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Study of Adaptive DC-DC Converter for Powered Hybrid Electrical Vehicle Drive Train

Deepamala Narayankar[1] , Sujata.M.Bagi [2] , Fatima.N.Kudchi[3]

1.Student, Dept. of EEE, BLDEA's V.P.Dr.P.G.Halakatti CET Vijaypura, Karnataka, India

2. Assistant Professor, Dept. of EEE, BLDEA's V.P.Dr.P.G.Halakatti CET Vijaypura, Karnataka, India.

3. Assistant Professor, Dept. of EEE, BLDEA's V.P.Dr.P.G.Halakatti CET Vijaypura, Karnataka, India.

deepamala.narayankar@gmail.com, ee.sujata@bldeacet.ac.in ,ee.fatima @bldeacet.ac.in

ABSTRACT

The Automotive industries are working to develop fuel cell powered Hybrid Electric Vehicles (HEV). These fuel cells will produce a reduced emission and improved fuel economy. In this paper for hybrid fuel cell vehicle drive train is implemented in MATLAB Simulink and the parameter like performance is evaluated under different dynamics. This paper represents some different DC-DC converter topologies, which is used to interface fuel cells with the motor controllers in HEVs. The main goal is to design a simple and practical boost converter topology with a easy control that can maintain both the output voltage and the input current simultaneously.[1],[4]

Keywords:*Hybrid fuel cell, DC-DC converter, Feasibility.*

1. INTRODUCTION

Nowadays, Fuel cells are undergoing an extensive research in order to develop them as energy conversion devices. Fuel cells are particularly appealing because they are the only contemporary technology capable of significantly lowering car emissions and fuel consumption within a short period of time. Shows the electrical components needed for a hybrid electric vehicle (HEV) fuelled by a fuel cell [1]–[3]. The DC voltage is necessary for three-phase inverter to maintain the AC motor in between 200 and 500 volts, whereas the fuel cell voltage is around 60 volts (for the commercially available is 10 KW). The major power source is the fuel cell, however the power density of fuel cells is limited [4].

2. PROPOSED SYSTEM

The proposed system is to control the DC-DC converter and to keep voltage at the desired value of Vo as well as coil current below to its rated value. A simple PI controller implements the outer controller in order to find the difference among the reference voltage (* Vo) and the actual output voltage (Vo), to get the essential coil current signal for compensation of voltage. The coil current is regulated by the inner control loop at its projected value from the outside. component is in charge of increasing the output voltage to a anticipated level. In addition, the aim of the current controller is to restrict the coil current to its rated value in order to shield the coil. Different types of current controller techniques were used. A current controller's essential properties include quick reaction, ease of installation, extreme current capability, and insensitivity to parameter fluctuation.

2.1.Objectives

- The approach of remodeling a user- description of an enter right into a computer-based totally device is known as input layout.
- Its miles achieved with the aid of designing person-friendly facts entry panels that can manage huge quantities of statistics
- It will validate the information as soon as it's being entered.

3. LITERATURE SURVEY

3.1 "**A comprehensive review on hybrid electric vehicles : architectures and components"** By studying the features of the fuel cells, this paper proposed a new framework for the fuel cell-powered electric vehicle driving system. Due to the FC's inability to absorb the regenerated damper energy, additional gadgets must be installed. The superb capacitance has been tuned to absorb regenerative energy. The LC filter is used to eradicate the ripple in the FC output current. The results of the simulation reveal that the current ripple may be considerably reduced. As a result, the FC may operate at maximum efficiency, and the overall system performance is enhanced.

3.2 **"An Improved High Voltage DC – DC Converter with Partial-Resonant Network for Enhanced Efficiency and Power Density in Electric Vehicle Applications"**. The power electronics and controls of an induction motor for a fuel cell electric vehicle system are described in this study. Attainment, cost, size, volume, manufacturability, component count, and simplest are all factors in determining the power topology. The lowering of the battery bank (back-up supply) and its control access is another hallmark of the topology. A full-bridge DC/DC converter is used to raise the fuel cell voltage in the suggested method. A three-phase PWM inverter powered by the DC-link voltage drives the vector-controlled induction motor. The performance of electric vehicles has been investigated as a result of induction motor parameter adjustment.

3.3. **"Analysis and Review of DC-DC Converter for Electric Vehicle"** The progress of feasible, clean, and effective transporting systems is essential for improving overall air eminence and reducing the country's reliance on finite domestic capital and imported fuels. Transportationmaccounts for one-thirdhof all energy usage and carbon releases in the United States, largely from own vehicles, and is one of the most difficult areas to reduce greenhouse gas emissions. The development difficulties for an inventive fuel cell electric car infrastructure and bi-directional grid connection obtained from renewable and clean power sources are presented in this study.

