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Arduino Based Pwm Output Voltage Control of a DC-DC Boost Converter

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***Abstract*-The main objective of this paper is to design a boost converter which uses the Arduino to provide the gating pulses switch the semiconductor devices used in the boost converter. The input of these converters is an unregulated DC voltage, which is mostly obtained by photo voltaic system and therefore it will fluctuate due to changes in radiation and temperature which in turn, changes the average output voltage. Thus we have proposed a system in whichthe output voltage is monitored by introducing two push buttons, through which the Arduino generated pulses, are given to the semiconductor devices. By pressing one push button the duty cycle of the PWM signal generated is increased and by pressing another switch the duty cycle is decreased and hence the output voltage is monitored accordingly.**

Keywods – Arduino; Boostconverter; PWM

I. INTRODUCTION

Power electronics is one of the most abruptly growing branches in the field of applied science. During the past decades as the size, utility and complexity of today's most modern electronic devices increases new techniques has been developed to effectively power them up and create very useful devices in order to meet various requirements such as long battery life, cheap and small power system. To cope up with these increasing developments many innovators has come up with various converts and control strategy.

A DC-DC boost converter is an electronic circuit whose output voltage is greater than the input voltage. They are also called as step up converters since it steps up the input voltage. They play an important role in renewable energy sources such as solar energy, hybrid vehicle systems, lightning system etc. Boost converter is a class of switched mode power supply. It consists of at least two semiconductor switches and at least one energy storage element such as capacitor or inductor or the combination of the both.

The PWM pulses needed to switch on the semiconductor switches used in the boost converter are generated in many ways. A PIC microcontroller can be used but it requires an external interface to produce the PWM. In another method omp-amp based microcontroller is used which becomes very bulky to handle and hence not advantageous.

II. METHODOLOGY

In order to overcome all these disadvantages we are using Arduino for generating the PWM signals for powering the semiconductor switches and also for monitoring the output voltage of the boost converter.

Arduino package is a single-board microcontroller whose hardware has a simple open source hardware board .The software has a standard programming language compiler and a boot loader that executes on the microcontroller. The programming is done using C language. This package reduces the complexity of generating PWM triggering signals. Based on the implementation of an effective control technique the output voltage can also be monitored using this Arduino board.

The method proposed implements the generation of pulses for the switches using Arduino and the open loop control of the output voltage in a boost converter.A DC power source, mostly battery is used to power the boost converter. The boost converter then boosts the input voltage and gives it to the load. The pulse needed for switching on the semiconductor switch used in the boost converter is generated using the Arduino UNO.

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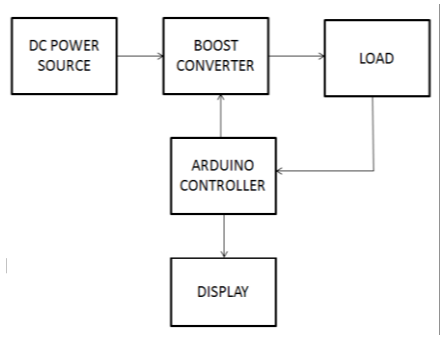

Fig 1 : Block diagram

In order to monitor the output voltage of the boost converter we have used two push buttons together with Arduino. The duty cycle of the PWM signals generated by the Arduino pins is controlled by two push buttons before giving them to the semiconductor switches.

The Arduino board is coded in such a way that when the increasing push button is pressed the duty cycle of the PWM signal is increased by some value for each press. Similarly when the decreasing push button is pressed the duty cycle of the PWM signal generated is decreased by some value for each press. When the duty cycle of the pulse is varied the time for which the semiconductor switches are kept on is varied this in turn changes the output voltage of the converter. Thus the output voltage of the boost converter is monitored.

III. COMPONENTS

A dc source is used to give input supply to the boost converter. The boost converter produces an output voltage greater than the input voltage depending on the duty cycle of the PWM pulses produced by the Arduino board. The output voltage is given to the load and it is displayed in a display.

A mosfet based chopper kit was used in this project. It consists of three modules such as the power circuit, load and DC source.A dc voltage of about 24V is used as a source. An incandescent lamp of 230V is used. The power circuit of the kit comprises of MOSFET, inductance, capacitance and diode. The type and the values of the components used are as follows:

Table 1: components

MOSFET	IRF 840
Inductance	60mH
Diode	BYQ 28E
Capacitance	100μF/450V

The gating signal produced by the Arduino pin is of low current value and hence it cannot directly trigger the semiconductor switch. In order to overcome thus a driver circuit is employed. The driver circuit also provides isolation between the Arduino and boost converter. A driver circuit of specification TLP250 is used.

