iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: VI Month of publication: June 2021

DOI: https://doi.org/10.22214/ijraset.2021.35499

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI June 2021- Available at www.ijraset.com

High Voltage Gain Interleaved Boost Converter with Neural Network Based MPPT Controller for Fuel Cell Based Electric Vehicle Applications

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Abstract: As a result of the strict regulations on carbon emissions and the fuel economy, fuel cell electric vehicles (FCEV) vehicles are becoming increasingly popular in the automotive industry. This paper provides the Neural Network Maximum Power Point Tracking (MPPT) controller of the 1.26 kW Proton Exchange Membrane Fuel Cell (PEMFC), which provides electric vehicle powertrain using DC-DC power converters.
The proposed neural network controls the MPPT Radial Basis Function Network (RBFN) using the PEMFC Maximum PowerPoint (MPP) tracking algorithm. High frequency switching and high DC-DC converting power are important for FCEV continuity. For maximum power gain, a three-phase power supply interleaved boost converter (IBC) is also designed for the FCEV system.
The interleaving process reduces the current input pressure and electrical pressure in semiconductor electrical equipment. FCEV system performance analysis with RBFN based MPPT control compared to fuzzy logic controllers (FLC) on the MATLAB / Simulink platform.
Keywords: Fuel cell electric vehicle, high voltage gain IBC, PEMFC, MPPT, RBFN etc.

I. INTRODUCTION

Due to environmental pollution and limited stocks of fossil fuels, the automobile industry is increasingly interested in fuel cell electric vehicles (FCEVs). The Rapid Advancements in Power Electronics And electric cell Technologies Have Empowered the numerous Development in FCEV. Fuel cell technology has the advantages of new energy, high reliability, high performance and low noise. counting on the kind Of Electrolyte Substance Cells Are Categorized Into differing types like Proton Exchange Membrane Fuel Cell (PEMFC), Alkaline cell (AFC), oxyacid electric cell (PAFC), Solid oxide cell (SOFC) and Molten Carbonate electric cell (MCFC). within the midst of all of this, PEMFCS controls the automotive industry because of its cold and fast start.

A. Fuel Cells

1) Thanks to Environmental Pollution and also the End of Natural Oil Depot, the Automotive Industry Shows More Interest in Electric Vehicles.
2) This fuel cell has the advantages of polluted systems for generating electricity, high reliability, high efficiency and low noise.
3) There is no demand for PEMFCs in the automotive industry because of their cheap operating temperature, and even at start-up.

B. MPPT

1) MPPT (P&O) is a simple, popular and easy-to-use tool.. P&O And Incremental Conduction Methods Produces Oscillations at Steady State which is able to Reduce Efficiency of Cell System.
2) To overcome this problem, symbolic logic controllers and neural network algorithms were introduced to detect MPPT with increased efficiency and accuracy. Radial Basis Function Network (RBFN) MPPT Management Base offers PEMFC MPPT tracking.

A high voltage gains three-phase non-isolated interleaved boost converter (IBC) for electric cell applications to achieve low switching stress and high voltage gain. The fraudulent measure measures the reliability of the cell and provides greater power. The output voltage of the proposed converter is given to the electrical motor through an inverter for propulsion of the vehicle. the electrical motor plays a vital role in FCEVs. An adequate motor considerably reduces the price and size of the cell.

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II. OBJECTIVES

The primary objectives of this study are often summarized as follows:

A. To study a neural network based on MPPT-a controller.
B. To understand the boost converter, you need a deep concept.
C. To study MPPT topology, modulation strategy and operating principles Widely.
D. To study simulation validations of the proposed system.

III. ELECTRIC VEHICLE CHARGING IN FUEL CELL APPLICATION

Like all electric vehicles, fuel cell electric vehicles (FCEVs) use electric-electric motors. Unlike other electric vehicles, FCEVs generate electricity using a hydrogen-powered fuel cell rather than drawing energy from a battery. During the vehicle design process, the vehicle manufacturer defines the power of the vehicle by the size of the electric motor (s) that receive the appropriate amount of electrical power from the fuel cell and battery combination. Although vehicle manufacturers were able to design an FCEV with plug-in capabilities to charge the battery, most FCVVs today use batteries to recover braking power, providing additional power during low acceleration events, and lubricants with the option of deactivating the energy delivered from the fuel cell. Or turn off the fuel cell during low power requirements. The amount of energy stored in the vessel is determined by the size of the hydrogen fuel tank. This is different from an all-electric vehicle where both available power and power are closely related to battery size. Learn about fuel cell electric vehicles.

