INDUCTION HEATING

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***Abstract*—** Induction heating is a heating method for electrically conductive materials that takes advantageof the heat generated by the eddy currents originated by means of a varying magnetic field. Since Michael Faraday discovered electromagnetic induction in 1831, this phenomenon has been widely studied in many applications like transformers, motors or generators‟ design. It was not until the turn of the 20th century that inductionstarted to be deeply studied as a heating method. The investigations on this field led to the construction of the first industrial induction melting equipment by the Electric Furnace Company in 1927 and the first induction hardening equipmentby Midvale Steel and Ohio Crankshaft Company some years later [1,2].

I. INTRODUCTION

Induction heating (IH) is a method of heating electrically conductive materials taking advantage of the heat produced by the eddy currents generated in the material. It has many advantages compared to other heating systems (e.g. gas- and oil-fired furnaces), such as quicker heating, faster start-up, more energy saving and higher production rates. The research done these last years in specific power supplies for this application, the numerical and computational methods developed, as well as the decrease of the cost of these systems, has lead to a widespread of IH in many processes and applications, such as cooking, automotive sealing, motor heating, paper making, tube and bar heating or aluminum melting. Since, Michael faraday discovered electromagnetic induction in 1831. This phenomenon has-been widely studied in many applications as per example, transformer and other magnetic design. This basic electromagnetic phenomenon in which induction heater relies has been described and discussed extensively used. An induction heater consists of an electromagnet and an electronic oscillator that Passes a high-frequency alternating current (AC) through the electromagnet. The Rapidly alternating magnetic field penetrates the object, generating electric currents Inside the conductor, called eddy currents. The eddy currents flowing through the Resistances of the material heat it by Joule heating. In ferromagnetic (and ferromagnetic) Materials like iron, heat may also be generated by magnetic hysteresis losses. The Frequency of current used depends on the object size, material type, coupling (between The work coil and the object to be heated) and the penetration depth. An important feature of the induction heating process is that the heat is generated Inside the object itself, instead of by an external heat source via heat conduction. Thus objects can behead very rapidly. In addition there need not be any external Contact, which can be important where contamination is an issue. Induction heating is Used in many industrial processes, such as heat treatment in metallurgy, Czochralski Crystal growth and zone refining used in the semiconductor industry, and to melt Refractory metals that require very high temperatures. It is also used in induction cook Tops for heating containers of food; this is called induction cooking. This induction Heater is designed to heat bearings that are mounted with an interference fit on to a Shaft. The heat causes the bearing to expand which eliminates the need to use Force during installation. in 900 C (1940 F) temperature difference between the bearing and shaft is generally sufficient to enable installation.

II. RESEARCH METHODOLOGY

Induction heating is done using two methods:

The first method is referred to as eddy current heating from the I^2R losses caused from the resistivity of a work piece's material. The second is referred to as hysteretic heating, in which energy is produced within a part by the alternating magnetic field generated by the coil modifying the component's magnetic polarity.

Hysteretic heating occurs in a component up to the Curie temperature when the material's magnetic permeability decreases to 1 and hysteretic heating is reduced. Eddy current heating constitutes the remaining induction heating effect.

When there is a change in the direction of electrical current (AC) the magnetic field generated fails, and is produced in the reverse direction, as the direction of the current is reversed. When a second wire is positioned in that alternating magnetic field, an alternating current is produced in the second wire.

The current transmitted through the second wire and that through the first wire are proportional to each other and also to the inverse of the square of the distance between them.

When the wire in this model is substituted with a coil, the alternating current on the coil generates an electromagnetic field and while the work piece to be heated is in the field, the work piece matches to the second wire and an alternating current is produced in the work piece. The I^2R losses of the material resistivity of the work piece causes heat to be created in the work piece of the work piece's material resistivity. This is called eddy current heating.

