DESIGN AND REAL TIME OF SINGLE PHASE CLOSE LOOP BOOST POWER FACTOR CORRECTION CONVERTER

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***Abstract* : This paper presents a design of single phase Close loop boost. Power factor correction converter. Control of boost Converter is used to obtain a constant DC output voltage the switching frequency and duty cycle decides the output voltage. In the closed loop process the output voltage is compared with a set voltage and the error value is reduced by controlling the switching pulse. the proposed control improves the DC bus voltage loop and presents a good capacity to track the voltage reference point under a fast variation of the load with less fluctuation in the steady state. design in constant dc voltage source than a variable source in applied and boost converter using PID controller design simulink /matlab the duty cycle of the converter is varied by controller. The controller is verified conducting simulation in MATLAB, the result show good performances in both steady and transient states .the experimental results proved that the proposed controller enhanced the performance of the converter under different parameters variations.**

***IndexTerms* –DC-DC Converter, boost converter, closed loop control, PID controller.**

I. INTRODUCTION

Boost Converter is a converter which converts variable DC voltage to required DC voltage. Boost converter is used to get DC output voltage greater than input voltage. Closed loop control is a process by which the output voltage is maintained constantly by obtaining the feedback of the loop. Closed loop control of Boost Converter is used to obtain a constant DC output voltage. The switching frequency and duty cycle decides the output voltage. In the closed loop process the output voltage is compared with a set voltage and the error value is reduced by controlling the switching pulse. The basic operation is if the error value is positive the duty cycle is reduced and if the error value is negative the duty cycle is increased by continuing the process continuously the output voltage is maintained constant. the MOSFET (Metal Oxide Semiconductor Field Effect Transistor) transistor is a semiconductor device which is widely used for switching and amplifying electronic signals in the electronic devices. Commonly, the traditional regulators like PI and PID have been used to regulate the output voltage of the boost converter These types of controls are based on modeling of the system around a nominal point under constant parameters and distur- bance, which provide an acceptable performance but if the parameters change, the system loses its performance and give a bad results. For this reason, various intelligent controllers have been introduced to get an optimal performance of the converter regardless of parameters variations

I. BOOST CONVERTER

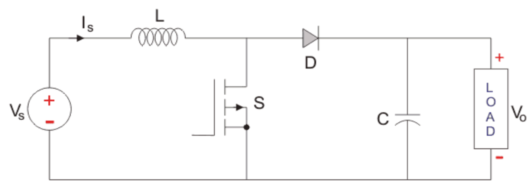

Fig 1. block diagram of boost converter

DC-DC converters are also known as Choppers. Here we will have a look at the Step Up Chopper or Boost converter which increases the input DC voltage to a specified DC output voltage. a typical Boost converter is shown below. The input voltage source is connected to an inductor. The solid-state device which operates as a switch is connected across the source. The second switch used is a diode. The diode is connected to a capacitor, and the load and the two are connected in parallel as shown in the figure above. he inductor connected to input source leads to a constant input current, and thus the Boost converter is seen as the constant current input source. And the load can be seen as a constant voltage source. The controlled switch is turned on and off by using Pulse Width Modulation (PWM). PWM can be time-based or frequency based. Frequency-based modulation has disadvantages like a wide range of frequencies to achieve the desired control of the switch which in turn will give the desired output voltage.

$$W_{in} = (\text{voltage across L})\, T_{on}$$

$$= V_s \cdot \left(\frac{I_1+I_2}{2}\right) T_{On} \qquad \text{.. (1.1)}$$

$$W_{off} = (\text{voltage across})\ T_{off}$$

$$= (V_0 - V_s)\left(\frac{I_1-I_2}{2}\right) . T_{off} \qquad \text{..(1.2)}$$

Considering the system to be lossless .these two energies given by eq.(1.1)and (1.2)will be equal .

$$V_s \cdot \left(\frac{I_1+I_2}{2}\right) T_{On} = (V_0 - V_s)\left(\frac{I_1-I_2}{2}\right) . T_{off}$$

$$V_s . T_{on} = V_0 T_{off} - V_s . T_{off}$$

$$V_s T_{off} = V_s\,(T_{on} + T_{OFF}) = V_s\ .\ \mathrm{T}$$

$$V_0 = V_s \frac{T}{T_{off}} = V_s \frac{T}{T - T_{on}}$$

$$= V_S \frac{1}{1-a} \qquad \text{...(1.3)}$$

It is seen from eq. (1.3) that average voltage across the load can be stepped up by varying the duty cycle.

Closed loop control of Boost Converter is used to obtain a constant DC output voltage. The switching frequency and duty cycle decides the output voltage. In the closed loop process the output voltage is compared with a set voltage and the error value is reduced by controlling the switching pulse. The basic operation is if the error value is positive the duty cycle is reduced and if the error value is negative the duty cycle is increased by continuing the process continuously the output voltage is maintained constant.

