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# HYBRID ELECTRIC VEHICLE USING SUPER CAPACITOR

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***ABSTRACT: In the strive to improve the lifetime and performance of a hybrid vehicle drive train, one of the most challenging tasks is to improve the performance of the electrical Energy Storage Unit regarding the electrical power and energy capacity. The process of storing electric energy chemically in batteries is affected both with losses, power limitations and limited usage. By introducing a super capacitor help to increase system power and mitigate the battery from stresses, the performance of the combined energy storage unit is improved. Dc -Dc Converter is used for controlling purpose and it is connected parallel to the super capacitor and battery. We are using different modes in HEV. The controlling of dc-dc converter is done by PWM Technique. The performance of hybrid storage system is simulating in MATLAB.***

***KEY WORDS: Hybrid Electric Vehicle(HEV), Dc -Dc Converter, Battery, Super Capacitor.***

NOMENCLATURE:

| | |
|---|---|
| DC | Direct Current |
| Vs | input Voltage |
| Vo | Output Voltage |
| L | Inductor |
| C | Super capacitor |
| D | duty cycle |

## I. INTRODUCTION

The increasing popularity of electric vehicles is presenting the automotive industry with new challenges. One key problem is the operational mileage range in one charge. Petroleum resources across the world is depleting at a high rate due to the large dependency of the transportation sector on petroleum as the primary fuel. Also due to this, there is a vast greenhouse gas emission that is degrading the quality of air and causing injury to life and environment. Electric vehicles attract more and more consideration because of its clean and eco friendly features. In electric vehicle one of the big issues is the life time of battery and other one is charging time, but new materials are utilized to extend the battery life and also Increase the storage density to save weight and space. Besides the new materials, there are still some researches focus on how to form hybrid energy storage system to improve the battery operation condition. Some fast charging schemes and related devices are developed to shorten the charging time. But nowadays condition is change they are widely used in portable electronics, hybrid or electrical vehicles. However the use of batteries as energy buffer is somehow problematic and difficult, it reducing the battery's lifetime. At present, Electrical Vehicle (EV), Electro chemical batteries, Super capacitors and flywheels are energy storing devices. Super capacitor is high power density and low energy density. Batteries are having very low power density and high energy density compared to the Super capacitors. Electric vehicles require high power density during acceleration or in starting and high energy density to travel more distance in single charge, so no single source can supply both energy and power demands in electric vehicles have regained a strong global presence. Super capacitor size is very small compared to battery. So, size, weight, space is required very small.

Thus, super capacitor module can be used in combination With the batteries in storage system of any EVs to get the Following benefits:
1) To improve vehicle acceleration;
2) To improve overall drive efficiency, there by Increasing the driving range;
3) To reduce life cycle costs by extending the battery Life;
4) To reduce capital costs by direct replacement of some Batteries.

## II. PROPOSED SYSTEM

This section reviews the modeling of the main power system components in an electric vehicle; namely, the battery bank, the super capacitor bank.

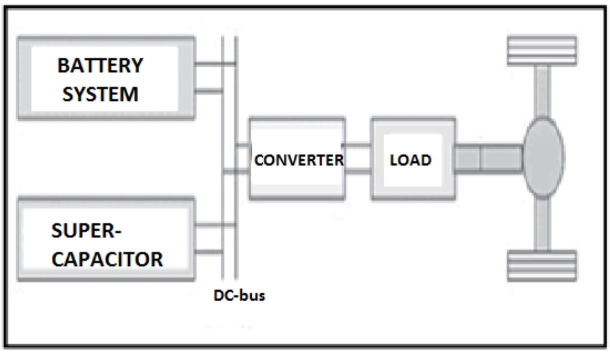


Fig.1 Proportional Block dia.[1]

HEV fig. is given. The battery is used as source supply for Electric Vehicle which supplies 12 Volt to the Bi Directional Converter (BDC), the converter is bidirectional only to fulfill the need of recharging the battery during the deceleration and supplying the voltage which is due to 50% duty cycle gives boast operation and produces 24 volt across 24 volt capacity Super capacitor.

