IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

REDUCING ENERGY COSTS BY USING OPTIMAL ELECTRIC VEHICALS SCHEDULING AND RENEWABLE ENERGY SOURCES

V.Jothika[1] and Dr.R.Sankarganesh[2]
[1]*PG Student, Department of EEE, K.S.R. College of Engineering, Tiruchengode – 637215, Tamil Nadu, India*
[2]*Associate, Department of EEE, K.S.R. College of Engineering, Tiruchengode - 637215, Tamil Nadu, India*

ABSTRACT: The goal of the current review study is to provide more information on the idea of a fully green energy system, which encompasses both the energy source and the energy storage system. The goal is to suggest an energy label called "Green to Green" (G2G), which recognises systems integrating both green sources and green storage as an effective way to reduce the dangerously high levels of pollution that most nations have attained as of late. Renewable energy sources like solar, wind, geothermal, and wave energy systems make up the majority of green sources. Green energy storage options include compressed air, hydrogen, flywheels, and pumped hydroelectricity. Energy storage has been an integral component of electricity generation, transmission, distribution and consumption for many decades. Today, with the growing renewable energy generation, the power landscape is changing dramatically. Battery-based ESS technology can respond to power drop-outs in under a second, making use of clean energy, sourced from collocated solar or wind plants. In such before-the-meter cases, ESS functions as bulk storage coupled with either renewables generation or transmission and distribution systems. In residential and commercial situations, ESS plays a role in behind-the-meter systems.In times of increasing popularity of e-mobility solutions (particularly electric cars) it can be expected that in the future the world will have to cope with a significant number of used EV-batteries. To overcome this limitation, modularly cascaded, multilevel architectures that utilize the benefit of highly efficient, low voltage MOSFETs like Infineon's market leading Optimise family have been developed. The **battery management system (BMS)** handles cell charging, balancing, and health monitoring, complemented by a microcontroller providing system control and communication. Essential elements to integrate ESS into larger systems. In this page all the different BESS topologies are shown. In this case study, a model predictive controller is used to simulate a V2G in Mat-lab for each power flow system**.**

***IndexTerms* -Bidirectional AC-DC converter, Vehicle-to-Grid (V2G), Electric vehicle (EV), Green to Green (G2G).**

1. INTRODUCTION

Batteries are the primary energy-storage devices in ground vehicles. Now days battery fed electric drives are commonly being used for electric vehicles applications, due to various advantages, such as: nearly zero emission, guaranteed load leveling, good transient operation and energy recovery during braking operation. To fulfill these requirements converters with bidirectional power flow capabilities are required to connect the accumulator (battery) to the dc link of the motor drive system. Battery fed electric vehicles (BFEVs) is required to function in three different modes namely: acceleration mode, normal (steady-state) mode and braking (regenerative) mode.During acceleration and normal modes, the power flow is from battery to motor whereas during braking or regenerative mode the kinetic energy of the motor is converted into electrical energy and fed back to battery. The DC-DC converter is required to perform mainly two functions: first to match the battery voltage to the motor rated voltage and second to control the power flow under steady-state and transient conditions, so that the drive performance is as per the requirement.

In the present work closed loop operation of bi-directional dc-dc converter feeding a dc motor and its energy recovery due to regenerative braking has been demonstrated. The characteristics of battery-operated electric vehicle under different drive condition are also presented. Regenerative method of braking of an electric vehicle (EV) helps in efficient utilization of the battery power to increase the range of the vehicle. Methods described in literature for the regeneration use complex control algorithms to deal with the energy flow during the transition from the motoring mode the newly presented method gives lower braking time and higher regeneration and does not necessitate any additional converters or ultra-capacitors.

