Simulation, Design and Implementation of High Frequency Power for Induction Heating Process

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***Abstract*— Induction heating is a non-contact heating process. Induction heating process to heat the material which is electrically conductive. Induction heating is a very popular techniques used in casting foundry, metal semis product as well as inner heat treatment process.Recend trends is to replace thyristor in converter with self-commutating device like IGBT & MOSFET for better efficiency and faster switching operation. Various topologies has been developed in this area like dc link inverter, resonant inverter and fly-back converter topology will modified to supply frequency to coil. In this paper IGBT based high frequency converter will be implement. Advantages of this converter are price will also reduce because small converter and less number of switch.**

***Keywords*— Induction Heating; High Frequency Power Supply; Selection of Topology; Simulation of High Switching Frequency Based Flyback Conversion and Simulation Result**

I. INTRODUCTION

Induction heating is a non-contact heating process. Induction heating process to heat the material which is electrically conductive. Since it is non-contact it is does not contaminate the material being heated. It is very efficient method because heat is generated inside the work piece. This is the difference between other method because heat generated in flame or heating element which is applied to the work piece. Induction heating is a fast, efficient, precise and non- repeatable non-contact method or electrically conductive material. Induction heating work on the basic principal of electromagnetic induction. Induction heating power supply converts AC line power into high frequency alternating current and deliver to work coil, which generates electromagnetic within the coil. Your work piece is placed in this field which generates eddy currents. The friction of this current will generates precise, clean and non-contact heat.

II. HIGH FREQUENCY POWER SUPPLY

Operating frequency of induction heating is depends on the size of work piece and heating application. Generally the large work piece has small frequency and small work piece has large frequency. The operating frequency is determined from capacitance of tank circuit, inductance of work coil and properties of material.

$$\mathcal{F} = \frac{1}{2\pi\sqrt{LC}}$$

Where $\mathcal{F}$= Operating frequency
L= Inductance of coil
C= Capacitance of tank circuit

III. SELECTION OF TOPOLOGY

Now day's different topologies are available such as Thyristor base, GTO, Diode and in case Of inverter CSI or VSI with Thyristor or GTO or MOSFET and resonance and hybrid circuit. But in my topic I have used FLY-BACK Converter because need of high frequency and high output value.This is the owen application of Fly-back converter.Fly-back converter configuration is shown in fig.1.

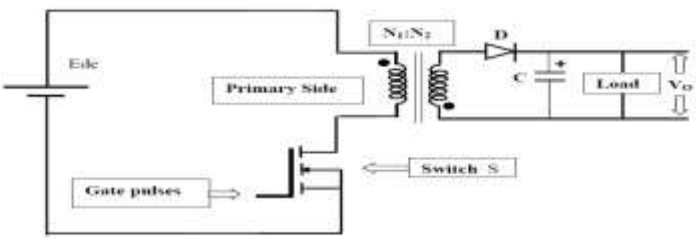

Fig.1. Fly-back converter configuration

In on state energy is transferred from the input voltage supply to transformer and the energy stored in capacitor, capacitor supplies energy to the output load.

In off state the energy is transferred from transformer to the output capacitor and output load. The working of fly-back converter is shown in fig.2.

When switch is closed; the primary of the transformer is connected to the input voltage source. The primary current and magnetic flux increase in the transformer so the energy stored in transformer. The voltage in the secondary winding which is negative so the diode is revers biased. The capacitor supplies the energy to the output load.

When switch is opened; the primary current and magnetic flux is dropped. The voltage induced in secondary winding is positive so the diode is forward biased, which is allowing the current to flow from transformer. The energy from transformer core is recharge the capacitor and capacitor supplies the energy to the load.

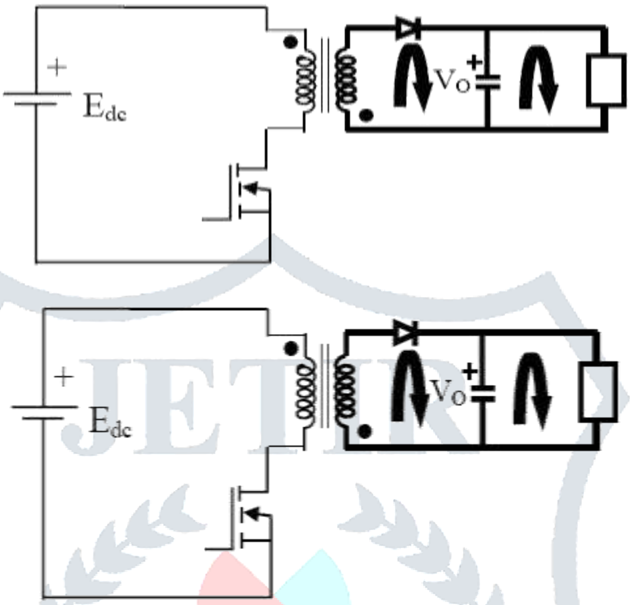

Fig.2 Working of fly-back converter

IV. SIMULATION AND SIMULATION RESULT

Simulation of MOSFET base high frequency converter has been shown below.

