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An Analysis of Scalar Resistor, Conventional Rotary Control, Resistor 3-phase Induction Motor and Animated Feedback in a Field Visible Expert

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ABSTRACT
The literature review demonstrates the three primary control strategies now employed in electric drives: field-oriented control, direct torque control, and scalar control. The temperature rise of the rotor bars, stat-or winding, stat-or core, and stat-or frame in a three-phase field-oriented controlled induction machine in operation is presented in this thesis. According to a review of the literature, no studies have been conducted to look into the thermal response of a field-oriented controlled induction motor.

KEYWORD
power losses, thermal behavior, squirrel cage induction motor with three phases, Method of Finite Elements, Fault Condition.

INTRODUCTION
These days, induction motors are widely employed in everything from small home motors to massive industrial applications. Pumps, fans, compressors, mills, shredders, extruders, DE-barkers, refiners, cranes, conveyors, chillers, crushers, blowers, and wind generators are among the common devices that use induction motors. The resilience, affordability, and minimal maintenance needed while in use are the key factors driving this increased interest in induction motors.

Induction motor failure is a significant problem that is becoming more frequent, such as in pulp and paper, despite their improved dependability and simplicity of construction. One of the main causes of motor failure is thermal dangers that develop during motor operation. High heat accumulation can cause severe thermal stress or even burnout in an induction motor. Due to downtime can be quite expensive in some industries, but in order to preserve employee safety and prevent other kinds of losses, such as power or economic losses, it is essential to have efficient machine thermal protection.

Induction motor failure is a significant worry and is on the rise, for instance in pulp and paper, despite their improved dependability and straightforward design. Temperature hazards during motor operation are a primary cause of motor failure. An induction motor may experience extreme thermal stress or possibly burn out if it accumulates too much heat. Since downtime can be highly costly in some industries, it is necessary to have enough machine thermal protection to reduce various losses, including power or economic ones, and to guarantee worker safety. Because of their benefits over other electrical machine types, induction motors are more appealing in today's applications. Understanding the fundamental formulas pertaining to this kind of electron mechanical device is therefore essential. Therefore, the electrical and mechanical aspects of instant messaging (IM) as well as the widely utilized control method, F.O.C., which is routinely employed in variable frequency applications with IM, are the main topics of this chapter.

The electromagnetic induction principle underlies the operation of an induction motor. There are two windings in an induction motor: the stator winding and the rotor winding. The stator winding is coupled to the input AC supply; a magnetic flux is created by the current passing through the stator winding. Because this magnetic flux typically rotates, it is also known as a rotating magnetic field.

LITERATURE REVIEW

Losses that take place during induction motor operation cause the motor to experience thermal stress or rise in temperature. Motor burnout and financial losses may result from this circumstance. It has been reported that 3 to 4% of induction motors failure occurs yearly due to overheating conditions. When a variable speed induction motor is running at low speed, overload relays are ineffective at protecting against heat. The over sizing technique is typically employed to prevent an induction motor from overheating. Regretfully, this method is inappropriate when operating at low speeds. It also results in extra expenses.

Induction motors were originally designed for applications requiring consistent speed. Recent advancements in control systems and power electronics have made it simpler to employ induction motors in variable speed applications. The use of an induction motor across a broad speed range has been made easier by the vector control technique for speed control. This method makes controlling an induction motor less complicated. The method is comparable to the volt/hertz method used for DC motors. In recent years, there has been a noticeable rise in the number of applications that use vector control. Accurately predicting the temperature rise in the motors is therefore strongly advised since excessive temperatures above the projected range might lead to motor failure and financial losses.

Numerous scholars have studied the thermal modeling of induction motors over the past few decades, producing a number of models that aid in predicting the temperature of the intricate induction motor construction. A straightforward model based on thermal resistance was created by Boggled et al. This simplified model is helpful for steady-state analysis and is designed for self-cooled induction motors. Finite element analysis (FEA) is necessary for a far more accurate examination of an induction motor thermal model. Even though contemporary computers have strong central processing units (CPUs), the FEA method is laborious and occasionally causes computer crashes. Then, in order to conduct a rapid and accurate Induction machines were first used in uncontrollable circumstances. However, induction machines are now widely employed in controllable applications because to the advancements made in the field of power electronics and the enhancement of control methods. Induction machines are being operated using a variety of control strategies, including vector and scalar control. Similar to how scalar control works with DC motors, vector control facilitates the control of induction motors.

- Modern applications employing vector control have increased the demand on induction motors, necessitating a precise assessment of their thermal response to safeguard them, minimize energy losses, and prevent motor failure while in operation. An estimation of a three-phase induction machine's thermal response under vector control is attempted to be implemented in this thesis.
- The specific objectives of this thesis are formulated as follows:
- Describe a three-phase induction motor thermal model using lumped parameters approach;
- Estimation of the temperature-rise in three- phase induction motor main parts under vector control using lumped parameters model.

The induction motor theory is explained in this thesis's chapter. The mechanical and electrical aspects are highlighted. This technique's algorithm and vector control theory are also explained. The chapter begins with the lumped parameters approach to the thermal model of an induction motor, which is followed by the computation of losses and the derivation of the temperature increase in the motor's primary components. The chapter that presents the simulation findings summarizes the thesis and offers suggestions for more research.

CONCLUSION

This thesis examined the electrical, mechanical, and thermal models of the IM. Given the effect of temperature on motor efficiency, consideration was given to temperature estimation in the instant messaging system. The lumped parameters model created in was used to implement temperature simulation of various IM parts. According to the simulation results, the motor's hot spot is the rotor bars. This study also provides a chance to prolong the motor's life, which is often shortened by overheating, and opens the door to possible energy savings in a field-oriented IM. The work done for this thesis is not comprehensive because of time constraints and the lack of resources. Consequently, the section that follows is devoted to developing some suggestions to enhance the research findings going forward.

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