

DESIGN AND SIMULATION OF SPEED CONTROLLING OF DC MOTOR USING ISOLATED DC-DC CONVERTER

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ABSTRACT

The goal of this project is to create an isolated DC-DC converter fed DC motor traction drive system for use in bidirectional electric vehicles. The input and output of a normal dc-dc converter are not segregated. A Dual Active Bridge Converter (DABC), which is an isolated dc-dc converter, has an input and output transformer. Anything from a few hundred volts to several thousand volts may be handled by this isolation. Transformers step up and step down the voltage level simultaneously. The method of Sinusoidal Pulse Width Modulation (SPWM) is not used to activate the switches. Using MATLAB/Simulation, an analogous suggested model is simulated and validated.

INTRODUCTION

Speed control of DC motor using an isolated DC-DC converter is a technique used to vary the speed of a DC motor by adjusting the output voltage of an isolated DC-DC converter. This technique is widely used in various industrial applications, such as robotics, electric vehicles, and renewable energy systems.

An isolated DC-DC converter is a device that converts DC voltage from one level to another while providing electrical isolation between the input and output sides. The isolation helps to protect the circuitry and equipment from electrical interference and provides safety to the user.

The speed control of the DC motor is achieved by controlling the duty cycle of the DC-DC converter, which is the ratio of the ON time to the total time of the switching cycle. By varying the duty cycle of the converter, the average voltage applied to the DC motor can be varied, which in turn changes the motor speed.

The isolated DC-DC converter used in this application can be either a buck converter or a boost converter, depending on the required output voltage level. A buck converter is used when the output voltage needs to be lower than the input voltage, while a boost converter is used when the output voltage needs to be higher than the input voltage.

Overall, speed control of DC motor using an isolated DC-DC converter is a versatile and efficient technique that is widely used in modern industrial applications.

DC motors are widely used in various industrial applications due to their excellent speed control characteristics. One of the most common ways to control the speed of a DC motor is by adjusting the voltage applied to the motor. In order to achieve this, an isolated DC-DC converter can be used to regulate the voltage and current supplied to the motor.

An isolated DC-DC converter is a power electronic circuit that provides electrical isolation between the input and output terminals of the converter. This isolation is achieved through the use of a transformer, which allows the input and output circuits to be electrically separated. The converter operates by converting the input DC voltage to a higher or lower DC voltage level as required, using high-frequency switching techniques.

By using an isolated DC-DC converter, the voltage supplied to the DC motor can be precisely controlled, allowing the speed of the motor to be adjusted. This can be achieved by varying the duty cycle of the converter's switching circuit, which changes the amount of time that the converter applies

the input voltage to the motor. The converter can be designed to provide a constant voltage output, which allows for precise speed control of the motor even under varying load conditions.

Isolated DC-DC converters are commonly used in applications where electrical isolation is required, such as in power supplies for sensitive electronic equipment, and in industrial control systems. The use of these converters for speed control of DC motors offers an efficient and effective solution that can improve the performance and reliability of the motor control system.

LITERATURE SURVEY

Hirofumi Akagi, Shin-ichi Kinouchi, and Yuji Miyazaki: "Bidirectional Isolated Dual Active Bridge (DAB) DC-DC Converters Using 1.2KV 400A SiC MOSFET Dual Modules". This paper describes the 750-Vdc, 100-kW, 20kHz bidirectional isolated dual-active-bridge (DAB) dc-dc converters using four 1.2-kV 400-A SiC-MOSFET dual modules with or without Schottky barrier diodes (SBDs). When no SBD is integrated into each dual module, the conversion efficiency from the dc-input to the dc-output terminals is accurately measured to be 98.0% at the rated-power (100 kW) operation, and the maximum conversion efficiency is as high as 98.8% at 41-kW operation, excluding the gatedrive and control-circuit losses from the total power loss. The bidirectional isolated DAB dc-dc converters are so flexible that series and/or parallel connections of their individual input and output terminals make it easy to expand the voltage and current ratings for various applications such as the so-called "solid-state transformer" or "power electronic transformer." Lung-Sheng Yang and Tsorng-Juu Liang : "Analysis and Implementation of a Novel Bidirectional DC-DC Converter". A novel bidirectional DC-DC converter is presented in this paper. The circuit configuration of the proposed converter is very simple. The proposed converter employs a coupled inductor with same winding turns in the primary and secondary sides. In stepup mode, the primary and secondary windings of the coupled inductor are operated in parallel-charge and series-discharge to achieve high stepup voltage gain. In step-down mode, the primary and secondary windings of the coupled inductor are operated in series-charge and parallel-discharge to achieve high step-down voltage gain. Thus, the proposed converter has higher step-up and stepdown voltage gains than the conventional bidirectional DC-DC boost/buck converter. Under same electric specifications for the proposed converter and the conventional bidirectional boost/buck converter, the average value of the switch-current in the proposed converter is less than the conventional bidirectional boost/buck converter.