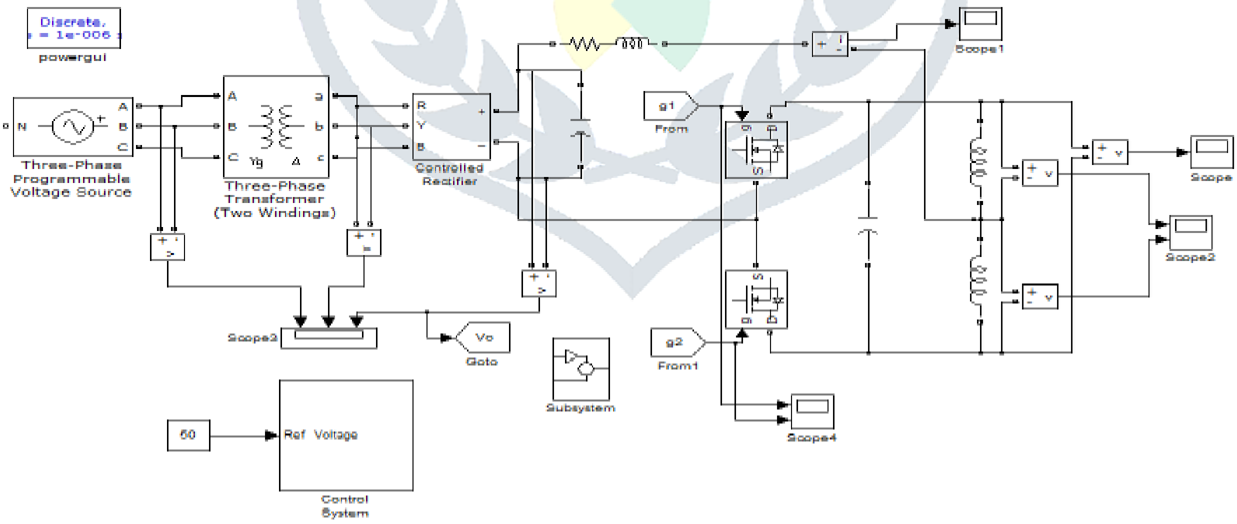

Fig.3 MOSFET base high frequency converter

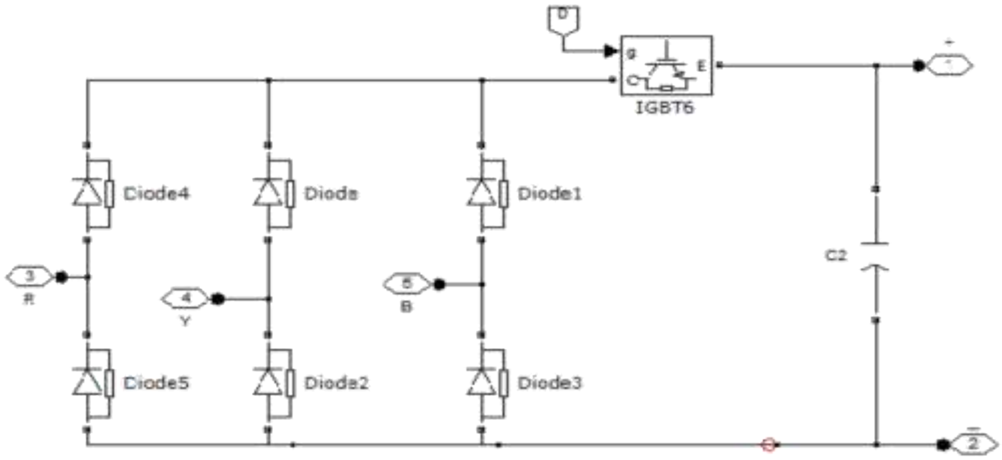

Fig.3.1 Design of Controll Rectifier

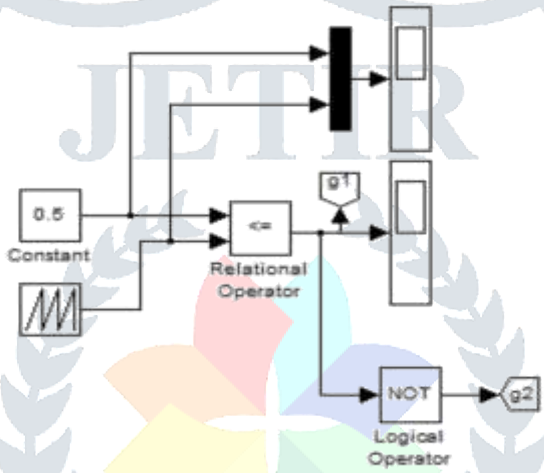

Fig.3.1 Converter Controll Scheme

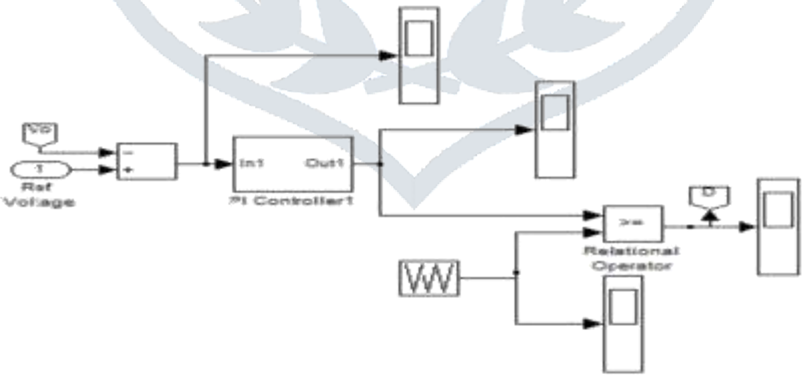

Fig.3.2 Rectifier Controll Scheme

V. OUTPUT WAVEFORMS

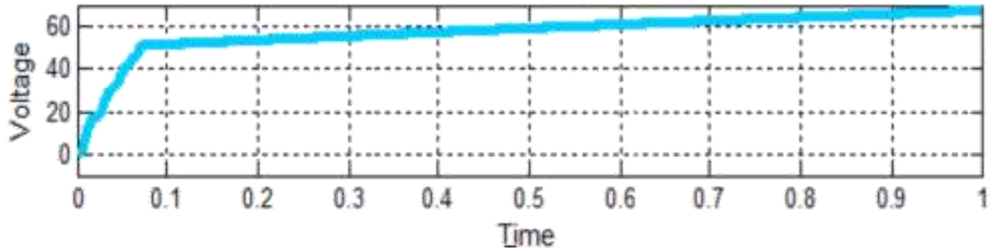