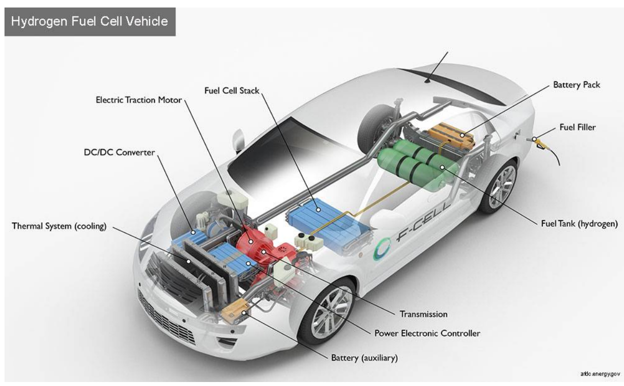

Fig 1. Fuel Cell Vehicle

FCEVs use a propulsion gadget similar to electric cars, in which the energy saved within the shape of hydrogen is converted into power by means of the fuel cell. Unlike traditional internal combustion engine vehicles, these vehicles do not emit harmful tail pipe. Other benefits include increasing U.S. energy security and strengthening the economy.

The FCEV vehicle is filled with pure hydrogen gas stored in a tank. Much like traditional inner combustion engine vehicles, they may be refuelled in less than 4 mins and have a driving variety of over 300 miles. FCVV is equipped with other advanced technologies to increase efficiency such as regenerative braking systems, which capture the energy lost during braking and store it in the battery. Major automobile manufacturers are offering non-limited FCEVs in some markets, which will help develop infrastructure.

IV. LITERATURE REVIEW

A. *Moe Moe Lwin and Htin Lin "Neural Network Based High-Performance Double Boost DC-DC Converter in Using Renewable Energy System" International Journal of Science, Engineering and Technology Research (IJSETR) Volume 7, Issue 5, May 2018*

Different types of DC-DC converter are used on various electronic and multi-use devices for many years. But a standard converter cannot pay for high voltage values and high current applications. Many investigators have tried to meet the requirements. In this paper, a two-step reinforcement DC-DC converter is used for the renewable energy system. Finding a way to control rather than the best performance under any circumstances is always required. The Voltage mode control process is used to achieve a high output voltage with the help of a high-level controller. The main purpose of this paper is to study the Neural Network Controller (NNC) under the response of the various parameters of the proposed converter using MATLAB / Simulink Software.

B. N. Sudhakar "High Step-Up Boost Converter with Neural Network Based MPPT Controller for a PEMFC Power Source Used in Vehicular Applications" International Journal of Emerging Electric Power Systems, 19(5), 20180015, 2018

This paper deals with the high mechanical replacement and the high-power conversion of DC-DC are required in electric vehicles. In this paper, a new advanced step-by-step converter (HSBC) is designed for high-performance electronic data processing (FCEV) applications. The designed converter offers the best gas power advantage compared to a conventional converter amplifier and reduces the current input and pressure pressures on the semiconductor candy power. In addition, a neural based maximum point tracking (MPPT) controller is designed for the 1.26 kW proton exchange membrane fuel cell (PEMFC). Network radical base function (RBFN) algorithm is used in neural network control to extract high energy from PEMFC in different temperature conditions. The performance analysis of the designed MPPT control is analysed and compared with the controlled logic control (FLC) in the MATLAB / Simulink area.

V. PROBLEM IDENTIFICATION

A. Existing Configuration

This wheel in the FCEV architecture system refers to the diagram shown in the figure .2. PEMFC stack production free for low DC voltage.

To increase it, step-up DC-to-DC converters are required to animate it and adjust the PEMFC output voltage.

A quadratic step-up converter consists of two step-up converters that are proposed to understand the high level of excitation. But with two boost converters, you can reduce the efficiency of the system. 2-step flexible converter powered by DC, always, in general, do not advise. But this topology suffers from low reliability, and less efficiency.