  

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While direct connection of the super capacitor across the battery terminals does reduce transient currents in an out of the battery, the best way to utilize the super capacitor bank is to be able control its energy content through a power converter. The direct super capacitor-battery shunts connection. The desired connection is then addressed by using a DC/DC converter. In the boost mode when discharging at >=50% duty cycle. The super capacitor bank is charging in the buck mode when at <50% duty cycle. The super capacitor gets charged up and in parallel provides the voltage to the LOAD. During the downhill, breaking or travelling the motor works in mode of generator motion. The Control Block provides the gating signals to drive the MOSFET in the converter. And further the control can enhance the working by different control techniques. Here PWM technique is used for controlling system. The main power system components in an electric vehicle are namely the battery, the super capacitor and DC-DC Converter and Load. The LOAD drive is designed to be able to handle the current at the lower voltage. A higher voltage SC bank is always directly connected to the DC link so as to provide peak power demands where as a lower voltage battery is connected to the DC link via a power diode (or a controlled switch). The DC/DC converter is always controlled to try to maintain the voltage of the SC higher than that of the battery. Therefore in most cases, the diode is reverse biased. The analysis is illustrated by computer simulations of an actual system. In order to explain the operation of the HESS, all electric vehicles are used as an example. In an electric vehicle application, the operation of the HESS can be separated into three modes. They are vehicle low and high constant speed operating modes, accelerationmode. The practical operation of the HESS is complex, but it is a combination of the above three modes. The three operating modes will be discussed below in detail.

Mode I: Vehicle Low Constant Speed Operation The constant speed operation of the vehicle was separated into two depending on if the power of the DC/DC converter (converter P) can cover the power demand (demand P). If demand P is equal to or smaller than converter P, we call this operating condition the low constant speed mode. If the vehicle is running at a higher speed and in which demand P is higher than converter P, we call it the high constant speed mode. Both the low and high constant speed operating modes are ideal modes, since in practical vehicle driving; the power demand is always changing. They are defined here in order to explain the operation of the proposed HESS.

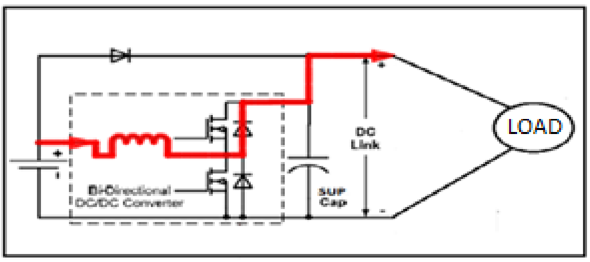


Fig.2 Low Constant Speed Operation Energy Flow[5]

Mode II: Vehicle High Constant Speed Operation In the high constant speed operating mode, demand P >converter P, UC V can no longer be maintained higher than Battery V. Therefore, the main power diode is forward biased. The battery is providing energy directly to the motor. In this mode, the DC/DC converter will be turned off. Figure 3.3 shows the energy flow of the high constant speed operating mode.

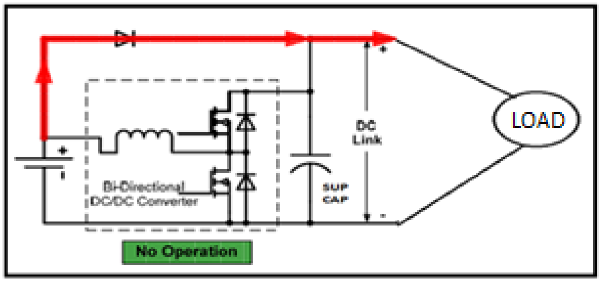


Fig.3 High Constant Speed Operation Energy Flow [5]

Mode III: Acceleration At the beginning of the acceleration mode, assume SC V >Battery V. Since converter P < demand P, SC V will keep decreasing. Energy from the SC and the DC/DC converter are both supporting the vehicle acceleration. Figure 3.4 illustrates the energy flow of the acceleration mode phase I.