Fig.4.1 Show the output of DC link rectifier

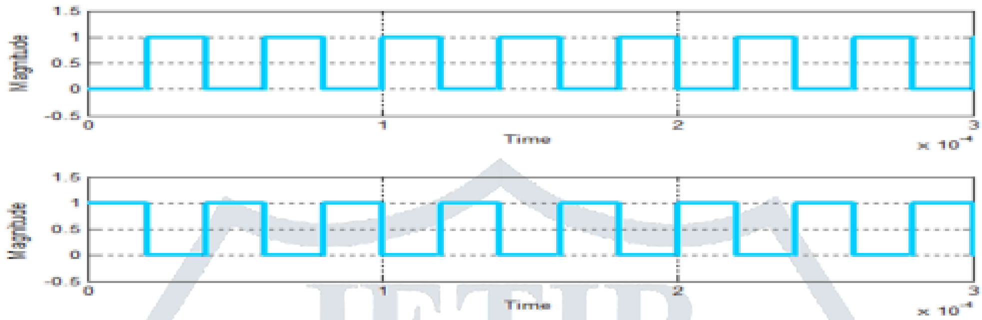

Fig.4.2 getting signal of MOSFET

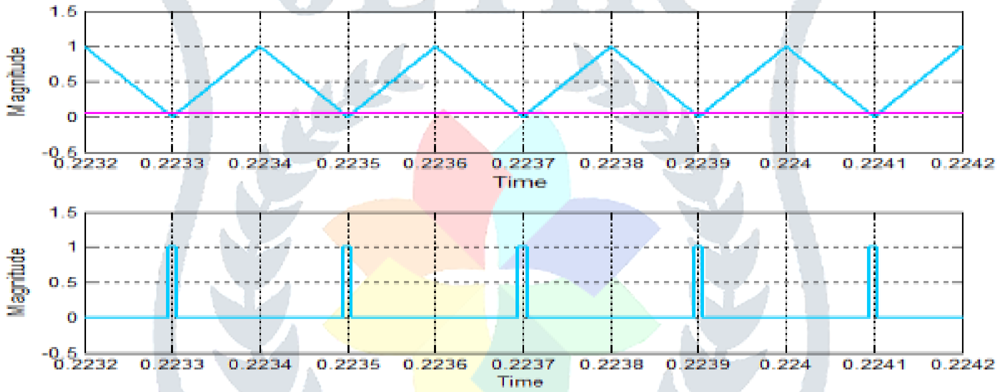

Fig.4.3 Output of PI Controller

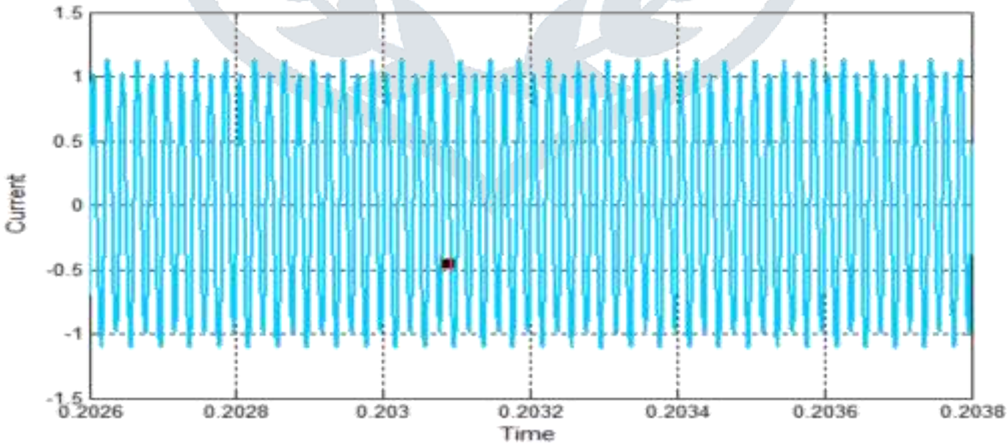

Fig.4.4 Input Current Waveform

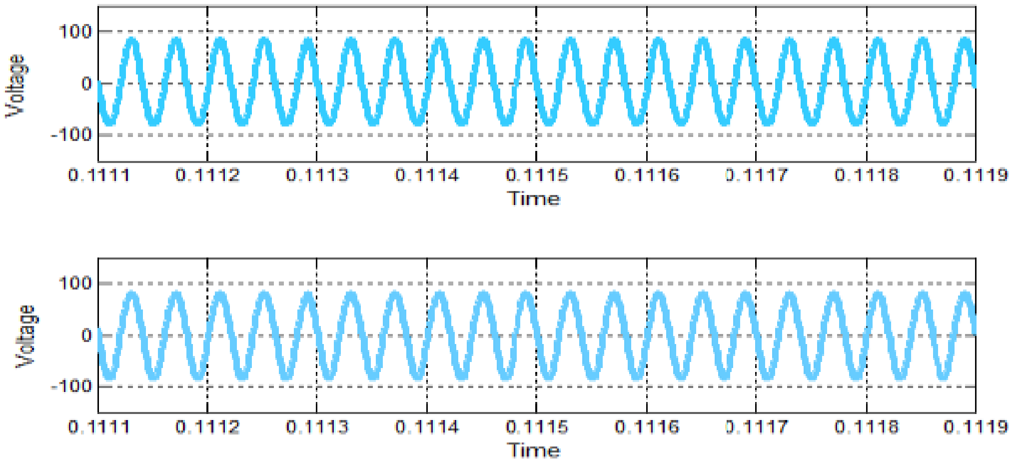

Fig.4.5 voltage waveform of load coil

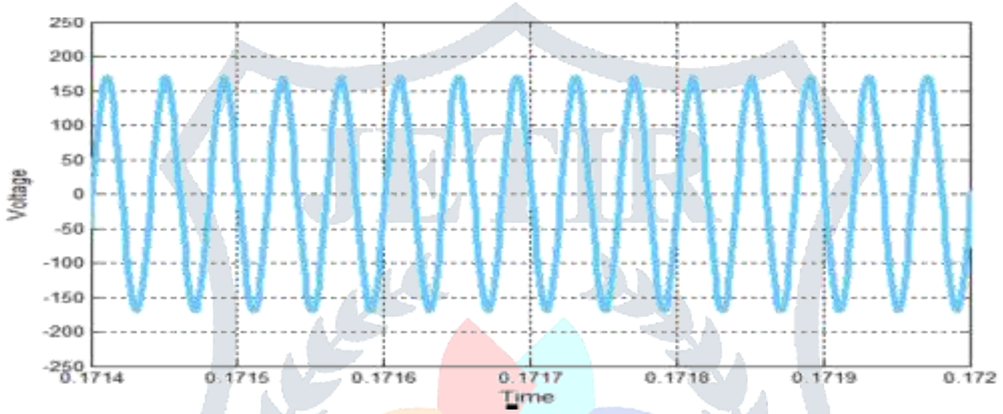

Fig.4.6 output voltage waveform of load coil

VIII. CONCLUSION

In This Paper High switching frequency based flyback converter topology is used to heat the given job. Results are verified by simulation in MATLAB software environment. Controll Circuit and driver circuit also presented in this paper.

IX. ACKNOWLEDGMENT

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