Volatile fuel prices, coupled with an increased emprise on reduction greenhouse and carbon dioxide emissions, have fostered significant growth in the electric vehicles‟ (EVs‟) market over the last ten years. Even though EVs have not been widely adopted, in part because of technical limitations, social obstacles, and cost compared to conventional internal combustion engine (ICE) vehicles, based on moderate expectations, by 2020 up to 35% of the total vehicles in the U.S. will be EVs, according to the Electric Power Research

Institute (EPRI). With the large-scale introduction of EVs, the power grid will face a major challenge to satisfy the load demand. The increasing number of EVs will put an additional stress on the existing distribution system‟s components, such as transformers and cables, and may perturb their operation, particularly during the peak demand periods. Several studies have been carried out to investigate the impact of EVs on the power system in terms of load capacity, power quality, economy and environment.

concept, EVs as ESSs can provide peak load shaving and act as a reserve resource against unexpected outages. As the size of the 3 EV fleet increases, the bulk energy storage available can become considerable in size, which adds to flexibility of actions taken by the power system operator. The benefits of V2G technology can be maximized if it is being associated with renewable energy sources (RESs), such as solar and wind generations.

The intelligent integration between the EVs and RESs can provide an ideal solution for the issues due to both. The RES can be designed to supply the bulk power demand of EVs charging with minor support from the power grid. On the other hand, EVs (as ESSs) can be utilized to smoothen the power generation for the intermittent RESs and mitigate their bad impacts on the power grid, such as voltage and frequency instability issues. Unlike conventional loads, the energy in EVs is sizable enough to maintain all solar and most of the wind generation. Among all RESs, Photovoltaic (PV) power systems are expected to play a vital role in the future energy efficient and zero emission society. Several factors have been boosting this: improved generation efficiency of PV modules, flexibility of implementation and governmental subsidies. However, PV power fluctuates depending on the environmental conditions, season, and geographic location, and causes problems, such as voltage fluctuation and large frequency deviation in an electric power system.

Electric cars are a variety of electric vehicle (EV). The term "electric vehicle" refers to any vehicle that uses electric motors for propulsion, while "electric car" generally refers to highway-capable automobiles powered by electricity. Lspeed electric vehicles, classified as neighborhood electric vehicles (NEVs) in the United States, and as electric motorized quadricycles in Europeare plug-in electric- powered microcars or city cars with limitations in terms of weight, power and maximum speed that are allowed to travel on public roads and city streets up to a certain posted speed limit, which varies by country.

While an electric car's power source is not explicitly an on-board battery, electric cars with motors powered by other energy sources are typically referred to by a different name. An electric car carrying solar panels to power it is a solar car, and an electric car powered by a gasoline generator is a form of hybrid car. Thus, an electric car that derives its power from an on-board battery pack is a form of battery electric vehicle (BEV). Most often, the term "electric car" is used to refer to battery electric vehicles, but may also refer to plug-in hybrid electric vehicles (PHEV).

2 . BATTERY

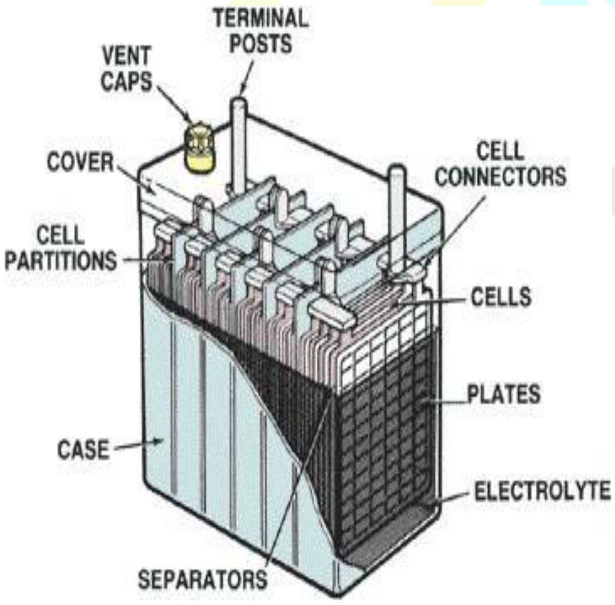
The proposed solar charging application require a deep cycle battery. Deep cycle batteries have larger plates and different chemistry to avoid the corrosive effect of frequently using the full capacity. The solar energy is converted into electrical energy and stored in a lead-acid battery. The ampere-hour is the rated capacity of the battery. There are a few types of lead acid deep cycle batteries: If lead acid batteries are maintained properly, they will function at 80-90% efficiency. To extend the life of the battery and maintain efficiency it is important to maintain a full charge under most condition. Hence the use of a charge controller with solar panels to charge, so they don't over charge the battery or apply the wrong voltage.

