix can be embraced for the DCM operation. So as to lessen the info current swell of the pre-controller, a relative high esteem for the inductor L1 is considered. A relative low estimation of the inductor L2 is utilized for the converter operation as a part of DCM as a voltage devotee, where the information current takes after the info voltage waveform. Subsequently, the pre-controller information current takes after the information voltage waveform with low current swell, without info channel and without current control circle. An important equation for the operation analysis of the converter is presented in (1). Considering the operation at steady state, the average voltage across the inductors L_1 and L_2 are null and the sum of the input voltage V_i and capacitor C_S voltage is equal to the capacitor C_M voltage. The operation stages in DCM are presented as follows:

$$^{V}CM\ ^{=V}i\ ^{+V}CS \qquad (1)$$

1) First Initially Stage [t0 - t1] (Fig. 4) – During the conduction ofthe power switch S, the info inductor stores vitality with the information voltage connected crosswise over L1 (VL1). The voltage connected crosswise over L2 (VL2) is equivalent to the voltage of capacitor C M short the voltage of capacitor CS.

As displayed in (1), this voltage distinction is equivalent to the information voltage. Subsequently, inductors L1 and L2 store vitality in this operation stage and the same voltage is connected over these

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International Journal & Magazine of Engineering, Technology, Management and Research
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inductors. The streams through inductors L1 and L2 increment taking after (3) and (4) separately, yet since L2 is lower than L1, the present variety in L2 is higher than in L1, as exhibited in the hypothetical waveforms appeared in Fig.7. The diodes DM and Do are obstructed amid this operation stage..

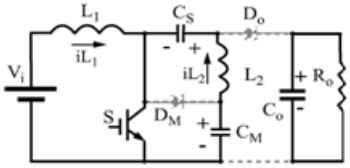

Fig. 4.First operation stage.

2) Second Stage [t_1 – t_2] (Fig. 5) – At the instant t_1, switchS is turned-off and the energy stored in the input inductor L_1 is transferred to the output through the C_S capacitor and output diode D_o. There is also energy transference to C_M capacitor through diode D_M and the maximum switch voltage is equal to the C_M capacitor voltage. The energy stored in inductor L_2 is also transferred to the output and capacitor C_S through diodes D_o and D_M. The voltage applied across L_1 is equal to C_M capacitor voltage minus the input voltage and this difference is equal to the C_S capacitor voltage as calculated by (1) . The voltage across the inductor L_2 is equal to the negative capacitor C_S voltage. Thus, the voltage applied across the inductor L_1 and L_2 are equal to the negative capacitor C_S voltage during this operation stage and the inductor current variation is calculated by (6) and (7) respectively.As presented in Fig. 7, the time interval (t_2-t_1) of the second operation stage is defined as t_d and is equal to the transference period of the energy stored in inductors L_1 and L_2 through diodes D_o and D_M. When L_2 current value becomes equal to L_1 current value with the same direction, the currents at diodes D_o and D_M becomes null, finishing this operation stage. Therefore, t_d is the conduction time of diodes D_M and D_o, when the energy stored in the inductors L_1 and L_2 is transferred.

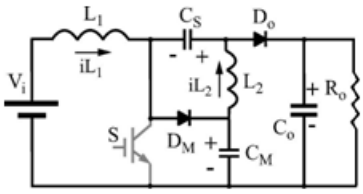

Fig. 5.Second operation stage.

3) Third Stage [t_3 – t_4] (Fig. 6) – When diodes $D_o$and D_M are blocked at the instant t_3, the voltage applied across the inductors L_1 and L_2 are null, maintaining the inductors currents constant as presented in (9) and (10). The currents through the inductors L_1 and L_2 present the same value, operating as a freewheeling stage. This operation stage is finished when the power switch is turned-on at the instant t_4, returning to the first operation stage.

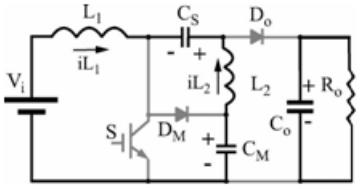

Fig. 6.Third operation stage.