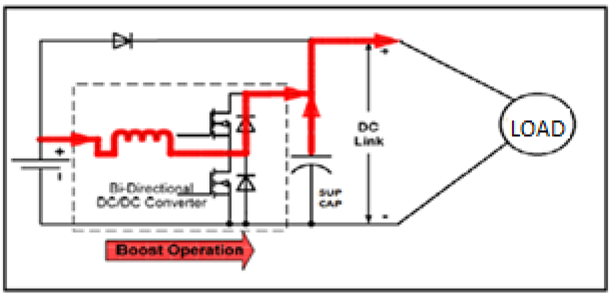


Fig.4 Acceleration Operation Energy Flow Phase 1 [5]

With the decreasing of SC V, SC V will drop to the same level as Bat V. When SC V = Bat V, the battery and UC become directly paralleled through the diode. The system enters the high constant speed operating mode. In the high constant speed operating mode, if demand P becomes less than converter P, the power difference between converter P and demand P will be used to charge the SC. The energy flow is illustrated in Figure.

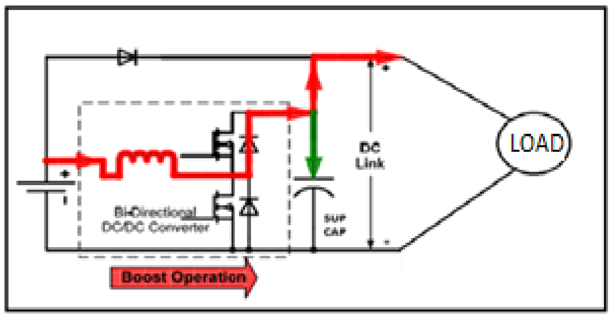


Fig.5 Acceleration Operation Energy Flow Phase 2 [5]

  

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## III. CONTROLLING TECHNIQUE

### A. DC-DC CONVERTER

Dc-Dc power converters are employed in a variety of applications, including power supplies for personal computers, office equipment, spacecraft power systems, laptop computers, and telecommunications equipment, as well as dc motor drives. Pulse-width modulation (PWM) allows control and regulation of the total output voltage. This approach is also employed in applications involving alternating current, including high-efficiency dc-ac power converters (inverters and power amplifiers), ac-ac power converters, and some ac-dc power converters (low-harmonic rectifiers).

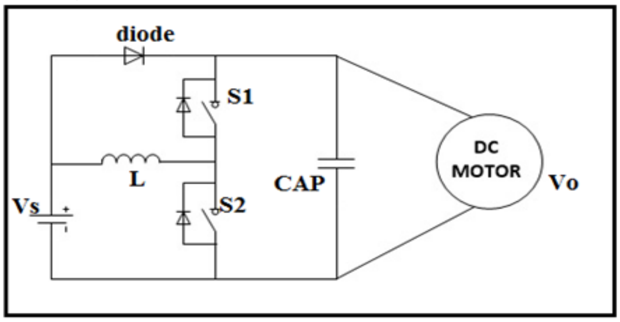



Fig.6 half bridge converters

### B. PWM (PULSE WIDTH MODULATION)

Because of advances in solid state power devices and microprocessors, switching power converters are used in industrial application to convert and deliver their required energy to the load. PWM signals are pulse trains with fixed frequency and magnitude and variable pulse width. There is one pulse of fixed magnitude in every PWM period. However, the width of the pulses changes from pulse to pulse according to a modulating signal. When a PWM signal is applied to the gate of a power transistor, it causes the turn on and turns off intervals of the transistor to change from one PWM period to another PWM period according to the same modulating signal. The frequency of a PWM signal must be much higher than that of the modulating signal, the fundamental frequency, such that the energy delivered to the load depends mostly on the modulating signal.

## IV. SIMULATION RESULTS

There are triangular and dc wave both compared by this we controlling load.S2,S1 Pulse is used for select mode by duty cycle.IF D>50% THEN it is boost mode.IF D<50% THEN it is buck mode.