A lead-acid storage battery is an electrochemical device that produces voltage and delivers electrical current. The battery is the primary "source" of electrical energy used in vehicles today. It's important to remember that a battery does not store electricity, but rather it stores a series of chemicals, and through a chemical process electricity is produced. Basically, two different types of lead in an acid mixture react to produce an electrical pressure called voltage. This electrochemical reaction changes chemical energy to electrical energy and is the basis for all automotive batteries.

BATTERIES - Primary or Secondary

Batteries can either be a primary cell, such as a flashlight battery once used, throw it away, or a secondary cell, such as a car battery (when the charge is gone, it can be recharged).

Fig 2.1 Lead Acid Battery Parts



PRIMARY CELL: Because the chemical reaction totally destroys one of the metals after a period of time, primary cells cannot be recharged. Small batteries such as flashlight and radio batteries are primary cells.

SECONDARY CELL: The metal plates and acid mixture change as the battery supplies voltage. As the battery drains the metal plates become similar and the acid strength weakens. This process is called discharging. By applying current to the battery in the reverse direction, the battery materials can be restored, thus recharging the battery.

This process is called charging. Automotive lead-acid batteries are secondary cells and can be recharged.

BATTERIES - Wet or Dry Charged

Batteries can be produced as Wet-Charged, such as current automotive batteries are today, or they can be Dry-Charged, such as a motorcycle battery where an electrolyte solution is added when put into service.

WET-CHARGED: The lead-acid battery is filled with electrolyte and charged when it is built. During storage, a slow chemical reaction will cause self-discharge. Periodic charging is required. Most batteries sold today are wet charged.

DRY-CHARGED: The battery is built, charged, washed and dried, sealed, and shipped without electrolyte. It can be stored for up to 18 months. When put into use, electrolyte and charging are required. Batteries of this type have a long shelf life. Motorcycle batteries are typically dry charged batteries.

An automobile battery contains a diluted sulfuric acid electrolyte and positive and negative electrodes, in the form of several plates. Since the plates are made of lead or lead-derived materials, this type of battery is often called a lead acid battery. A battery is separated into several cells (usually

Two dissimilar metals placed in an acid bath produce electrical potential across the poles. The cell produces voltage by a chemical reaction between the plates and the electrolyte. The positive plate is made of reddish-brown material such as Lead Dioxide (PBO2) while the negative plate is made of grayish material called Sponge Lead (PB). The acid bath is a mixture of sulfuric acid and water cell electrolyte. Together a cell element is formed.

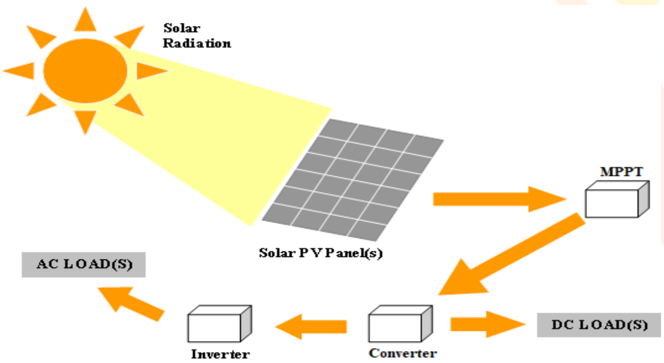


Fig 2.2: From PV Cell to PV Module to PV Panel to PV Array.