The main theoretical waveforms are presented in Fig. 7. The switch turn-on occurs with ZCS such as a classical DC-DC converter operating in DCM and the diodes do not present reverse recovery current. The maximum switch voltage is equal to the capacitor C_M voltage and this voltage is lower than the output voltage. The L_1 inductor average current is equal to the input current and the L_2 inductor average current is equal to the output current. The average current in the capacitors C_S and C_M are null at steady state, thus, the average current of diodes D_M and D_o are equal to the output current.

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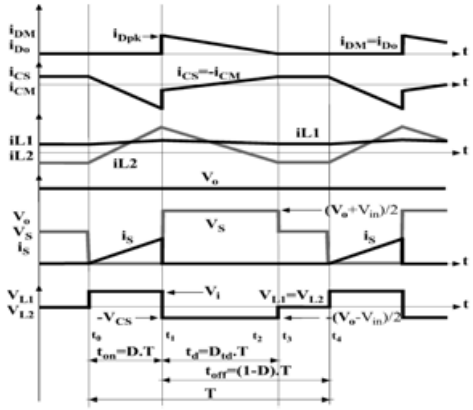

Fig. 7. Main theoretical waveforms.

A. Converter static gain and the capacitors C_S and

VI. OUTPUT VOLTAGE CONTROL SYSTEM

A. Control-to-output transfer function ($v_o(s)/d(s)$)

A dynamic model of switching converter is required for feedback control loop. However, the power converters are described by a set of the nonlinear differential equations. Usually is easier to analyze a small-signals model that is linearized related to the quiescent operation point in order to obtain a linear model, as presented in [15]. The small signal equivalent circuit of buck, boost and buck-boost converters presents a capacitor and inductor, operating in DCM. The transfer functions have two poles. One pole is due to the output capacitor, at low frequency, and other pole, in much higher frequency due to the inductor. For this reason, an approximate way to determine the low frequency small-signal transfer function of the basics converters is to let the inductance tend to zero [15]. Also, the capacitor C_M and C_S are very small in the modified SEPIC converter, where $C_o>>C_M$ and $C_o>>C_S$. Therefore, they can be neglected to obtain control-to-output transfer function for low frequency. In this case, the high frequency capacitors dynamics can be ignored. The modified SEPIC without C_M, C_S and L_1 is shown in Fig. 13(a) and the equivalent circuit is shown in Fig. 13(b). The remaining model is solved for the low-frequency converter dynamics.

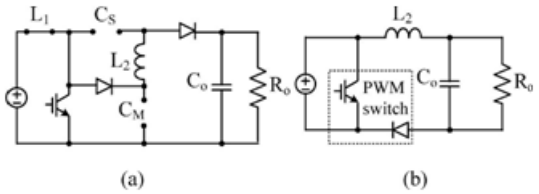

Fig. 13. Simplified circuit model of modified SEPIC DC-DC: (a) with neglected components, (b) equivalent circuit.

To perform this analysis, the model of the PWM switch in DCM proposed in [16] is used considering the equivalent circuit presented in Fig. 13(b). The equivalent circuit of an average model and small-signal model of PWM switch in DCM is shown in Fig 14. Transfer function is obtained considering a resistive load. The model of the PWM switch in DCM is replaced in the modified SEPIC converter and the input voltage is shortened. Figure 15 shows the equivalents circuits.

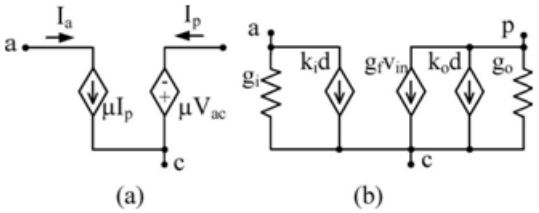

Fig. 14. Model of PWM switch in DCM: (a) Average model(b) Small-signal model.

