

BIDIRECTIONAL SYSTEM USING DC-DC CONVERTER

Vishal Pimple¹, Shantanu Urkande², Roshani Kawade³, Namrata Umate⁴, Sumedh Khobragade⁵, Rakshanda Kuntewar⁶

¹Vishal S. Pimple, Pursuing Electrical Engineering, DMIETR, Maharashtra, India

²Shantanu S. Urkande, Pursuing Electrical Engineering, DMIETR, Maharashtra, India

³Roshani D. Kawade, Pursuing Electrical Engineering, DMIETR, Maharashtra, India

⁴Namrata M. Umate, Pursuing Electrical Engineering, DMIETR, Maharashtra, India

⁵Sumedh V. Khobragade, Pursuing Electrical Engineering, DMIETR, Maharashtra, India

⁶Rakshanda N. Kuntewar, Pursuing Electrical Engineering, DMIETR, Maharashtra, India

ABSTRACT

This paper describes bidirectional system using DC-DC converter fed to DC motor for EV application. The proposed model is required to function in three different modes normal mode acceleration mode and braking mode. This model is meant for battery fed electrical vehicle (BFEV) and many more application. During acceleration mode and normal mode the power flow is from battery to motor where the kinetic energy of the motor is during braking or regenerative mode is converted into electrical energy and fed back to battery. Experimental results of the modal are verify the proper charging and discharging operation of the battery using this system.

Keyword: - Bidirectional system¹, DC-DC converter (Boost)², Series DC motor³, Battery⁴.

1. INTRODUCTION

In recent years the population of the India is being increased rapidly. The utilization of power has become very important in every humans life. Recently bidirectional systems are widely research and developed for various applications. In case of the battery fed to the circuit, electrical energy flow between motor and battery side, and this mode meant for battery fed electrical vehicle (BFEV) and many more application. The use bidirectional circuit fed dc motor and allows to control in both motoring and regenerative braking operations.

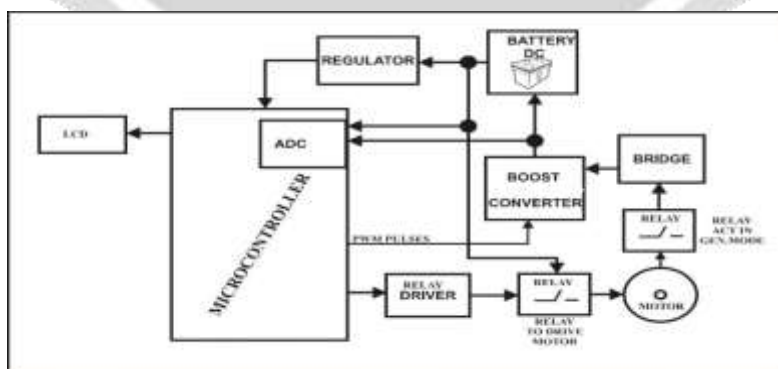


Fig.1. Block diagram of bidirectional system

In this system when the circuit is ON, the operation of acceleration and regenerative mode is automatically performed. This is happened because of use of microcontroller. The microcontroller observes the acceleration

voltage and regenerative voltage. Up to 10sec the acceleration mode is ON. (The time which fed to the microcontroller program) then its stop the acceleration mode. Because of kinetic energy which produced by the motor the regenerative energy is produced and is fed to the battery. When the regenerative voltage is not sufficient to the battery then the microcontroller again start acceleration mode.

2. CONVERTER

In this project we use boost converter for increase the regenerative voltage. A boost converter is a converter that steps up voltage from its input to its output. It includes at least two semiconductors and at least one energy storage element or the two in combination. To decrease voltage ripple, filters are added to converter's output and input.

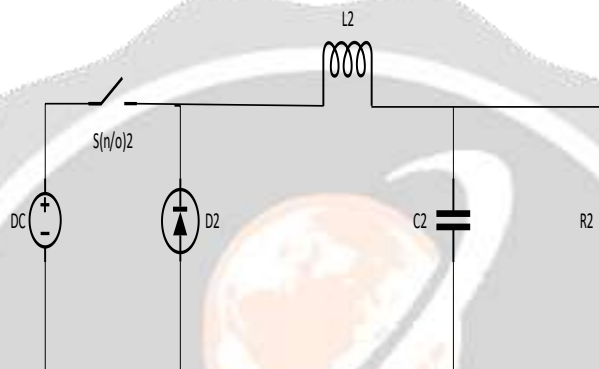


Fig.2. Circuit Diagram of Boost Converter

2.1 ELEMENT USE IN CIRCUIT

Series DC motor rated at 12V, 2400RPM,

DC-DC converter parameter $L=1\text{H}$, $C=1000\mu\text{F}$, $F_{\text{sw}}=1\text{MHz}$