II. Closed Loop Control of Boost Converter

Boost Converter is a converter which converts variable DC voltage to required DC voltage. Boost converter is used to get DC output voltage greater than input voltage. Closed loop control is a process by which the output voltage is maintained constantly by obtaining the feedback of the loop

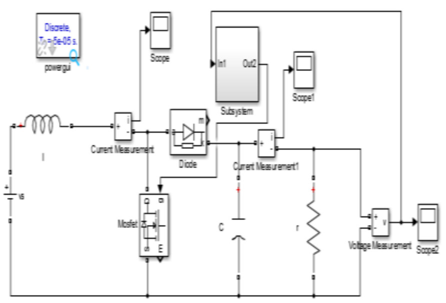

fig 2. MATLAB- model of conventional close loop Boost converter

Table 1

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Parameter close loop boost converter	
Input voltage Vs	12V
Output voltage Vo	18V
Inductor L	76.8e-6H
Inductor current IL	8.33A
Capacitor C	400e-6F
Load resistance R	4ohm
Switching frequency	25KHz

It reduces the current distortion and achieves a near unity power factor in single-phase application and it is used to have a regulated output DC voltage across the DC link capacitor the power circuit is based on a full bridge diode rectifier followed by a boost DC–DC converter.fig (1.2)

When the MOSFET transistor in the boost converter is on (S = 1), the current start flowing in the inductor and the inductor stores the energy as a magnetic field, the rectifier is blocked and the load is supplied with the energy stored in the capacitor from the previous In the second operation mode, the MOSFET is turned off (S = 0) and the load is powered at the same time from the AC power source and the energy stored in the inductor together

$$C\frac{dv_0}{dt} = (1-S)i_{l-i_0}$$

$$L\frac{dt}{dt} = v_{0-(1-S)V_0}$$

Where:

C: capacity in farad.

$v0$: output voltage.

I0: load current.

V in: Is the input voltage.

L: Inductance in Henry.

IL: Inductance current

.S: Is the state of the MOSFET

This idea is realized by comparing the sensed current in the inductor and the reference current derived from input voltage via phase locked loop and its amplitude is controlled by the output of the DC voltage controller In this paper, an improvement is introduced into the unit sinus signal synchronized to the network by a phase loc stability of radial distribution systems,

III. PID CONTROLLER

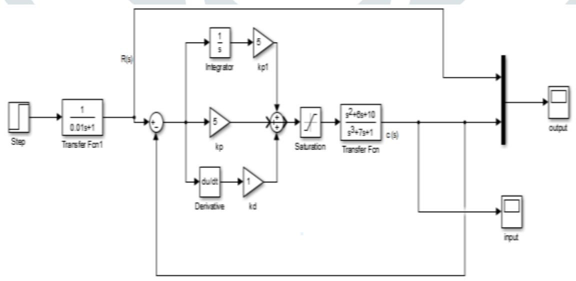


Fig3. simulation diagram PID controller

Signal which serves as the input R(t) and the actual output signal Vo(t). The tracking error is fed on to the PID controller which computes the derivative and integral of the signal provided. The output of the PID controller u (t) to be applied to the plant is equal to the proportional gain (KP) times the magnitude of the error signal plus the integral gain (KI) times the integral of the error signal plus the derivative gain (KD) times the derivative of the error signal.

