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POWER ELECTRONICS STARTER FOR WOUND ROTOR INDUCTION MOTORS

A dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfilment of the requirements for the
Degree of Master of Science

By
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Abstract

Being the workhorse, induction motors are serving the industry. Mostly we can see squirrel cage motors, but when it's come to the large industries, wound rotor induction motors are also there. Applications like Mills, Large Fans, Pumps, Blowers, Crushers and Overhead Cranes which require higher starting torques use wound rotor induction motors to have a higher starting torque at a lower starting current at the stator. Generally wound rotor induction motors require more maintenance than squirrel cage motors because of its rotor construction, slip ring assembly and the starting method used.

Conventionally, wound rotor motors use an external resistor bank, which is connected to the rotor winding via slip rings, and external rotor resistance varies from a maximum value to zero as the rotor speed develops. Varying the external resistance can be achieved by several electromechanical methods. This is done in a stepwise manner with a motorized camshaft with electromechanical contact points or with a set of electrical power contactors and timers having a suitable time delay between adjacent steps. The traditional starter is highly mechanical and can cause lot of startup delays and is bulkier and requires frequent maintenance. To ensure right operation of rotor resistance control, the motor control circuit incorporates several additional measures and these are too prone to failures due to their own nature. Due to high heat dissipation in the resistors the number of consecutive startups during a short time period is also limited.

The proposed power electronic starter is entirely a power electronic device, which is having a three-phase rectifier bridge and a programmable transistor chopper. Programmable transistor chopper ensures a gradual speed development at rotor and control the acceleration with the duty factor of the transistor. This could eliminate the major disadvantage of traditional starter, which is the dependability of rotor speed with the load torque by extending it to have a closed loop speed control. Thereby we can ensure the programmable torque-speed characteristics with this power electronic

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starter. This power electronic development will minimize the overall maintenance, and avoid current fluctuations completely during speed changes while demanding speed up or down at the rotor.

This report discusses the proposal, simulations in prone to the construction, hardware design and practical implementation and testing of starter with a no load wound rotor motor. Latter part of the report shows the performances of new starter over the conventional starter and future developments possible.

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

SOYSA. W.H.I.D.
30th January 2010

I endorse the declaration by the candidate.

UOM Verified Signature

Dr. J. P. Karunadasa.

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