Battery voltage=12V, 7AH

PIC microcontroller,

Relay=12V, 7A,

Driver L298

3. OPERATION OF BIDIRECTIONAL SYSTEM

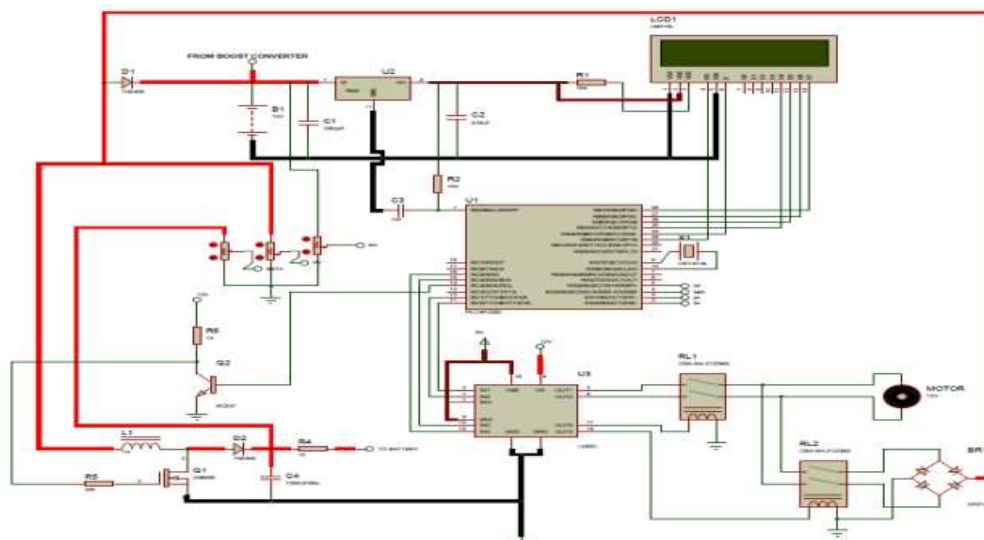


Fig.3.Circuit diagram of bidirectional system

The voltage from the battery to the regulator which decrease up to 5V is fed to the microcontroller, 5V is required to operate the microcontroller. The circuits relay need 12V to operate for that the driver L298 which connected to the microcontroller. It takes 5V from the microcontroller and amplifies it to 12V to excite the relay coil.

Case 1: Operation in acceleration mode

In acceleration mode, the relay RL1 is ON due to the excitation given by driver (L298) to excitation coil of relay and closed path is formed between battery to motor. Up to 10sec the acceleration mode is ON.

Case 2: Operation in regenerative mode

After the 10sec of acceleration mode (The time which fed in microcontroller for acceleration mode) then microcontroller OFF RL1 relay by driver (L298) and switched ON the relay RL2 and the motor goes under regenerative mode. The voltage which is getting from the regenerative mode is Boost up the voltage by boost converter and fed back to battery. If, after the 10sec acceleration mode can't generate more than 9.2V then the acceleration mode is continue.

Case 3: Operation in regenerative to acceleration mode

When the regenerative voltage of a motor decreases up to the 9.2V which is the set value of microcontroller for regenerative mode gets OFF. Because in input our Boost converter need 9.2V to charge the battery. Then again, microcontrollers switch OFF relay RL2 and switch ON the relay RL1 with the use of driver (L298). Again, the motor operates in acceleration and the process continues.

3.1 EXPERIMENTAL RESULT

- 1) Time period for which acceleration mode is ON = 10sec. (which is already set in microcontroller)
- 2) Set value for the regenerative mode from which again, the motor operates in acceleration mode = 9.2V.
- 3) Time period for which regenerative mode is ON = 3sec.



Fig. 4. Proposed circuit of bidirectional system

4. CONCLUSION

In this work, we demonstrate the performance of the bidirectional system and it shows satisfactory performance at different diving condition. The proposed circuit is suitable for electric vehicle. The performance of the circuit is verified under forward motoring mode and regenerative mode.

5. REFERENCES

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