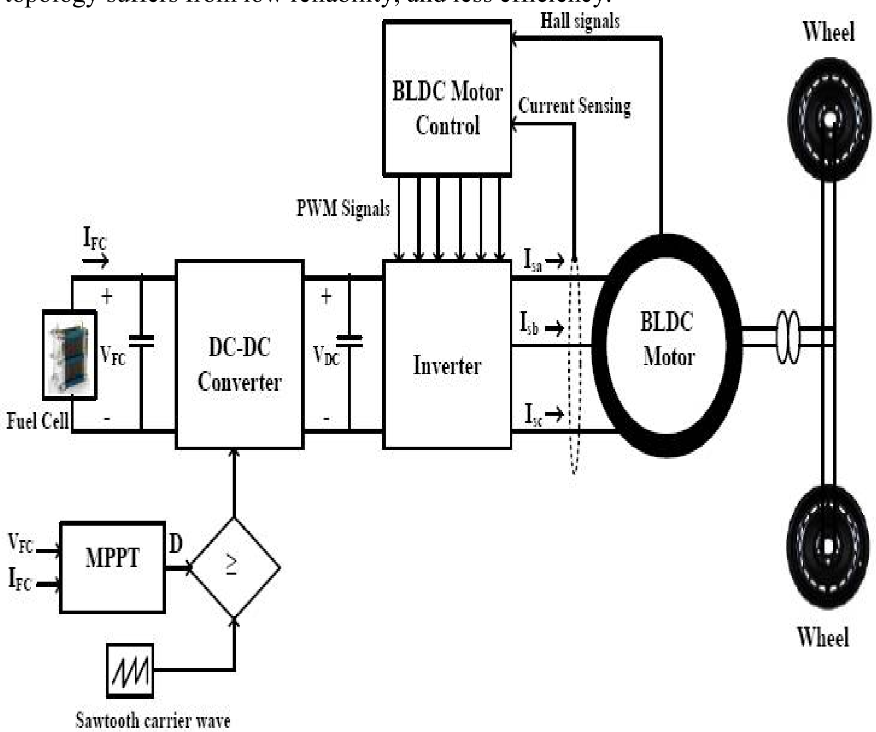

Fig 2. Conventional configuration of cell fed BLDC motor driven electric vehicle

B. Disadvantages Of Existing Confirguration

1) Poor Reliability
2) Less Efficiency.
3) Expensive
4) For Low Power Applications, the standard Boost Converter is utilized as an influence Electronic Interface Whereas for prime Power Applications Boost Converter Won't Be Compatible because of its Low Current Handling Capability and Thermal Management Issues.
5) To overcoming those variable voltage benefit dc-dc integrated information.

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VI. PROPOSED CONFIGURATION WORK

This project provides for high-voltage generation of a three-phase alternating increase converter (IBC) fuel, very low metal content, varying complexity and high-voltage gain. The method used to save time increases the reliability of the fuel cell and provides high power of Fig 3. Displays the proposed FCEV.

FCEV system with IBC with a higher level. It consists of a 1.26 kW PEMFC-rigid container with a 3-phase high-voltage power supply, a voltage source inverter (VSI), and a BLDC motor. The third stage includes intermediate bulk containers that serve as an interface between PEMFC and VSI. The RBFN-based algorithm is designed to provide a high-power fuel cell. - A 3-phase (A) container provides BLDC power to the vehicle using VSI. Transition VSI control of BLDC motor control electronics. Engine shaft connected wheels for vehicle, import and its movement.

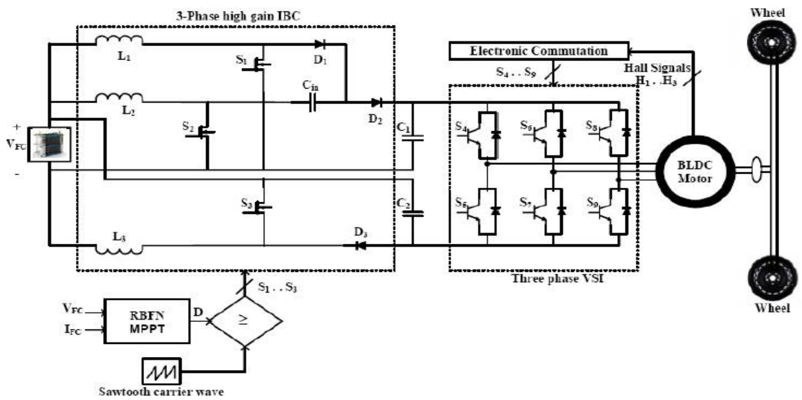

Fig.3. The proposed BLDC motor driven FCEV system with three-phase high voltage gain IBC

A. Advantages Of Proposed Configuration

1) Clean power generation,
2) High reliability,
3) High efficiency
4) Low noise
5) High voltage gain

B. Applications

1) Fuel cell applications
2) Solar power applications.