4. OUTPUT DESIGN

The desired output is one which satisfies the consumer's wishes and to indicates the information without any doubt. Any result processing system are conveyed to customers with different structures through outputs.

- The output of the computer is constructed in sequence, well-notion-out way the proper output need to be evolved while making sure that each output component is designed in this type of manner that human beings will find the gadget smooth to use..
- To select methods for output presentation.

- Create a paper, report, or other records that contains the system's information.

The system's output should satisfy one or more of the following goals.

- To convey about the past activities and current status or projections of the future.
- Signal important events, warnings, opportunities, or problems.
- Activate the action.
- Approve the action.

5. MODULES DESCRIPTION:

5.1 Powered Hybrid Electric Vehicle

Hybrid Electric Vehicle (HEV) with a Powered Battery. The DC voltage necessary for the three-phase inverter is to regulate the AC motor in between 200 and 500 volts, whereas the fuel cell voltage is around 60 volts (for commercially available 10 KW). The major power source is the fuel cell, however its power density is limited. Due to the fact the dynamic response of Fuel cells are notably slower than those essential for traction, a storing unit which includes a battery or extremely-capacitor financial institution ought to be integrated with this system, which isn't always depicted for simplicity, to deliver the peak strength requirement for the duration of transient conditions [3].

5.2 DC/DC converter

The DC-DC converter raises the fuel cell voltage to the motor controller's needed level. Converting the electrical output from the fuel cell into usable power is a fundamental difficulty in constructing automobile fuel cell power systems. In count, the DC-DC converter must be economically implemented with appropriate weight and capacity. In the literature, a variety of DC-DC converter topologies and control mechanisms have been proposed. Since of the greater power grade and the large jump in DC voltage required, a push pull representing half wave or full wave bridge type DC-DC converter with transformer separation is suited for its application[4].

5.3 FC dynamics

In this study's, initial job is to assess the enactment of the suggested control algorithm, which was provided in the earlier section, for raising the fuel cell voltage to adapt both load voltage and coil current. The first path depicts the fuel cell voltage at the input terminal of DC-DC converters. The fuel cell voltage is set to drop from 60 to 36 volts in 0.5 seconds. The second trace shows the output voltage at the load terminals [2], [3].

5.4 Load dynamics

The load is dynamically altered in this scenario to simulate the Vehicle's acceleration and deceleration. Plots the proposed system's dynamic response while the load changes dynamically. The top trace shows how the dynamic coil current changes as the load is doubled. Uniform when the load disturbance occurs at 0.55 sec and 1.025 sec, the suggested controller succeeds in controlling the PCC voltage at 200V, as seen in the bottom trace. At the shifting instances of the load, the load voltage dips up and down. The proposed controller's disturbance rejection capabilities are investigated in this result. It is evident that the voltage setting is tracked accurately and with a quick reaction.

5.5 Feasibility analysis

The project's feasibility is evaluated at this phase, and a business proposal is provided, along with a very basic project design and some cost predict. During the system Scrutiny, a possibility evaluation of the projected system will be conducted. This is to ensure that the scheduled system will not cause any concerns for the organization. For the feasibility study, a basic grasp of the system's primary requirements is required.[3]

Three key considerations involved in the feasibility analysis are

- Economical Feasibility
- Technical Feasibility
- Social Feasibility

6. WORKING

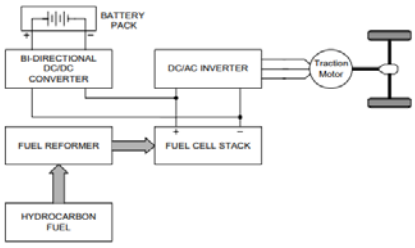

Figure 1: *Detailed View of hybrid fuel cell vehicle drive train*

The accompanying diagram depicts the operation of a dc converter in a vehicle motor train. Because of the inherent features of a transistor, the choice of transistor becomes limited when numerous transistors are coupled in parallel.For dc-dc converters,. MOSFETs may readily be coupled in series to increase current transport capacity, and MOSFETs in series have inherent current sharing features.

For the same reason, if an individual MOSFET does not familiarity a particularly high breakdown voltage and the MOSFETs are not coupled in series, a circuit using MOSFETs may be the best option. This method, the extra expense of the sophisticated gate drive circuit may be avoided, and an unequal voltage stress can be avoided, resulting in voltage breakdown.[1],[5].

7. CONCLUSION

The multi-functional control for adaptive DC/DC converters used in fuel cell powered electric vehicles is studied in this paper. The use of proposed DC/DC converter to connect the fuelv cell to the powertrain is proposed. Due to the gentle witching, this type of converter offers the advantage of lower exchanging losses.

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