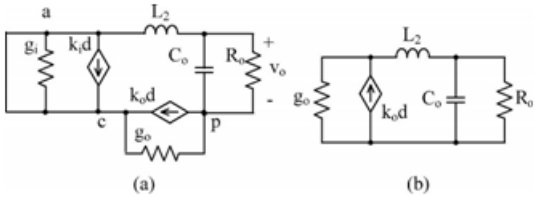

Fig. 15. Small-signal equivalent circuit for control -to-output transfer function of modified SEPIC: (a) complete circuit (b) simplified circuit.

Figure 16 shows the dynamic behavior of the output voltage waveform under duty-cycle disturbances considering the operation as a DC-DC converter. At 0.5 s, a 1% step is applied in the duty-cycle. At 1.1s, the duty-cycle returns to its nominal value. The results show good resemblance between the proposed model and the simulation of the converter power circuit.

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The dynamic response of the proposed converter operating in DCM is an over damped second order system with a step response similar to a first order system. The modified SEPIC rectifier presents an oscillating input voltage with double line frequency. On the other hand, a large output capacitor is used to minimize the output voltage ripple. Thus, output voltage does not change significantly in a half-line period and a simplified model can be considered without the input ripple. The simulation result of the modified SEPIC operating as a rectifier and the prediction of the small signal model for a step change in the duty-cycle are shown in Fig. 17. It can be observed that this model gives good results at low frequencies. It cannot accurately predict high frequency dynamics because C_M, C_S and $L_1$are neglected. However, the output voltage feedback loop in the conventional rectifier control system must have a low- bandwidth in order to avoid distortions in the input current waveform. The controller should have sufficiently small loop gain at the even harmonics of the AC line frequency. Therefore, low-frequency small-signal transfer function is appropriate for the control of the modified SEPIC rectifier.

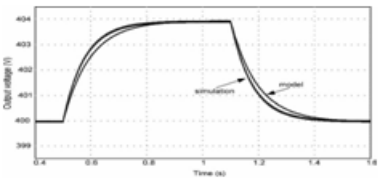

Fig. 16. Comparison of the transient responses of output voltage for a 1% disturbance in the duty-cycle for the modified SEPIC operating as a DC-DC converter in DCM

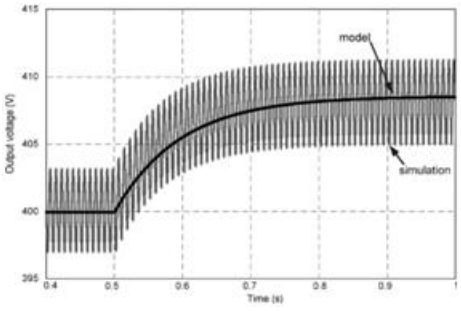

Fig. 17.Comparison of the transient responses of output voltage for a 2% disturbance in the duty-cycle for the modified SEPIC operating as a rectifier in DCM.

B. Control System

The pre-regulator operation in DCM allows obtaining high power factor without a current control loop and only a voltage control loop is necessary [14]. The output voltage control algorithm used in the proposed converter is based on the classical PI controller. The design procedure can be simplified using a design procedure similar to the classical boost converter. Also, the 120 Hz ripple of the pre-regulator output voltage must be rejected by the voltage control loop in order to maintain the high power factor operation. Therefore, the voltage control loop presents a very slow dynamic response such as any classical pre-regulators. The block diagram of the digital control implementation is presented in Fig. 18, including the third harmonic reduction technique. Only the output and input voltages are necessary to control the pre-regulator. The control algorithm was developed using a digital signal processorTMS320F2812, operating with sampling rate equal to 30 kHz. The sampled output voltage signal is compared to an output voltage reference and the error is applied to a PI voltage controller. Simultaneously, the sampled rectified input voltage and the output voltage reference are applied to (63) in order to calculate the duty -cycle variation for the third harmonic reduction. The result of the PI output voltage controller and the result of the third harmonic reduction are multiplied obtaining the pre-regulator duty-cycle and generating the PWM signal that controls the switch *S*.