VII. CONCLUSION AND FUTURE SCOPE

High Phase Converter DC-DC Converter is proposed for FCEV applications. The Proposed Converter has reduced the Fuel Cell input Current Ripples and the Voltage Stress on the Power Semiconductor Switches. The RBFN based MPPT technique is designed for 1.26 Kw PEMFC for extracting the Maximum Power from the Fuel Cell at different temperatures. Suggested MPPT method compared with FLC MPPT Controller. In future Simulation results reveal the RBFN Based MPPT Controller has tracked the Maximum Power Point faster when compared to the Fuzzy Logic Controller. Also analyzed are differences in engine BLDC parameters like electromagnetic torque, rotational speed, and back EMF at different fuel cell system temperatures.

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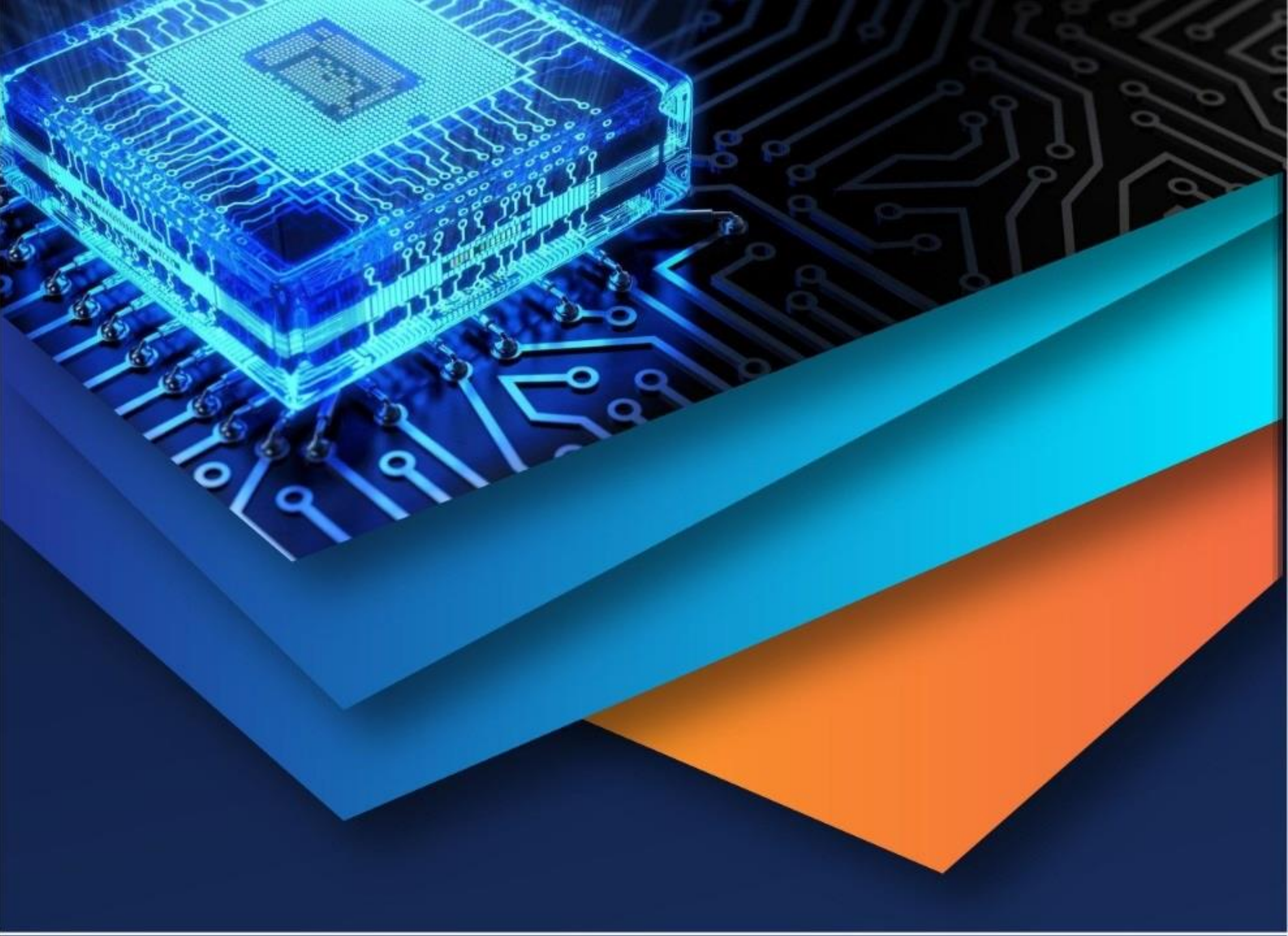

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