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Design of Boost Converter Using Matlab Simulation

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ABSTRACT:- The paper presents the application & design of DC/DC boost converter. A boost converter is the most popular application in the industry to step up the direct current (DC) input voltage. Since, the proposed converter delivers high conversion efficiency, it can be selected for multilevel boost DC-DC converters. There are many types of controller that can be used to implement the elegant and effective output. This design focuses on continuous mode operation, with different voltage inputs of 100V and 200V DC, where the switching frequency input is 25kHz using the MOSFET as a switching device. The boost converter maintained the constant output voltage in the load. The PI stands for Proportional and Integral Controllers, which are designed to eliminate the need for continuous operator attention, thus provide automatic control to the system. In this paper the PI controller is used and the Kp and Ki gain value is calculated by using trial and error method. r. The boost converter model is simulated by using MATLAB/SIMULINK.

I.INTRODUCTION

The conversion voltage supply directly from DC voltage to a different DC voltage is called a DC converter. This converter is used to step UP the input voltage to desired voltage. A boost converter has the ability to increase the input voltage based on duty cycle of the switch DC converters are widely used for traction motor control in electric automobiles, trolley cars, marine hoists, forklifts trucks, and mine haulers. They provide high efficiency, good acceleration control and fast dynamic response. proportional integral (PI) controller is used and the boost converter is used for converting DC into DC then that voltage is used for some application for example load as motor mean it operates in constant voltage if that voltage needs continuously this paper is very suitable. . The PI controller is used for controlling the voltage signal after that it will send to PWM generator then the PWM generator is used to tuning the Kp and Ki values from PI controller. The PWM generator is used for commutating the duty cycle then the MOSFET is used for closed and open operation for boost converter. When the switch on n the inductor gets energized if the MOSFET is closed the energy will goes to diode the diode operates only in forward direction the capacitor is used for removing the ripple component.

II.OPERATION OF BOOST CONVERTER

The basic circuit diagram of the operation boost converter shown in Figure1 The inductor used to provide a smooth input current, and some ripple components are included in the input current. The process of energy transfer is carried by various elements like inductor, power switch, diode and filter capacitor. Pulse-width modulation(PWM) allows control and regulation of the total output voltage. The circuit operation can be divided into two modes. Mode 1 when the switch opens. The switch can be implemented by a MOSFET, IGBT, or BJT. In this study, MOSFET is used to react to a switching process in a Boost circuit. The mode1 (figure) switch is on and current will be flow in inductor L r gets charged by the current flowing through the loop during this period. inductor voltage is also high as it is not delivered to any load but to itself. Diode is off during this mode. The equivalent circuit representation of mode 1 is shown in fig.

MODE 2, When the switch is in OFF state (Open), The energy stored in the inductor during ON state is, discharge through diode**.** charging the capacitor at the load side. The equivalent circuit for mode 2 is shown in fig

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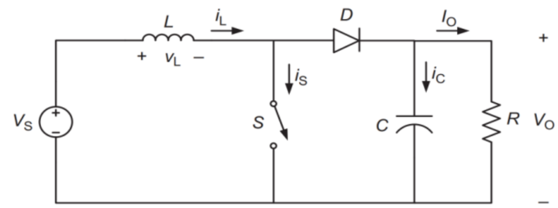


Figure(a)