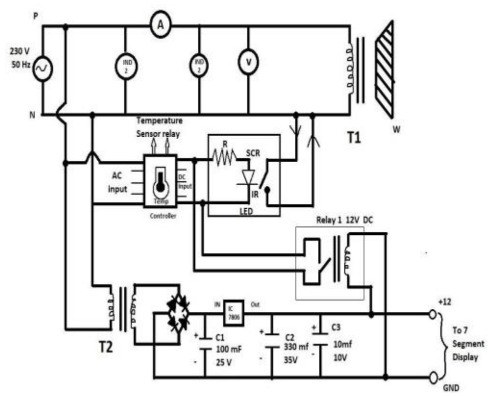

Fig. 2: CKT DIAGRAM

The most basic elements composing an induction heating system are the piece to be heated also known as a work piece , & the inductor or call that producers the magnetic field need to generate the heat . The inductor & the work piece can have shape & the piece is usually placed inside the coil to have better coiling. Considering that this study focused on the negative of round wires, the inductor used us a solenoid & the work piece a round wire. Induction heating phenomenon is based on two mechanism ofenergy dissipation.

III. INDENTATIONS AND EQUATIONS

STEP DOWN TRANSFORMER: **Transformer Equation can be Written As,**

$V_p \times I_p = V_s \times I_s$ If we know the input voltage and the number of turns on the primary and secondary coils, we can calculate the transformer output voltage.

7806 IC: Here is the elementary 6V 1A **power supply** circuit using 7806 IC. The 7806 three-terminal positive **voltage regulator** is available in the TO-220/D-PAK package making them useful in a wide range of applications. 7806 employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If proper heat sinking is provided, it can deliver over 1 ampere output current

IV. HARDWARE MODEL

Fig. 2: Actual hardware model of INDUCTION HEATING

The module consists of 20W solar panel and 2.7V/100F supercapacitor connected in parallel with solar panel. When the solar radiation is constant or not is detected by Pic-microcontroller with the help of relays then all the information coming from the Pic-microcontroller displayed on LCD display.

V. RESULT

The present thesis has considered structures used in induction heating field .This system have been tested and real industrial applications proving its reliability and flexibility.

Finally, experimental results using equipment designed and constructed by the authors were presented. Although there are differences between the experimental and simulation results, these are mainly due to the complexity of the converter control system and the difficulty of determining the parasitic components. However, the results obtained have proven to be accurate enough and show a correspondence between experimentation andsimulation

R.NO	CORE DIAMETER RANGE	TEMPRATTURE CONNTROL	EMPRATUREISE TIME	MAXIMUM TEMPRATURE
1	0-100mm (0.8-4.9inch)	to 200°	40se	00°C
2	0-300mm (0.8-11.8inch)	to 250°C	40sec	00°C
3	0-400mm (0.8-15.7inch)	to 250°C	40sec	00°C
4	0-600mm (0.8-23.6inch)	to 250°C	45sec	00°C
5	0-800mm (0.8-31.5inch)	to 260°C	60sec	10°C

Fig. 3: RESULT

VI. CONCLUSION

COMPARED TO OTHER SIMULATION METHODS IN LITERATURE, THE SOLVING PROCEDURE PRESENTED CONSIDERS THE CONVERTER‟S PERFORMANCE AND PROVIDES A ﬂEXIBLE METHOD OF MODELING THE OVERALL SYSTEM BEHAVIOR. MOREOVER, THE SIMULATION PROCEDURE PRESENTED TAKES ADVANTAGE OF THE ﬂEXIBILITY PROVIDED BY COMMERCIAL SOFTWARE‟S AND ALLOWS AN EASY AND ﬂEXIBLE IMPLEMENTATION COMPARED TO OTHER SIMULATION PROCEDURES. FINALLY, THE EXPERIMENTAL SETUP SHOWED A CORRESPONDENCE WITH THE RESULTS OBTAINED, VALIDATING THE SIMPLIﬁCATIONS ASSUMED DURING THE PROCESS.

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