The figure the radiation from the sun is made to fall on the solar panels are made from Photovoltaic silicon semi-conductor materials. Due to the photoelectric effect of PV cells the sun's energy is directly converted to electricity. The DC output from the solar panels are fed to the input of converters. Maximum Power Point Tracking techniques are used along with the system to track the maximum solar energy and these pulses are supplied to the converter. Converters are used for supplying a regulated DC output by transforming the voltage from one level to other level. The converter takes the input signal from solar panels and gives a controlled DC output. The controlled DC output from converters are fed to the inverter input convert to AC output, which is to be supplied to the grid or the load. The figure 3.3 is the block diagram representation for a solar energy generation.

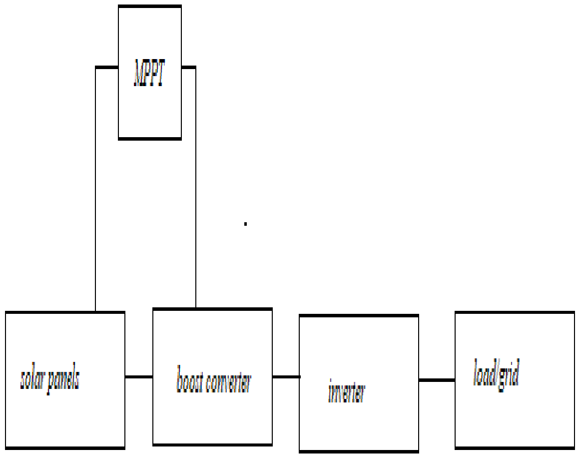


Fig 3.1: Block Diagram of Solar Energy

3 . MAXIMUM POWER POINT TRACKING

The Maximum Power Point Tracking system is an electronic device for tracking the maximum available energy resource thus, improving the output performance and efficiency of the solar PV panels. Due to variations in weather condition the output has a nonlinear behavior and changes frequently. This device helps to track the available power in the atmosphere and operate at maximum power point thus increasing the efficiency. In a PV panel the voltage at which maximum power is attained is called maximum power point. (Sharma and Jain 2014, Atiq and Soori 2016)

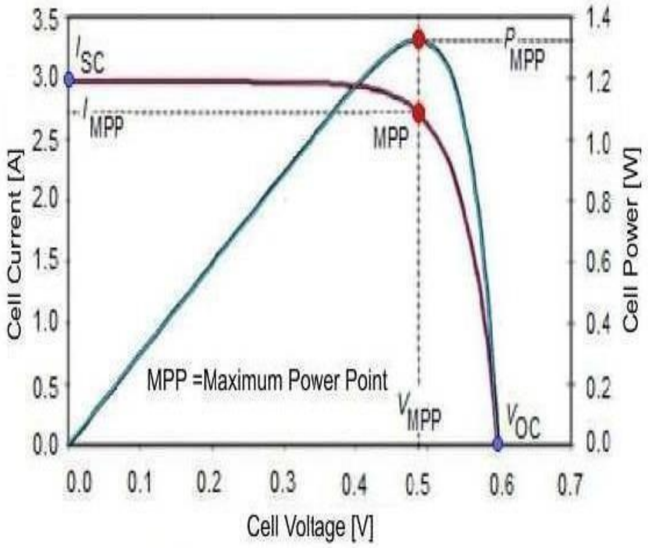


FIG 3.2 V/I & P/V Power characteristics curve

The P&O method with oscillations around MPP tracks the maximum amount of power. The P&O MPPT algorithm is useful with the changes in the solar irradiance and the temperature conditions and these changes are resolved by decreasing the perturbation and slowing down the tracking.