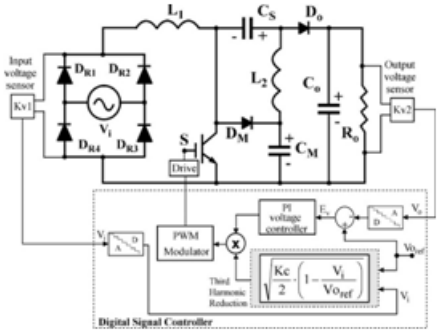

Fig. 18. Block diagram of the pre-regulator control system.

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VII. EXPERIMENTAL RESULTS:

The proposed pre-regulator was implemented as presented in Fig.18 using the specifications presented in Table I and the components used are shown in Table IV. The pre-regulator performance is compared with and without the implementation of the third harmonic reduction technique. The waveforms were obtained with nominal output powerand input voltage equal to 127 V_{rms} and 220 V_{rms}.The pre-regulator input current and voltage waveforms, operating with V_i = 127 V_{rms} and without the third harmonic distortion reduction technique are presented in Fig. 19.

TABLE IV
Pre-regulator components

Parameter	Pre-regulator with modified SEPIC converter
Inductor L_1	L_1 = 6.8 mH ESR=692 mΩ
Inductor L_2	L_2 = 540 µH ESR=98 mΩ
Capacitor C_S	C_S=220 nF ESR=10 mΩ
Capacitor C_M	C_M=220 nF ESR=10 mΩ
Output capacitor C_o	C_o=120 µF ESR=390 mΩ
Diodes D_M -D_o	D_M=D_o=UF5408 V_f=1.7 V
Power switch S	S=FQA28N50 V_{DSS}=500 V R_{DSon}=0.16 Ω (25°C)

The total input current harmonic distortion is equal to 13% without the application of the third harmonic reduction technique and the pre-regulator power factor is equal to 0.993. The total input voltage harmonic distortion is equal to 3.1%.

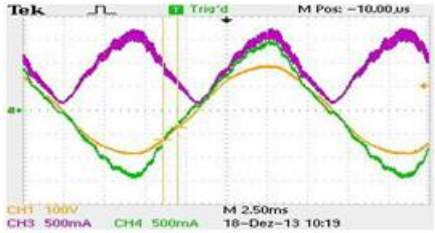

Fig. 19. Input voltage and current operating with V_i=127 V_{rms} and without the third harmonic reduction technique (CH1 - Input voltage - 100 V/div, CH3 - L_1 current – 0.5 A/div, CH4 - Input current – 0.5 A/div).

The pre-controller information current and voltage waveforms, working with Vi = 127 Vrms and with the third symphonious twisting decrease strategy are exhibited in Fig. 20. The aggregate information current symphonious contortion is decreased to 5.3% with the utilization of the third consonant lessening system and the pre-controller power variable is expanded to 0.999. Considering that the aggregate voltage symphonious contortion is equivalent to 3.1%, the aggregate information current mutilation is 2.2% higher than the aggregate info voltage twisting. The pre-controller information current and voltage waveforms, working with Vi = 220 Vrms and without the third consonant bending diminishment method are exhibited in Fig. 21. Lessening the voltage contrast between the pinnacle of the info voltage and the yield voltage, the third symphonious bending increments, working with steady obligation cycle.The aggregate info current symphonious contortion is equivalent to 35.9% without the utilization of the third consonant diminishment method and the pre-controller power component is lessened to 0.951.

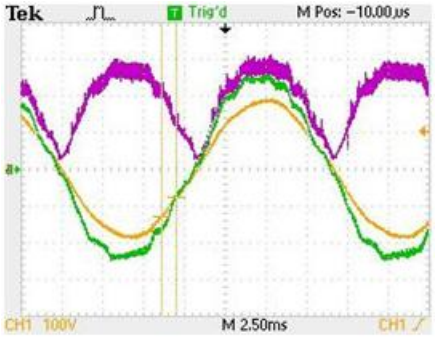

Fig. 20. Input voltage and current operating with V_i=127 V_{rms} and with the third harmonic reduction technique (CH1 - Input voltage - 100 V/div, CH3 - L_1 current – 0.5 A/div, CH4 - Input current – 0.5 A/div).