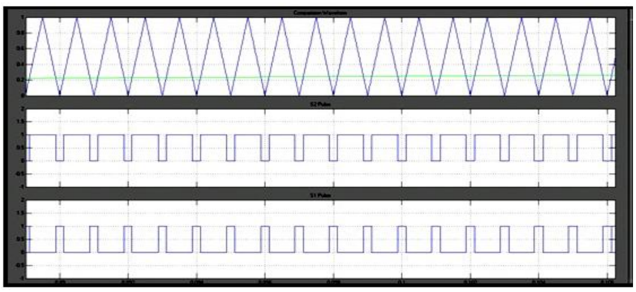
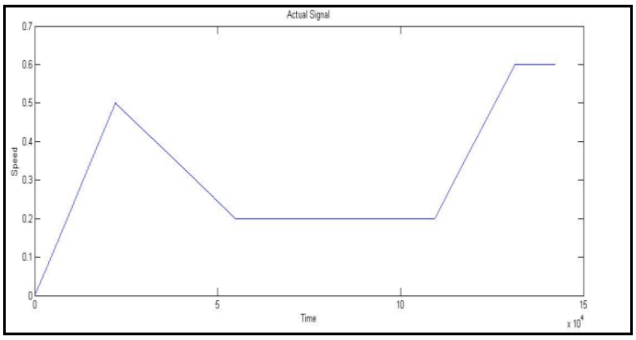
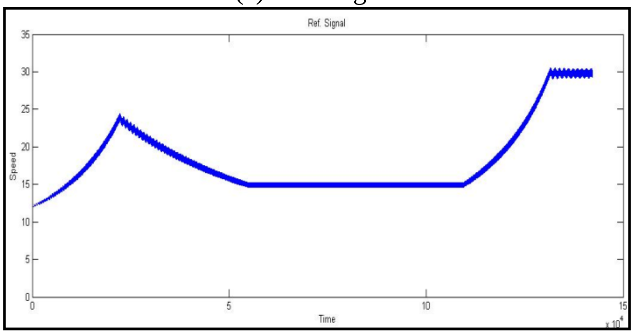


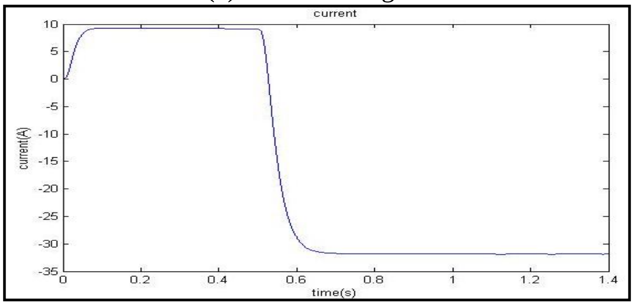
Fig.7 Comparision Waveform,S1 and S2 Pulse



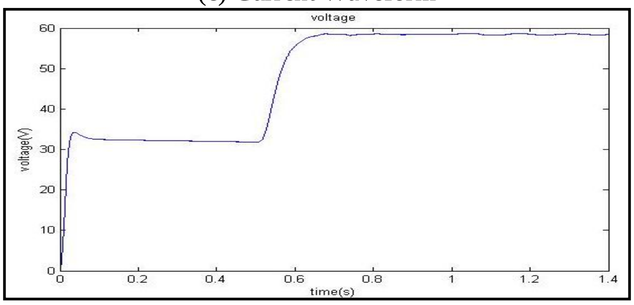

(a)Atual Signal



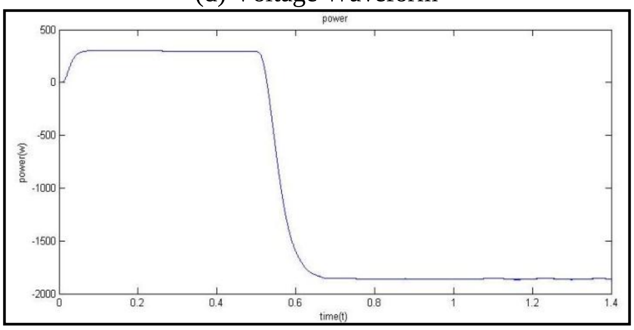

(b) Reference Signal




(c) Current Waveform




(d) Voltage Waveform




(e) Power Waveform

Fig.8 (a)Atual Signal (b) Reference Signal (c) Current Waveform (d) Voltage Waveform (e) Power Waveform

## V. CONCLUSION

By this We Can Conclude that by Using Super Capacitor Charging time is increased as Compared to Battery .With this strategy and a suitable Super capacitor it is possible to relieve the battery from stress. Life of Battery increased. Performance of Vehicle is become well, reduce the average Energy Consumption

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