PROPOSED SYSTEM

An isolated dc-dc converter uses a transformer to eliminate the dc path between its input and output. For safety considerations, there must be isolation between an electronic system's ac input and dc output. Isolation requirements cover all systems operating from the ac power line, which can include an isolated front-end ac-dc power supply followed by an isolated "brick" dc-dc converter, followed by a non-isolated point-of-load converter. An Isolated dc-dc converter consists of full-bridge inverter and full-bridge rectifier. Power conversion system consists of DC-DC converter. DC-DC converter generally operates either in buckmode or in boost-mode. Buck operation delivers smaller output voltage at receiving side and boost operation delivers higher output voltage at receiving side. Transformer is used to transmute power from lower side to higher side and vice versa. Transformer also provides the barrier between the two converters. Non-isolated dc-dc converter and isolated dc-dc converter are the two classification of DC-DC converter.

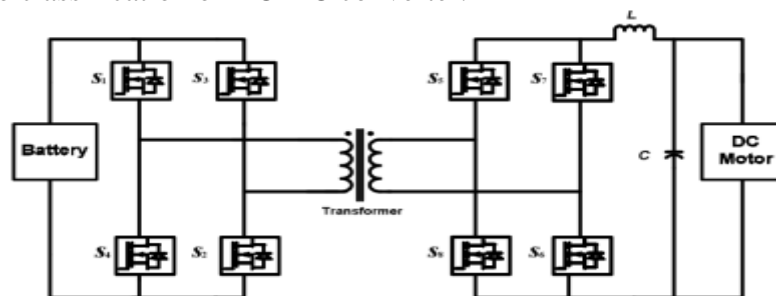


Fig.1: Isolated DC-DC Converter

Reduction in cost and improve the system efficiency is possible in non-isolated topology but it dispensation the safety issues of leakage current. Huge voltage dissimilarity between input side and output side produces the switching losses due to the capability of driving circuit which gives reduction in an efficiency of the converter. Therefore, isolated DC-DC converter is a main application for huge voltage dissimilarity.

SIMULATION RESULTS

The complete system is simulated using MATLAB/SIMULINK and from simulation results for isolated DC-DC converter has been implemented.

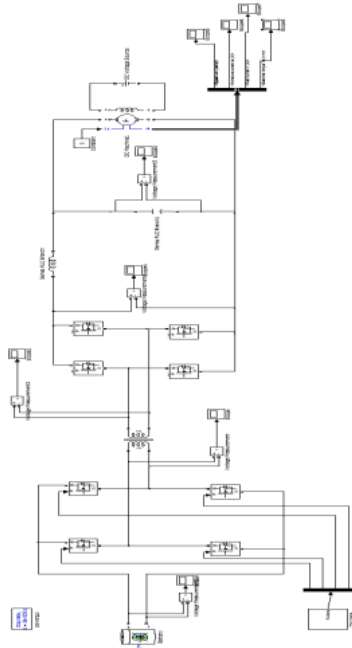
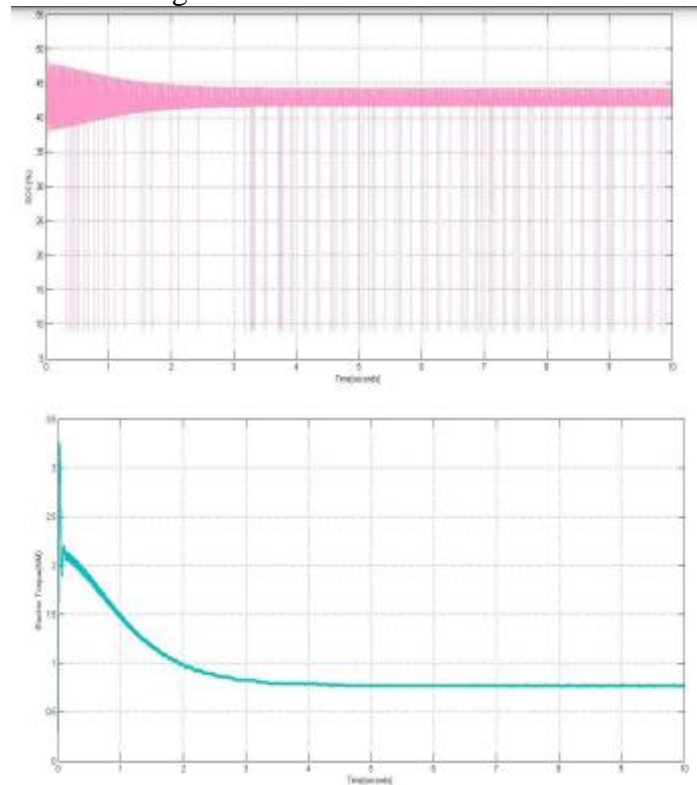