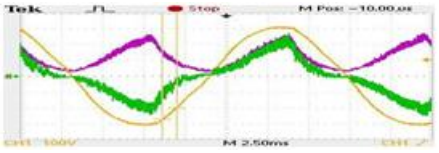

Fig. 21. Input voltage and current operating with V_i=220 V_{rms} and without the third harmonic reduction technique (CH1 - Input voltage - 100

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V/div, CH3 - L_1 current – 0.5 A/div, CH4 - Input current – 0.5 A/div).

The pre-regulator input current and voltage waveforms, operating with V_i = 220 V_{rms} and with the third harmonic distortion reduction technique are presented in Fig. 22.

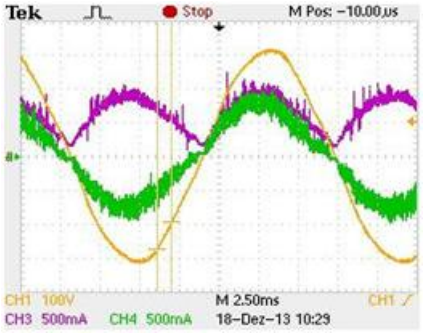

Fig. 22. Input voltage and current operating with V_i=220 V_{rms} and with the third harmonic reduction technique (CH1 - Input voltage - 100 V/div, CH3 - L_1 current – 0.5 A/div, CH4 - Input current – 0.5 A/div).

The aggregate information current consonant bending is decreased from 35.9% to 8.84% with the use of the third symphonious diminishment procedure and the pre - controller power variable is expanded from 0.951 to 0.988. The aggregate info current bending is 5.74% higher than the aggregate information voltage mutilation. The pre-controller operation with ostensible yield power and information voltage equivalent to Vi=127 Vrms are exhibited from Fig. 23 to Fig. 30, considering the operation with the third consonant diminishment method. The L1 and L2 streams are exhibited in Fig. 23 and its present swell is near the hypothetical qualities 0.3 An and 3.56 An individually. The CS and CM capacitor voltages are displayed in Fig. 24. The hypothetical estimation of the CS and CM capacitor voltages at the pinnacle of the information voltage, considering the capacitor voltage swell invalid, is equivalent to 110 V and 290 V separately. The switch voltage and current are shown in Figs 25 and 26. The most compelling switch voltage is near 300V for an info voltage break even with 127 Vrms and yield voltage equivalent to 400 V.

The streams in the diodes DM and Do are exhibited in Fig. 27. The hypothetical diode crest current is equivalent to 2 An and the hypothetical estimation of the diode conduction period is equivalent to td=17.45 µs at the pinnacle of the info voltage.

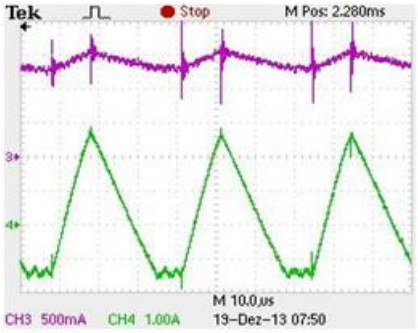

Fig. 23. L_1 and L_2 currents (CH3 – L_1 current – 0.5 A/div, CH4 – L_2 current – 1 A/div).

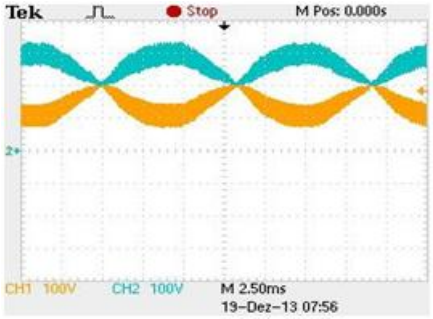

Fig. 24.C_S and C_M capacitor voltages (CH1 – C_S voltage - 100 V/div, CH2 – C_M voltage – 100 V/div).