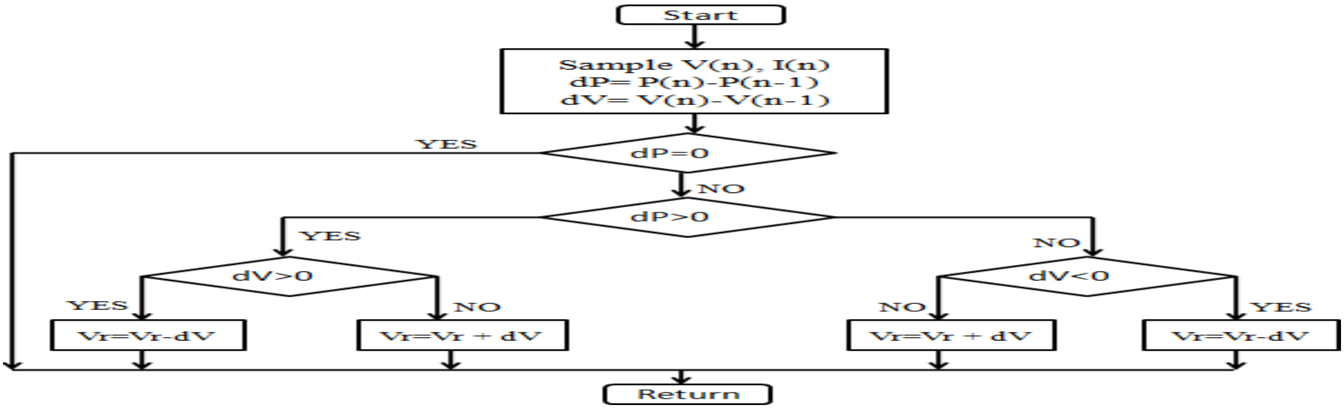


FIG 3.3: P&O MPPT Algorithm flow chart

4 . BUCK-BOOST CONVERTER

The Buck Boost converter is a DC-DC converter having the output voltage greater than or less than the input voltage. The output voltage magnitude is based on the duty cycle of the switch. Buck- boost converters are called as step down or step up converters. There converters are same in function to a step down or step up transformer

