DESIGN AND IMPLEMENTATION OF HIGH PERFORMANCE AC-DC CONVERTER

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https://doi.org/10.26782/jmcms.2019.12.00054

Abstract

This paper mainly focuses on the power quality issues that occur in the power system and how this can be reduced by using the more outputs from the SMPS. The theme of the paper is usage of different power electronics converter methods in the supply side and constant converter by using the transformer with high frequency (HFT). In order to improvement of the PQ and for the best monitoring purpose different control strategies like NN is used in the SISO and MOSMPS. Here we mainly focus on the SISO System to obtain best output under standards conditions. Isolated and non-isolated configuration for Boost converter and various models are proposed. These entire configurations are simulated and modelled by using the MATLAB under certain loaded conditions.

Keywords: Power Factor Correction, PFC Converters, Power Factor, Total Harmonic Distortion, Switched Mode Power Supply SMPS

I. Introduction

Now a days power electronic devices plays an important role while these power electronics devices are used to convert the power from one end to the other end every easily, these devices are used to monitor the power to be stabilized and controlled by using SMPS Strategies [II], where these can be used to regulate the low power losses, increases its efficiency and simplicity in manufacture.

According to the standards of IEC we are using the low total harmonic distortion devices for the input side and high power factor in the case of the telecommunication power supply [IX] and IEEE standards [IV]

This paper [III] mainly focus on the what are the developments we are made in order to improve the PQ converters to reduce the power quality problems and how we are improving the efficiency the system and cost of the system can be used less number of equipments. For this case Power factor correction models are designed with in the SMPS.
II. Layout & Proposal of 1-0 MOSMPS Structure

The main work of this paper is that PQ can be improved at the AC terminals in case of the low Harmonics of current, power. For this case of process we are using various stages with NN is control is mentioned.

II.i. Isolated Point Converter Form of MOSMPS

The diagram shown below is the Isolated Point Converter of the Multiple output SMPS. The use of the Isolated point Converter is that the uses only one converter and one controller to enhance the work.

![Isolated Point Converter Diagram](image)

**Fig. 2.1. Shows the isolated point converter of Multiple SMPS**

II.ii. Boost Type Converter Based Multiple Output SMPS

This process involves that the primary base is connected to the capacitor, inductor and static switching devices. And the secondary end is connected to the all possible reactive elements.

![Boost Type Converter Diagram](image)

**Fig 2.2 Layout of the Boost type Multiple SMPS**
Representation of the Boost Converter design:

**Determination of Inductor:**

The equation is taken has the

\[ L_i = \frac{DTsV_d}{\Delta iL_i} \]  \hspace{1cm} (1)

Where

| Voltage(v) | ΔiL | Time(s) |
|------------|-----|---------|
| 200        | 0.035 | 60      |

Substitute above value in eq(1) to get the desired value

**Representation of Capacitor:**

Here the capacitor are used to reduce the harmonics, Hence The equation is taken has the

\[ C_i = \frac{IpTan\theta}{2\pi fV_p} \]  \hspace{1cm} (2)

Where

| Freq(Hertz) | Voltage (v) | Current (A) | Teta value |
|-------------|-------------|-------------|------------|
| 50          | 320         | 0.8         | 1          |

Substitute all above mentioned values in the above eq(2)

**Representation of the Turns Ratio:**

The Relationship between the \( i_v \) and \( O_v \) is taken has the below equation

\[ V_o = \frac{nV_d}{1-d} \]  \hspace{1cm} eq(3)

Where

| Voltage(V_d) | Voltage(V_o) | Duty Ratio |
|--------------|--------------|------------|
| 200          | 14           | 0.7        |
Substitute the above values in the eq(3) to desired the turns ratio value.

II.iii. Model of the Push pull converter:

The current which was formed due to magnetisation in the transformer are considered as almost zero but due to the bidirectional excitation large values of magnetisation is formed.

Fig 2.4 Shows the push pull converter.

Representation of the Push pull:

Determination of turns ratio:

The Relationship between the $i_v$ and $O_v$ is taken has the below equation

$$V_{o1} = \frac{nV_d}{2(1-d)}$$  \hspace{1cm} (4)

Where the above equation can be solved by using the below

| Voltage($V_d$) | Voltage($V_{o1}$) | Duty Ratio |
|----------------|-------------------|------------|
| 200            | 14                | 0.4        |

Determination of Inductor:

Consider the below equation to derive the inductor

$$L_i = \frac{DV_d}{fs\Delta i}$$  \hspace{1cm} (5)
Where

| Voltage($v_d$) | $\Delta iL$ | Freq($f_s$) | Time(s) | Duty cycle |
|---------------|------------|------------|--------|------------|
| 200           | 0.035      | 50         | 60     | 0.45       |

**Determination of RFC:**

In this process, we are using the 2nd order low-pass filter in order to reduce the Harmonics which we are occurring. For this, the required equation is taken as

$$C_{max} = \frac{Im\tan\theta}{2nf} \quad (6)$$

where

| Current($I_m$) | Voltage($V_m$) | Freq($f_s$) |
|---------------|---------------|------------|
| 1.244         | 320           | 50         |

Substitute the above value in the eq(6) to find the Maximum capacitor value.