IV. SIMULATION AND RESULT

MATLAB is a multi-paradigm numerical computing environment and fourth-generation programming language. MATLAB allows matrix manipulations, plotting of functions and data implementation of algorithms, creation of user interface and interfacing with programs written in other languages, including C, C++, C# , Java, Fortran and Python.

In this section the simulation of the boost converter is shown. The boost converter is first designed and simulated using the MATLAB R2013a software. The Simulink diagram of the boost converter and the output voltage and current waveform is as follows.

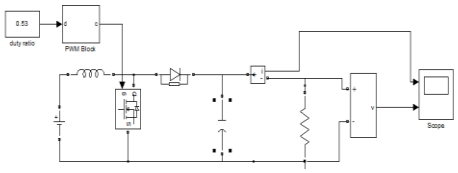

Fig 2: simulation diagram

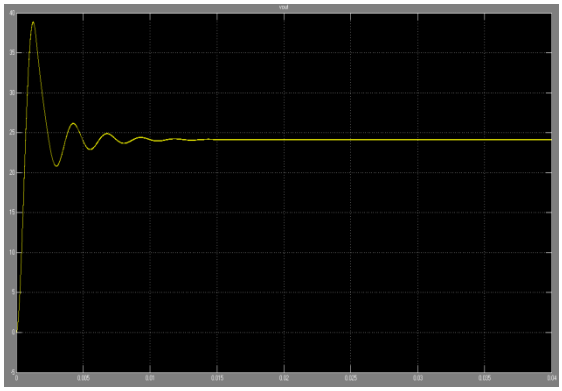

Fig 3: output voltage waveform

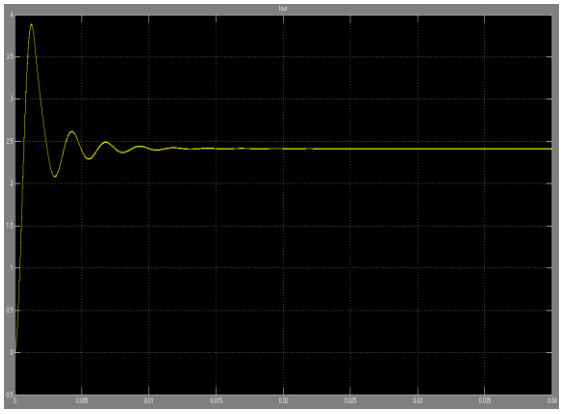

Fig 4: output current waveform

The arduino based generation and control of PWM signals using two push buttons are simulated using the PROTEUS software.

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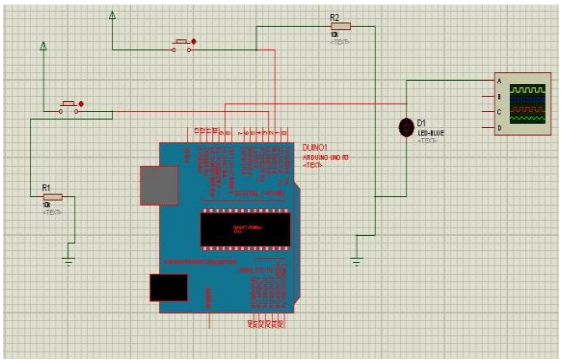

Fig 5: proteus simulation

The program is burned into Arduino and the boost converter is turned on. Initially the input voltage of 25V appears on the output side without any boosting. As we press the increment button the duty cycle increases and the voltage also increases accordingly. As we pressthe

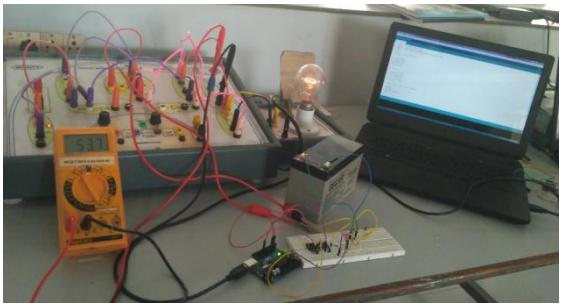

Fig 6: Hardware module

decrement switch the output voltage decreases correspondingly. A maximum output voltage of about 75V is obtained using this kit.

V. CONCLUSION

A boost converter is an efficient step-up DC-DC converter used in numerous electronics devices. In this project, a boost converter is modelled and simulated using Arduino with two push buttons. An open loop model is developed by using which the output voltage is monitored. This method has advantages like reduced hardware, high performance, less weight and accuracy. The simulation results thus obtained are in accordance with the output obtained.

To apply the PWM control technique, Arduino is used to avoid the need for complex hardware circuits. Thus we have the simplest way to regulate the dc output voltage with the use of push button, they have less efficiency regarding power consumption. The DC converters which use Arduino have very high efficiency.

VI. References

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