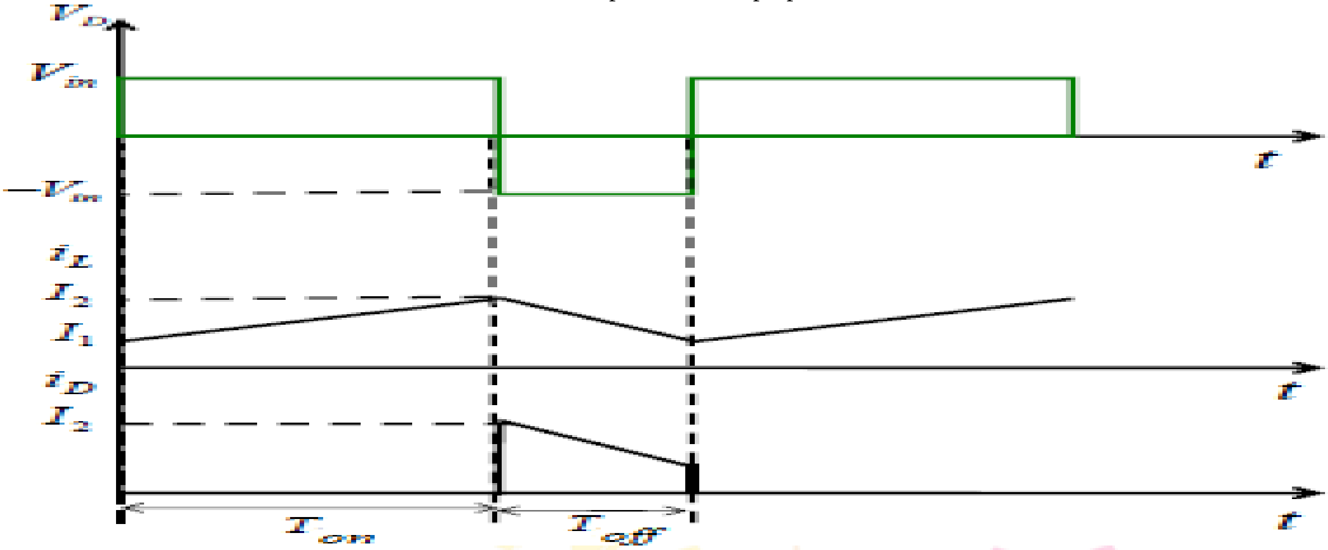


Fig 4.1: Wave of Buck Boost converter.

When switch is ON VL=Vd and when switch is OFF VL-Vo . The performance of buck-boost converter is depending upon the duty ratio. If the duty ratio is less than 50percent it functions like a buck converter similarly if the duty ratio is greater than 50percent then it acts like boost converter. Based on the duty ratio the output can be higher or lower than the input. Cascading these two converters gives buck-boost converter.

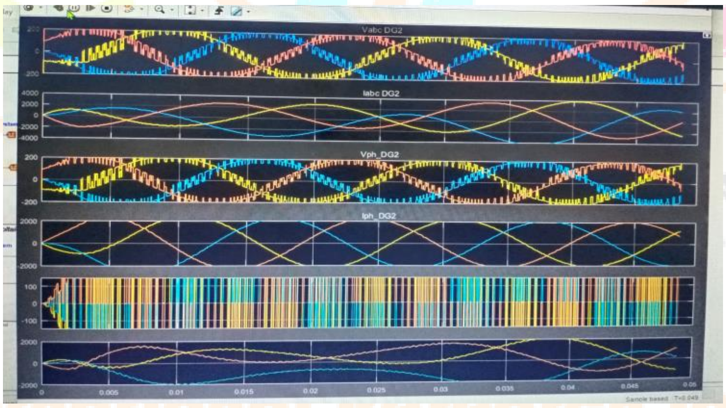


FIG.4.2 SOFTWARE OUTPUT

5. RESULT AND FUTURE SCOPE

Energy captured from the radiation of sun is called solar energy. It is present abundantly over the earth surface and is freely accessible. The energy from sun is pollution free and highly efficient source with low cost. PV panels are used for generating electricity from sun's energy. Solar panels are used as the medium for the conversion of energy into heat or electricity. The solar panels are made using semiconductor materials. The semiconductor material used in the solar cells are silicon where the sunlight strikes the surface of cell and gets absorbed. Basically, the solar cells functions like diode with PN junction formed in the material. As the sunlight falls over the surface of material energy gets absorbed allowing the electrons to move freely. The flow of electrons results in generation of electric current. The principle used behind the conversation of solar energy to electric power is termed as photo electric effect.(Sivaramakrishna and Reddy 2013, Ingole and Rakhonde 2015)

Solar panels are formed by combining the PV cells. PV cells are connected to form a PV module and PV modules are further interconnected to get the required PV panels or arrays. Usually, PV cells are normally in the range of 36 or 96 cells in a module. Based on the load demands the cells are connected either in series or parallel combination.

