DESIGN OF INDUCTION HEATING SYSTEM USING ZVS FLYBACK DRIVER

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ABSTRACT

Heating systems have many industrial, domestic and medical applications. The first heating method was by burning fossil fuel however with concern about the environment other alternatives came e.g. induction heating and resistance heating.

Induction heating (IH) system is one of most efficient and fastest heating systems. In this project, a comparison between alternative heating systems is presented.

An IH system using zero voltage switching (ZVS) flyback driver is chosen as best solution. Modes of operation, components design and selection and computer simulation results using MATLAB/SIMULINK software program are presented.

A prototype of designed IH system is implemented. Obtained experimental results verify the validation of simulation results .Recommendations of the future work are introduced.

Keywords: Induction Heating; Zero Voltage Switching; ZVS Flyback Driver.

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INTRODUCTION

Heating systems have many industrial, domestic and medical applications. For e.g. in industrial, plants use heating systems in furnace, boilers, reactors, dryers and so on. In the past, people used fossil fuel for heating but now with the concern of the environment, the heating systems used electricity instead because in electrical heating systems are more efficient and have no emissions. Many electric heating systems are resistance heating type due to its simplicity design and low cost. New technology appear with the development of power electronics and control techniques which is Induction heating and it is more efficient than resistance heating.

There are many heating systems types which cause the customer to be confused what to choose. Of course every customer has different demands in the heating systems but they share some demands which are fast heating, efficiency, low cost and low impact in the environment . The project choose the induction heating system because it highly satisfied the common demands of customer.

PROJECT OBJECTIVES

The project objectives are:

- Design induction heating (IH) system.
- Simulate the design IH system using MATLAB/SIMULINK.
- Implement prototype.
- Compare the simulation and experimental results .
- Highlight the finding of the project method.

PROJECT FRAMEWORK

- Comparison is made between IH systems in the literature in terms of efficiency, cost and simplicity. IH system using ZVS flyback driver is chosen as a best solution using KTD analysis.
- Design and selection of IH system components.
- Modeling the IH system and obtain simulation results using MATLAB/SIMULINK software program.
- The working coil is wounded to give its designed value.
- Finally, the prototype is implemented and experimental results are obtained.

RESULTS AND DISCUSSION

The IH system is tested by heating a rod of iron inserted into the working coil. The iron rod is heated and its temperature reached to a value 640^{0}C during a time interval of 30 s. The short time interval shows the effectiveness of the designed IH system. The simulation and experimental results comparison shows that there is a close agreement between them that which validate the theoretical analysis and prove the feasibility of the design IH system.

CONCLUSION AND RECOMMENDATIONS

It can be conclude that the designed IH system is efficient, fast heating, low cost, self-oscillating and does not produce CO2 emissions. However, the system has disadvantage that the heating temperature cannot be controlled due to uncontrolled switching frequency. In future work, a control circuit that control the frequency which control the heating temperature is recommended.

FIGURES

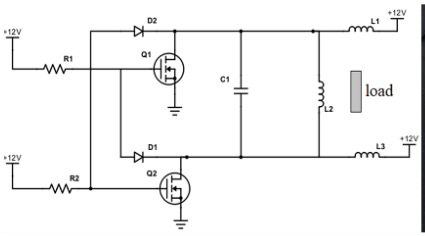

Figure 1: ZVS circuit.

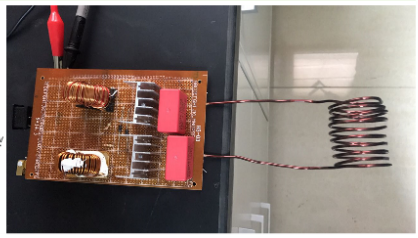

Figure 2: Photo of experimental system.

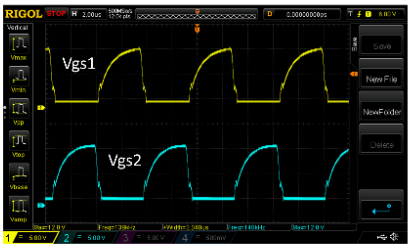

Figure 3: MOSFETs gate-source voltage.

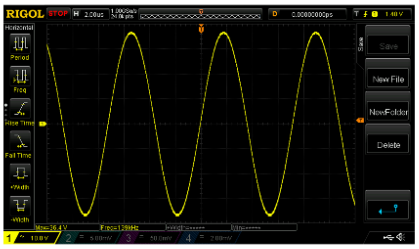

Figure 4: Coil voltage.

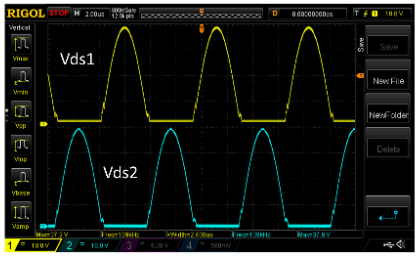

Figure 5: MOSFETs drain-source voltages.

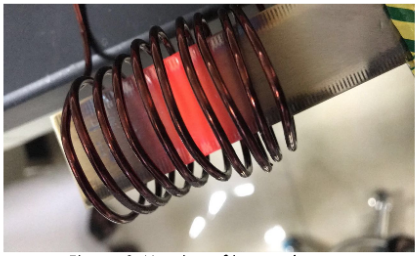

Figure 6: Heating of iron rod.

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