The currents in the diodes D_M and D_o are presented in Fig. 27. The theoretical diode peak current is equal to 2 A and the theoretical value of the diode conduction period is equal to t_d=17.45 µs at the peak of the input voltage.

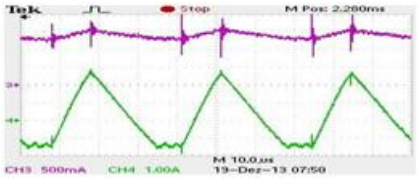

Fig. 23. L_1 and L_2 currents (CH3 – L_1 current – 0.5 A/div, CH4 – L_2 current – 1 A/div).

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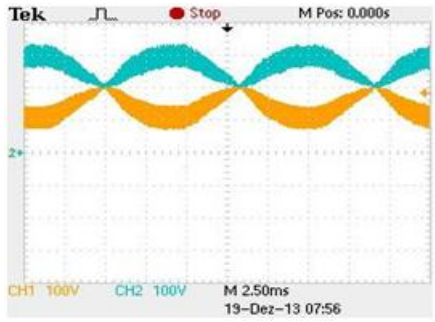

Fig. 24.C_S and C_M capacitor voltages (CH1 – C_S voltage - 100 V/div, CH2 – C_M voltage – 100 V/div).

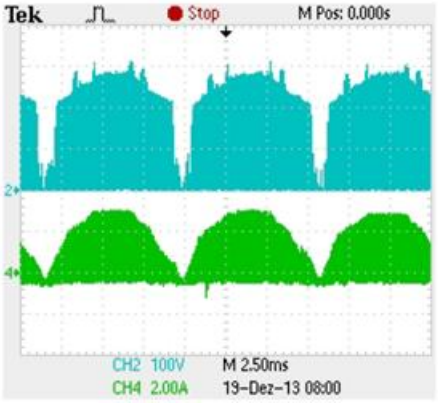

Fig. 25. Switch voltage and current (CH2 – Switch voltage - 100 V/div, CH4 – Switch current – 2 A/div, 2.5ms/div).

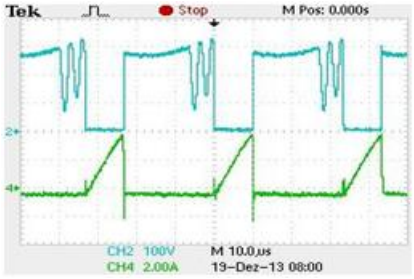

Fig. 26. Switch voltage and current (CH2 – Switch voltage - 100 V/div, CH4 – Switch current – 2 A/div, 10□s/div).

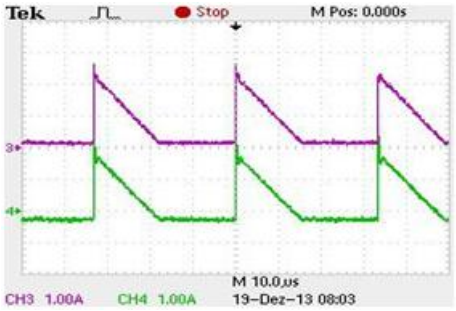

Fig. 27. Currents in the diodes D_M and D_o (CH3 – D_M current - 1 A/div, CH4 – D_o current – 1 A/div).