**II.iv. Cuk type Converter Representation:**

Here, the Cuk type converter is used for the model of the Neural network based. The capacitors are used on both the side of the model to act as the energy transfer from one end to multiple end.

![Fig 2.3. Represent the Cuk type converter](image)

Designing of the Cuk type can be made by using the equation (2) & (3) for both inductor and also the capacitor.

**II.v. Flybacktype Converter representation:**

Now a days this converter is using as important one due to its easy structure structure. This representation is shown below by using the neural network. Where the...
designing of the required inductor, capacitor and RFC are calculated by using the necessary equations.

Fig 3.4 Diagram of buck-boost fly back converter

The equation (4) & equation (6) is used to calculate the desired values of the turns ratio and RFC

III. Matlab Solutions of the Work

III.i. Performance of MOSMPS:

The analysis of the every SISO system is discussed and the results of the required thing are discussed by using the graphical representation by using the neural network process. All the values got are showed and they are tabulated. With two weighting factors.

III.ii. Matlab Results of the Boost Converter:

The performance of the Boost converter by using the Neural Network along with the waveforms are showed below, where the $V_{in}=220V$ is considered.

Fig.4.1 Shows the Voltage versus Time

Fig.4.2 Shows the Current versus time
Figure 4.3. Shows the $V_{in}$ Versus time

III.iii. Matlab results of the cuk based system

The performance of the cuk based along with the neural network is showed in the below figures. Fig4.6 shows the voltage v/s time

Fig4.4 shows the current v/s time

Fig.4.4 shows the current v/s time
Figure 4.5. Shows the $V_{in}$ Versus Time

III.iv. Results of the Flyback based converter:

The performance of the flyback converter based along with the neural network is showed in the below waveforms.

Fig: 4.7. Represents the output voltage versus time

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Fig. 4.8 Represents the Current (i) versus time and

Fig. 4.9. Represents the Vin versus Time (s)

III.v. Results of Push-Pull System:

The performance of this system based along with the neural network is showed in the below figures.

Fig 4.10 Represent the Voltage Versus time (t)

Fig 4.11 Represent the \(V_{in} \) Versus time (t)
Table:1 Represents the different values taken at half load for converter by using neural network

| Converter       | Required voltage (v) | DF   | Power Actor                | % THD | Rippleout |
|-----------------|----------------------|------|----------------------------|-------|-----------|
| Forward converter | 220                  | 1.00 | 0.989 NN1* 0.82 Conventano1v2* | 3.56  | 5.0       | 1.9       |
| Cuk converter   | 220                  | 0.99 | 0.97 NN1* 0.81 Conventano1v2* | 5.2   | 7.8       | 1.6       |
| Flyback converter | 220                  | 0.98 | 0.95 NN1* 0.79 Conventano1v2* | 4.6   | 6.4       | 1.3       |

Table:2 Represents the different values taken at complete load for converter by using neural network

| Converter     | CompleteTime(s) | Controller with Neural network | Controller with Standard Method |
|---------------|-----------------|-------------------------------|--------------------------------|
|               | Neural Network control | Conventional control | Overshoot(%) | Undershoot(%) | Overshoot(%) | Undershoot(%) |
| Fwd converter | 0.20            | 0.24                          | 3.08            | 3.24            | 3.56            | 4.10            |
| Cuk converter | 0.23            | 0.25                          | 2.2             | 2.3             | 2.85            | 2.67            |
| Flyback converter | 0.24          | 0.26                          | 2.3             | 2.52            | 2.95            | 2.86            |

IV. Conclusion:

Here various control techniques are being used to improve the PQ at the i/p side and VoltageRegulation at the output side can be made by using the constant state and transients state response. In this we are using neural network control strategies are represented and simulated by using the software called MATLAB/Simulink along with the Converters in half and full load conditions with the relevance conditions.
V. Future Scope:

In this case the future scope was mainly depends upon the Neural network control techniques where many models can be assigned to improve the PQ in the domestic and transmission side and also improve the $V_{\text{regulation}}$ for this case PFC can be modelling and implemented in the front end of the systems for Permanent magnet Brushless DC motors and telecommunication towers.

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