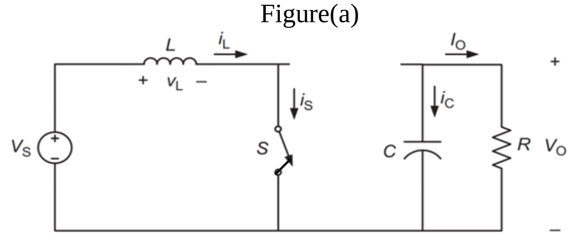


Figure (b) Mode 1

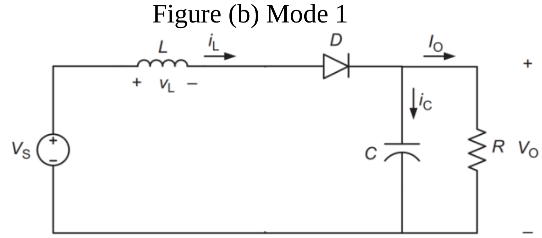
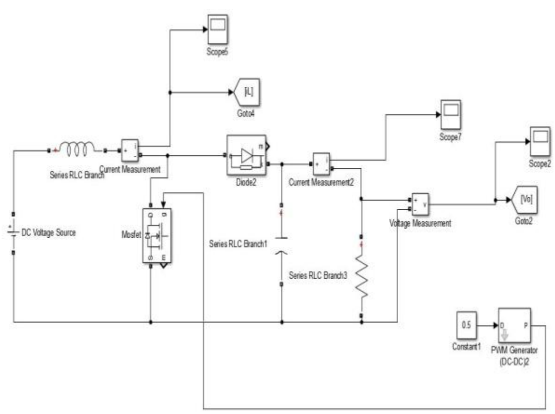


Figure (c)Mode 2

CIRCUIT DESIGN:-



Figure(d)

a. Input voltage = 100v
b. output voltage = 200V
c. p=2000w ,
d. f = 10KHz
e. DUTY RATIO = 1-VIN / VOUT
f. L = D*VIN/f* ΔI0

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PARAMETERS	VALUE
L(INDUCTANCE)	$5*10^{-3}$ H
C (CAPACITOR)	250µF
f(FREQUENCY)	10KHZ
R(RESISTANSE)	10Ohm
P(POWER)	2000W
D(DUTY CYCLE)	0.5

g. C = D*I0/f ΔV0

RESULT:-OPEN LOOP BOOST CONVERTER SIMULATION

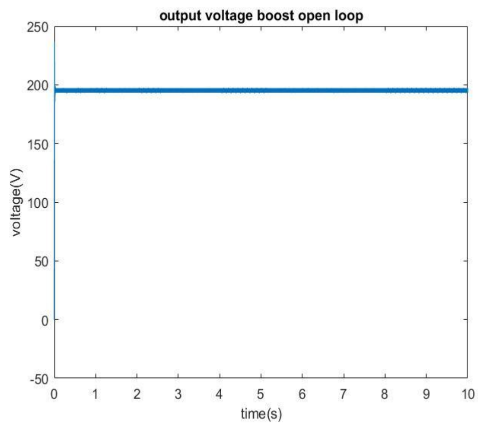

figure (e)

- **THE DESGIN OF CLOSE LOOP BOOST CONVERTER-**the output of an open loop boost converter is not regulated, so the output of a closed loop boost converter is regulated and fix.show in fig.f

- **PI controller-** use in close loop. PI control is becoming more popular because of its ability to maintain exact set point. Proportional-Integral controller mode results from the combination of the proportional and the integral mode. The integral feature effectively provides a 'reset' of the zero error output, after the load change occurs. The controller output is provided through a sum of proportional plus integral action that finally leaves the error to zero, so that the required output is obtained If the error is not zero, the proportional term contributes a correction and the integral term begins to increase or decrease the accumulated value, depending on the sign of the error and its direct or reverse direction. The integral term cannot become negative. The transfer function is given $K_{p\,+(}K_I/S)$

- . ZIEGLER-NICHOLS TUNING RULE The proportional gain and the derivative gain are determined by the Ziegler Nichols method. It is the pioneer method to determine the closed loop proportional and integral constant. It consists of two steps to get the tuning values. Step: The determination of the dynamic characteristics or personality of the control loop. Step 2: The estimation of the controller tuning parameters that produce a designed response to the dynamic characteristics, determined in the first step. In this method, the parameters by which the dynamic characteristics of the process are represented, by the ultimate gain of a proportional controller and ultimate period of oscillation are estimated. The ultimate gain and period can be experimentally determined by the following procedure. 1. Switch off the integral and derivative actions of the feedback controller so as to have a proportional controller. In some models the integral action cannot be switched off, but can be determined only by setting the integral time to its maximum value or equivalently the integral rate to its minimum value. 2. With the controller in closed loop action, increase the proportional gain until the loop oscillates with constant amplitude. Record the value of the gain that produces sustained oscillations as K cu (ultimate gainFrom a time recording of the controlled variable, the period of oscillation is measured and recorded as Tu (ultimate period). The Ziegler-Nichols controller settings of P, PI and PID controllers are shown in-
$K_P = 80$, $K_C = 0.3$