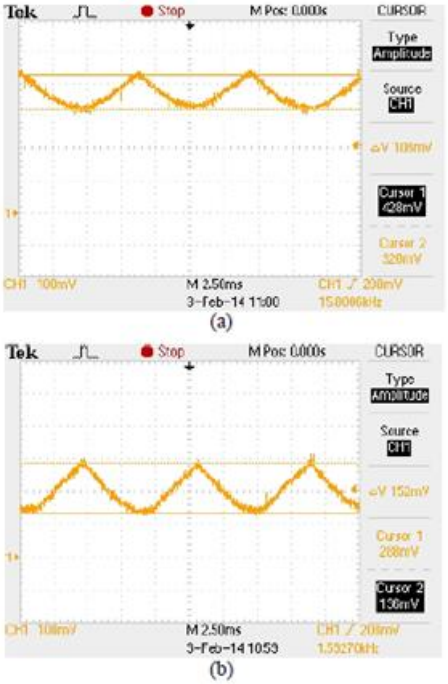

Fig. 28. PWM modulation signal (a) V_i=127 V and (b) V_i=220V

The PWM modulation signal obtained from the product of the voltage control loop and the third harmonic reduction technique, as presented in Fig. 18, was applied to a digital to analog converter of the digital controller and is presented in Fig. 28 working with Vi=127 Vrms and Vi=220 Vrms. The voltage variety from 0 to 1 V compares to the obligation cyclevariation from 0 to 1. The adjustment signal got from the model is like the hypothetical result introduced in Fig.9.The dynamic reaction of the pre-controller is displayed inFigs. 29 and 30 for Vi = 127 Vrms. Figure 29 demonstrates the dynamic reaction of the converter amid the heap changefrom 100% to 30% and Fig. 30 introduces the heap transient from 30% to 100%. The hypothetical effectiveness of the proposed converter working with a RMS information voltage meet 127 V has been evaluated considering the part parameters utilized as a part of the model appeared in Table IV.

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Considering the RMS switch current ascertained by (58) and the RDSon MOSFET with resistance square with 240 mω (at 80ºC), the switch conduction misfortune is equivalent to 0.22 W. The normal current in the DM and Do diodes are equivalent to the yield current and considering the diode UF5408 (3A-800 V) utilized as a part of the model with a diode forward voltage equivalent to 1.7 V, the DM and Do diodes all out conduction misfortunes is equivalent to 0.85 W.

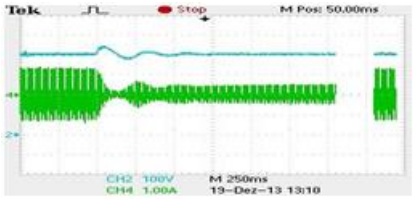

Fig. 29. Load change from 100% to 30% (CH2 – Output voltage - 100 V/div, CH4 – Input current - 1 A/div, 250 ms/div).

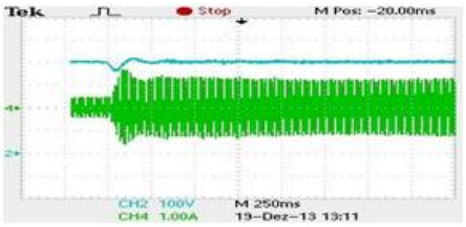

Fig. 30.Load change from 30% to 100% (CH2 – Output voltage - 100 V/div, CH4 – Input current - 1 A/div, 250 ms/div).

The normal current in the info span diodes is equivalent to 0.37 An and the aggregate conduction misfortunes of information diode scaffold is equivalent to 2.52 W. Consequently, the evaluated hypothetical proficiency of the proposed converter is equivalent to 95.6% considering the aggregate misfortunes of the inductors equivalent to 1 W. The established support converter presents comparative misfortunes in all parts. In any case, there is stand out diode in the converter yield, decreasing the diode conduction misfortunes in 0.42 W for the help model in contrast with the proposed converter model, bringing about a hypothetical productivity equivalent to 96%.

The same diode (UF5408) was utilized as a part of the trial models of the help and the changed SEPIC converters. Be that as it may, following the greatest voltage in the diodes DM and Do is dependably lower than the yield voltage (Vo=400V), the diode UF5404 (3A-400V) with a diode forward voltage equivalent to 1.0 V, as exhibited in the diode producer inventory (Vishay), could be utilized as a part of the proposed converter prototype.Consequently, utilizing the diode 1N5408 as a part of the established help converter, the yield diode conduction misfortunes is equivalent to 0.425 W and utilizing the diode 1N5404 as a part of the proposed converter as the diodes DM and Do, the aggregate diode conduction misfortunes will be decreased from 0.85 W to 0.5 W. Likewise a lower RDSon MOSFET could be utilized as a part of the proposed converter because of the lower switch voltage.

