

## SURVEY ON IMPLEMENTATION OF CHOPPERS FOR HYBRID ELECTRIC VEHICLES

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### Abstract

This work is a compilation study of four quadrant DC drive implemented using DC-DC voltage controller's with Space Vector Pulse Width Modulation (SVPWM) technique. Separately excited DC motors speed can be varied and controlled from 0 to rated speed with the help chopper. Chopper responds to the firing circuit when signal is received from the controller, due to which desired speed is achieved. To achieve the desired speed, variable voltage is applied to the motor armature as the chopper responds to it. Such a system has two loops to control; one acts as current controller, while the other used to control speed. To reduce the delay and achieve the rapid control, Proportional-Integral type controller is implied. In this study Insulated gate bipolar transistors (IGBT's) have been used, which implies pulse width modulation (PWM) technique. Developing HEV's uses orthodox system to control, which makes the vehicle to work on electric motor till the speed is switched over to IC engine, which drives the vehicle in this case. However, in first and second quadrant the speed limit depends on the efficiency of the IC engines. A four quadrant operation, on which the study is carried out is based on the design when the HEV is operated at a speed ranging from 0 to 850rpm, i.e., 0 to 100 kmph. Using Matlab, simulated results have been obtained. The obtained results correspond to the values of different speeds & load torque conditions. The simulated results are based on the application to be used- hybrid Electric Vehicles (HEV).

**Keywords :** Hybrid Electric Vehicles, Voltage Regulation, Choppers

### INTRODUCTION

The advanced development in the field of hybrid energy and chopper regulation has laid way to the innovative technologies in Hybrid electric vehicles. Adjustable speed drives are growing rapidly with concern to the HEV's. The maintenance cost of the vehicles are comparatively low than the fuel based vehicles. With the decline in fuel sources, the motor vehicle industry is in a need for an alternate approach. One such kind of approach is achieved through four quadrant DC drives. An adjustable speed drive is provided to control the vehicle motor in 4 modes, forward and reverse motoring, forward and reverse regeneration.

A dual output from single input have been achieved from the tapped sepic and cook converter in [1] which discusses about the DC-DC usage for a hybrid renewable energy system as input. [2], discusses about the use of boost converter with a multiplier type capacitor and a coupled inductor. A traditional Buck-Boost Converter with the KY converter used to operate for both the high and low voltage conditions has been discussed in paper [3]. A novel study on Sepic converter have been carried out in [4], in which Mr. Jae Won Yang has implemented a bridgeless Sepic converter for a ripple free input current. Brushless DC motor fed with cuk converter gives the operation characteristics in continuous conduction mode and discontinuous conduction mode, [5] is closely related to the implementation of such a system for Hybrid electric vehicles. A bipolar DC link with a combination of Cuk- Sepic have been analyses in [6]. Since hybrid vehicles use solar energy as input source, A MPPT would provide a high efficient input source, a study related to this has been made from [7], which discusses about sepic converter implemented with MPPT technique. The control strategies of Buck-Boost converter using soft switching techniques have been implemented in [8]. To gain a high voltage a non- isolated interleaved boost converter has been designed in [9]. A BLDC motor with ZETA converter based on Solar system has been given in [10]

#### Survey Considerations

This survey is a compilation of DC-DC voltage regulators.

Extensive survey has been married on various choppers existing.

- Buck Converters
- Boost Converters
- Buck-Boost Converters
- SEPIC Converters
- Cuk Converters

A study is made on this converters with regard to implementing them in Hybrid electric vehicles.

#### Purpose of Converters in Hybrid Electric Vehicles

Switched mode power supplies extensively use DC-DC converters. As the input to the DC converters are unregulated in nature since the input fed to them is from a renewable energy source. This might impose a severe effect on the load by creating unwanted noise, ripple and distortions. This can be avoided by implementing load side converters. In the load side converters the unregulated input supply is regulated. This is carried out using two modes of operation.

- a) Continuous Conduction Mode (CCM)
- b) Discontinuous Conduction Mode (DCCM)