Performance Enhancement of Wound Rotor Induction Motor by VSI with Dynamic Capacitor

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Abstract— The work proposes a novel method for improving performance of a Three Phase wound rotor induction motor using an indirect reactive current control method in the rotor a 3-phase VSI with a dynamic capacitor is connected in the rotor circuit used for controlling the reactive current in the rotor and the dynamic capacitor is an H-bridge switch by a capacitor in which the duty ratio of the H-bridge circuit is various in order to change the capacitance value dynamically. The performance parameters such as the torque, speed, rotor current and stator Current are obtained. In addition to improving performances, as the future method uses only one capacitor in the rotor whereas against three capacitors are used in the rotor impedance control scheme.

Key words: Wound Rotor Induction Machine, H-Bridge Capacitor switch, VSI with Dynamic Capacitor, Rotor impedance control, PWM generator (2-level)

I. INTRODUCTION

The three phase induction motors are the motor most frequently encountered in industry. They are simple rough low priced and easy to maintain. They rough at essentially stable speed zero to full load. The speed is regularly dependent and, consequently, these motors are not essentially the adapted to speed control. However variable frequency electronic drives are being used additional and more to control the speed of commercial induction motor.

If equal resistances are built-in in each secondary phase of three phase induction motor the speed decreases as the secondary resistance increases. A capacitive reactance have been introduced in the rotor circuit for cancelling the inductive reactance of the rotor circuit. Speed handle of an induction motor is possible by having a resonant rotor circuit, which is adjusted according to the slip frequency.

The Switched capacitor has been adopted with the use of non resistive secondary manage of an induction motor to improve the speed, torque, rotor current, and stator current. In this paper use of four IGBT which forms a H-Bridge circuit and a single capacitor. Many techniques are available for control of three phase machine to the best performance. It proposes a novel method for improving performance of wound rotor induction machine. Motor using indirect current control of VSI with dynamic capacitor.

This paper proposes a new technique of using a VSI with H-Bridge dynamic capacitor in the rotor circuit in direct to recover the performance of the wound rotor induction motor. The proposed scheme use PWM generator (2-level) with a VSI.

II. SWITCHED CAPACITOR PRINCIPLE

In fig. 1 author describes the switched capacitor concept which is used to improve the speed and torque of the inductive circuit. It consist of placing an ac capacitor in the centre of an H-Bridge with bidirectional switches as exposed in fig1. The complementary switch pairs (S1,S4) and (S2,S3) respectively are switched using a 2-level PWM strategy.

During time interval, the switch pair (S1,S4) is ON the capacitor is charging and a serial RLC circuit is modelled in the time interval, the switch pair (S2,S3) is ON the capacitor is applied with turn round polarity to the RL circuit and the capacitor starts discharging.

III. PROPOSED CIRCUIT

In the proposed scheme, only one H-Bridge switch through a capacitor and a VSI bridge circuit have been used. The number of components used in the proposed scheme is less compared by conventional secondary impedance control scheme.

Fig. 1: Basic H-Bridge switch with an ac capacitor

Fig. 2: Proposed simulation Circuit of VSI with Dynamic Capacitor controlled rotor circuit

The Fig 2. Show the proposed VSI with dynamic capacitor forced Rotor impedance control the Stator is known to the three phase supply and the Rotor is fed three phase bridge inverter with a dynamic capacitor. The duty ratio and frequency of the VSI bridge can be changed in order to work the induction motor at different slip speeds.
This thesis proposes a new technique of using a VSI by a H-bridge dynamic capacitor in the rotor circuit in order to improve the concert of the Wound Rotor Induction Motor. The PWM generator receives signal from the product of modulation index and Uref generation. With the help of 2-level PWM generator in which demux is attached which seperates the signals which goes to Goto Block.

Goto Block send signals to from block and From Block receives the signal and switching the IGBT on the gate terminal.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Rating</td>
<td>110 KW</td>
</tr>
<tr>
<td>Voltage</td>
<td>230 V</td>
</tr>
<tr>
<td>Frequency</td>
<td>50Hz</td>
</tr>
<tr>
<td>Stator Resistance</td>
<td>0.3 ohm</td>
</tr>
<tr>
<td>Stator Inductance</td>
<td>0.0013mH</td>
</tr>
<tr>
<td>Rotor Resistance</td>
<td>0.276 ohm</td>
</tr>
<tr>
<td>Rotor Inductance</td>
<td>0.00137mH</td>
</tr>
<tr>
<td>Mutual Inductance</td>
<td>0.0525 ohm</td>
</tr>
<tr>
<td>No. of Poles</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 1. Simulation Parameters
induction motor. The comparative study of the proposed work with rotor impedance control scheme shows better improvement in the performance parameters. As the proposed work uses IGBT switching components such as single capacitor, significant reduction of cost in overall control circuit can be achieved. In addition to this, it also further reduces the switching losses. In this thesis work reduced 2-level PWM generator are used which decreased the cost and complexity of the circuit and increase its performance. speed and torque waveform give better output and its Rotor current & Stator current also better.

V. CONCLUSION
The proposed work is simulated for loading conditions by varying dynamic capacitor value for obtaining the improved performance of parameters such as torque & speed of

REFERENCES