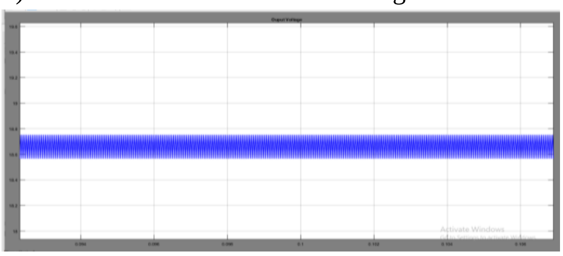


Fig 2.1. Output voltage close loop boost converter

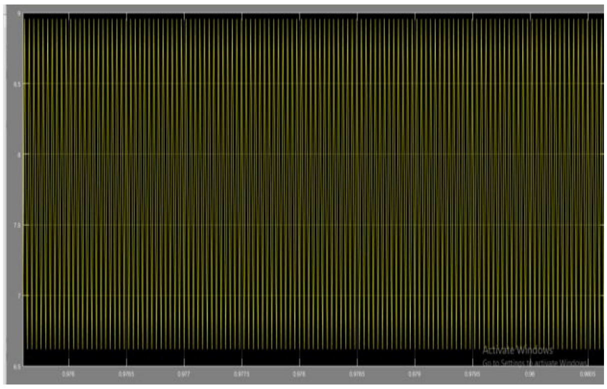


Fig: 2.2. close loop boost converter

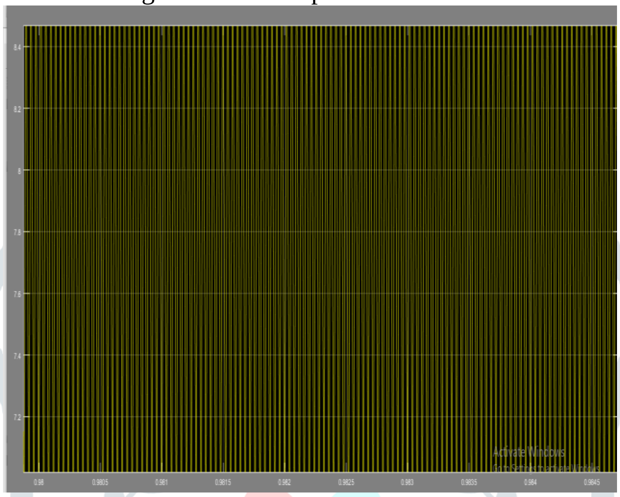


Fig: 2.3. close loop boost converter

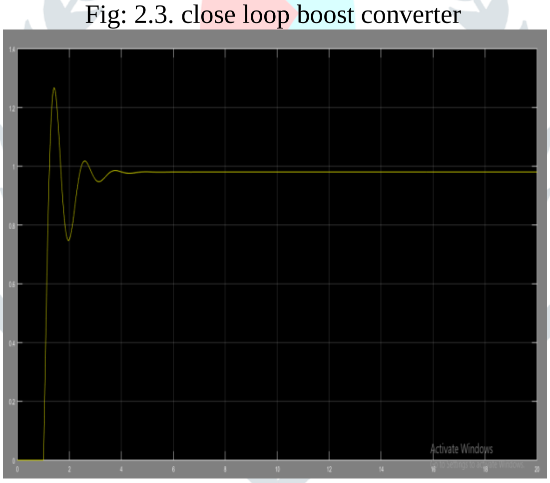
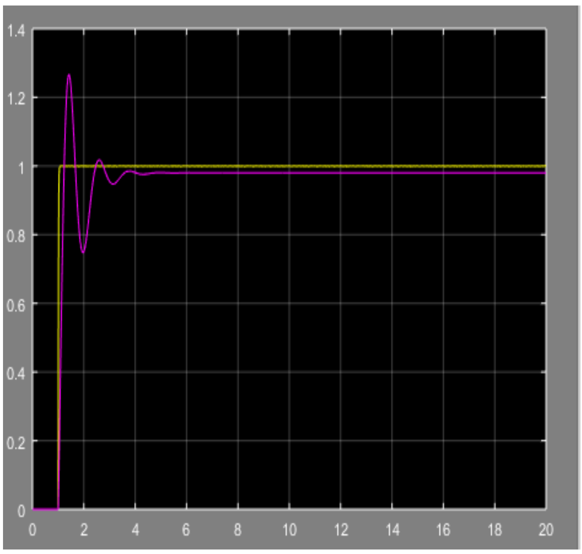


Fig: 3.1. Input voltage



. Fig 3.2. Output voltage plot of proposed with PID controller

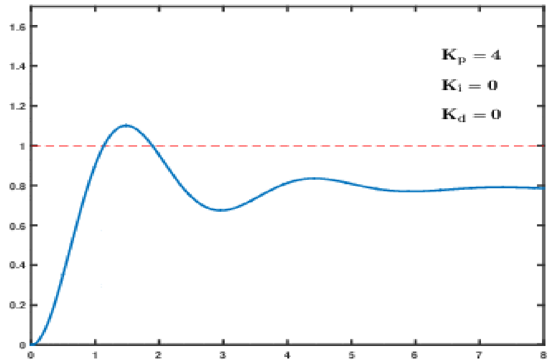


Fig 3.4. k_p PID parameter

IV. Simulation Results

The single phase close loop boost power correction conditioner power circuit has been designed to the specification described in table 1. the experimental test bench is based on the data space box controller to perform. boost converter for close loop boost converter is design simulation in matlab the proposed PID controller when used with close loop Boost converter provides better the output is maintained close to its unity is input 12V and the voltage reference was set at output24V.

The analysis on the deviation of voltage result sinusoidal waveform and in phase with the source voltage.

V. Conclusion

The proposed system presents the design of single phase boost power factor correction converter by using two control strategies PID and PWM techniques. The simulation result show that the two controllers has enhanced the converter performance .the output voltage track its reference perfectly; the input current is in sinusoidal waveform and in same phase with the grid voltage the system is stable during the changes of the reference output voltage.

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