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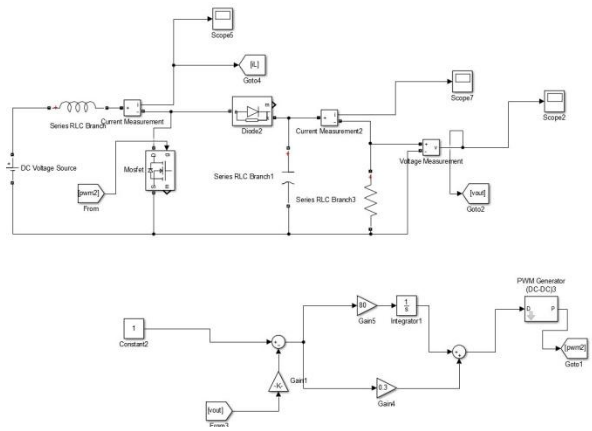
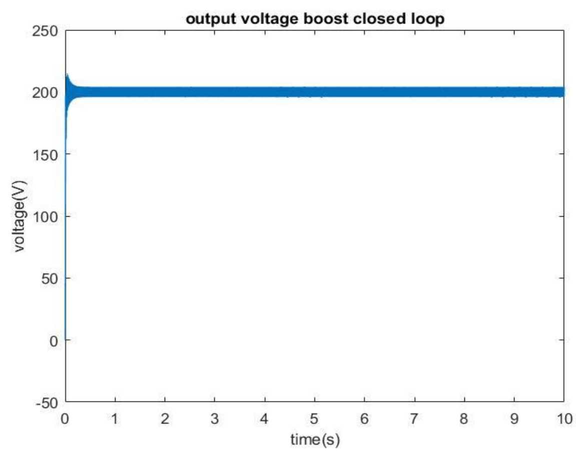


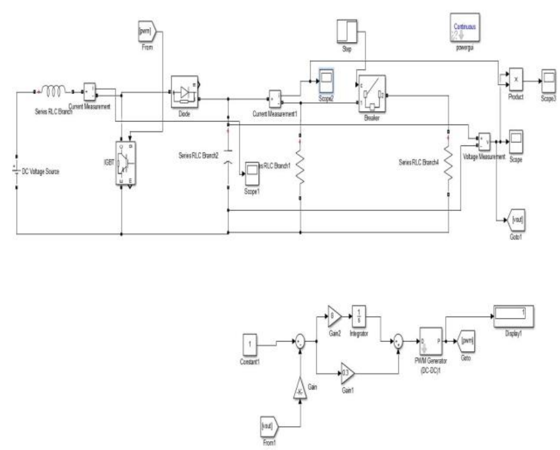
Figure(f)

RESULT:-CLOSE LOOP BOOST CONVERTER



Figure(g)

2 RESISTIVE LOAD CONNECTED BOOST CONVERTER



Figure(h)

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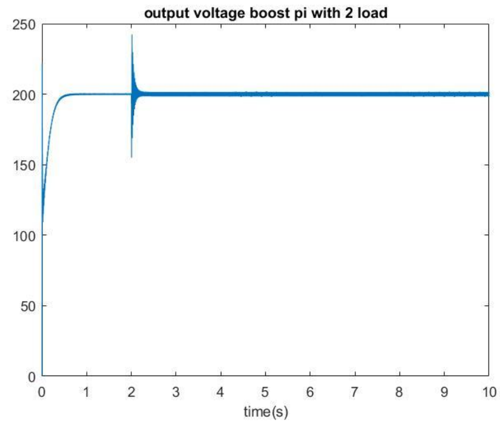

Figure(i)

III.CONCLUSION

This paper has discussed the basic design aspects of interleaved boost converters. Results of the simulation show that the proposed PI controller regulates satisfactorily the output voltage of the boost converter. The average output voltage of the converter practically comes to be 100V as compared to the 200V form the Simulink. This high conversion efficiency makes the proposed converter. The effect of parameter variation like capacitance, inductance and the input voltage variation is analyzed in a boost converter with constant power load using different types of controllers, PI controllers are used to maintain stability in case of steady and transient state.

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