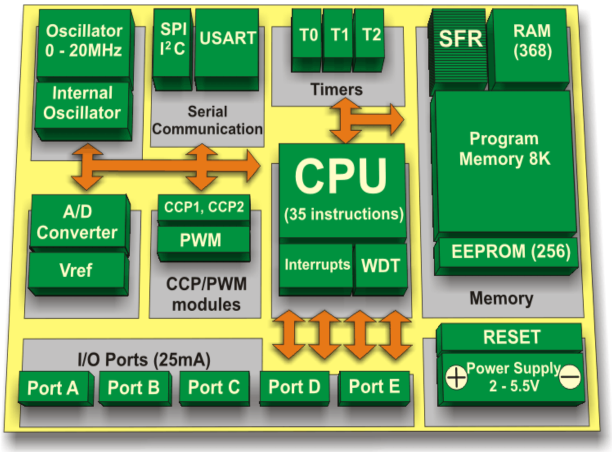


Fig. 4.3 PIC16F887 Block Diagram

Like the cell arrangement the modules will also be connected either in series or parallel combinations. For high output voltage the PV cells are arranged in series and for high output current the PV cells are arranged in parallel manner. Initially in a solar panel the cells are connected in series sequence to get the desired voltage and so formed strings are parallelly connected to obtain the desired current.(Sivaramakrishna and Reddy 2013, Ingole and Rakhonde 2015)

6. CONCLUSION

The line back-EMF based regeneration method presented in this paper delivers far better performance than the mechanical braking in vehicle EVs also. Further, the presented method is the simplest one among the known regenerative methods in terms of the simplicity of the system, ease of implementation and the higher braking torque developed. In this method, a noticeable power is fed back to the battery. The range of the EV is obviously increased.

In this work we demonstrate the performance of a battery-operated electric vehicle system and it shows satisfactory performance at different driving condition. The proposed control technique with ANN controller find suitable for this electric drive. The performance of the BFEV is verified under forward motoring mode, regenerative mode and when there is step change is speed command. The overall cost and volume of the battery-operated electric vehicle is less with the least number of components used in the system.

The canny converter with the pic microcontroller designed for electric vehicles (EV) used to adapt the regenerative energy under applying/removing accelerator into the electrical energy.

REFERENCES

[1] J. W. Dixon, and M. E. Ortlizar, "Ultra capacitors + DC–DC Converters in Regenerative Braking System," IEEE Aerospace and Electronic Systems magazine, Vol. 17, No. 8, pp. 16–21, August 2002.

[2] J. Cao, B. Cao, Z. Bai and W. Chen," Energy regenerative Fuzzy Sliding mode Controller design for Ultra capacitor –Battery Hybrid Power Electric Vehicle," Proceedings of the IEEE Int. Conf. on Mechatronics and Automation, , pp.
1570– 1575, August 2007.

[3] J. Cao and B. Cao,"Fuzzy-logic - Based Sliding Mode Controller Design for Position -Sensorless Electric vehicle," IEEE Trans.Power Electron. vol. 24, no. 10, pp. 2368-- 2378, October 2009.

[4] M. Ye, Z. F. Bai, and B. Cao, "Robust H2/Infinity Control for Regenerative Braking of Electric Vehicles," Proceedings of the IEEE Int. Conf. on Control and Automation, pp. 1366–1370, May/June 2007

[5] J. Cao, B. Cao, Z. Bai and P. Xu , " Regenerative – Braking Sliding mode Control of Electric Vehicle based on Neural network Identification," Proceedings of the IEEE Int. Conf. on Advanced Intelligent Mechatronics, pp. 1219–1224, July 2008.

[6] B. Cao, Z. Bai , P. Xu J. Cao, and X. Wu ," Neural network control of Electric Vehicle based on Position –Sensor less Brushless DC Motor," Proceedings of the IEEE Int. Conf. on Automation And logistics, pp. 2029–2034, August 2007.

[7] C.-H. Chen and M.-Y. Cheng, „„„Implementation of a highly reliable hybrid electric scooter drive,"" IEEE Trans. Ind. Electron., vol. 54, no. 5, pp. 2462--2473, Oct. 2007.

[8] R. C. Becerra ,M. Ehsani, and T.M. Jahns, „„„Four-quadrant brushless ECM drive with integrated current regulation,"" IEEE Trans. Ind. Appl., vol. 28,no. 4, pp. 833-- 841, Jul./Aug. 1992. Proceedings of the IEEE Int. Conf. on Automation and logistics, pp. 2029-- 2034, August 2012.