Fig.2: Isolated DC-DC Converter



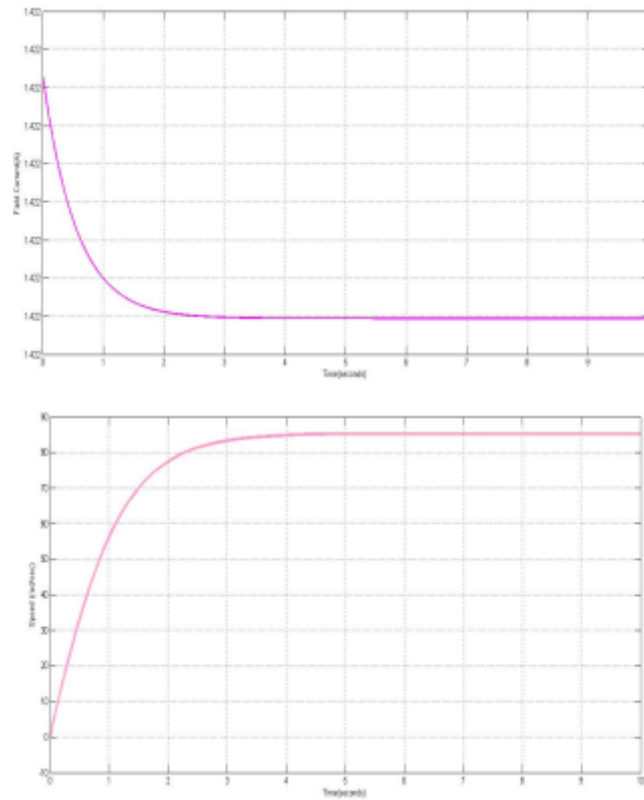


Fig.3: Speed of DC Motor

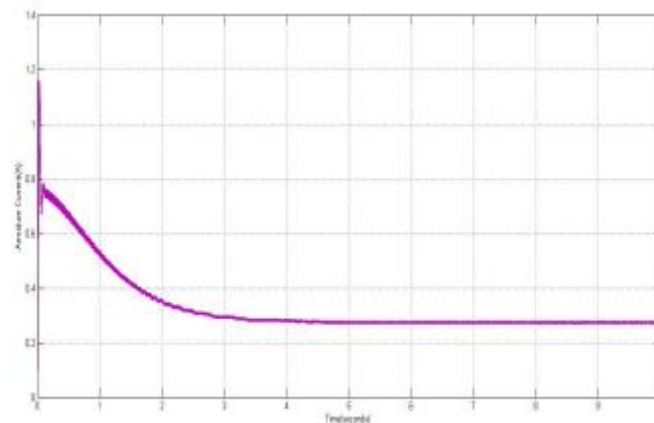


Fig.4: Armature Current

CONCLUSION

This project presents a battery-operated, isolated DC-DC converter, or DABC-fed DC motor, for use in bidirectional electric vehicles. The system's performance has been confirmed by simulation using the MATLAB/SIMULINK environment. While the dual active bridge uses a transformer to separate the input and output sides and guarantee user safety, a conventional Buck-Boost converter needs an extra isolation circuit for charging and discharging mode. Bidirectional isolated DC-DC converters may be added to the suggested system in the future, and MATLAB/Simulink can be used to analyse the system's performance for BFEV.

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