The exploratory proficiency of the proposed converter working with Vi=127 Vrms and Vi=220 V rms are appeared in Figs. 31 and 32 separately, measured with the computerized power meter Yokogawa WT230. The model design was additionally changed to the traditional support rectifier displayed in Fig. 1 utilizing the same semiconductors of the proposed converter. The effectiveness bend of the help converter is exhibited considering an operation guide comparable toward the proposed converter utilizing an inductance equivalent to 1.1 mH.The productivity of the proposed converter working withoutput power equivalent to 108 W and Vi=127 Vrms is equivalent to 95.6%, while for the support converter is equivalent to 95.2%.

The effectiveness of the proposed converter was measured likewise working with the third consonant diminishment method. The exploratory results demonstrate that not just a lessening of the third symphonious info current bending and the change of the rectifier power component happen, however there is additionally an augmentation in the converter effectiveness. The productivity increase utilizing the third consonant lessening regulation working with the ostensible yield is near 0.5% for the input voltage

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V_i=127 V_{rms} and equal to 1% for the input voltage V_i=220 V_{rms}.

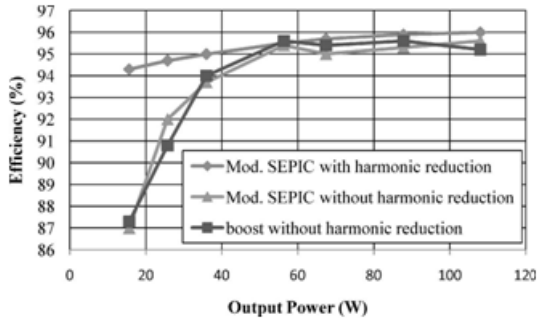

Fig. 31. Pre-regulator efficiency for V_i=127 V_{rms}.

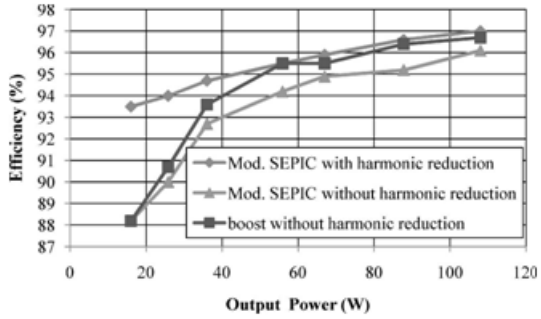

Fig. 32. Pre-regulator efficiency for V_i=220 V_{rms}.

In any case, a noteworthy proficiency increase happens in both info voltages for the light load operation, keeping up the converter effectiveness higher than 93% for all heap range. This operation trademark is fascinating for applications where the rectifier works amid a long stretch with low yield power.

VIII. CONCLUSION:'

The hypothetical and trial investigation of the altered SEPIC converter utilized as pre-controller working as a part of DCM is displayed in this paper. The proposed converter exhibits low info current swell working in DCM and the switch and diodes voltages are lower than the yield voltage. The switch voltage decrease expands the converter unwavering quality and a lower RDSon MOSFET can be utilized relying upon the converter particular. The exploratory results gave working the third symphonious diminishment strategy demonstrates that the aggregate info current consonant twisting is decreased from 13% to 5.3% working with an information voltage meet 127 Vrms and is lessened from 35.9% to 8.84% working with an info voltage equivalent to 220 Vrms, considering an aggregate information voltage symphonious contortion equivalent to 3.1%. The force element is higher than 0.988 with the third consonant decrease in all info voltage range.The proficiency working with information voltage equivalent to 127Vrms and yield power equivalent to 108 W is equivalent to 95.6%. The exploratory results demonstrate that there is likewise an addition inthe converter productivity working with the third consonant diminishment regulation that basically happens at light load operation in 127 Vrms and 220 Vrms.

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