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Incremental Voltage Level to Minimize THD in Multilevel Inverter Fed Induction Motor

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Abstract:- Harmonic Content in the electrical system is one of the most serious difficulties in terms of power quality, but multilevel inverters may help with that. Multilevel inverters have lately emerged as a viable option for controlling high-power, medium-voltage electricity. In this research, we suggested an incremental cascade H-Bridge fed induction motor. In addition, the suggested system is constructed into a MATLAB/SIMULINK model, with simulation results that have been confirmed.

Keywords:- *Incremental H –bridge inverter, Induction motor, MATLAB Simulation.*

I. INTRODUCTION

Power electronics is a technique that converts electric power from one form to another by combining high-power semiconductor devices with passive components such as transformers, inductors, and capacitors [1]. The input and output may be Alternating Current or Direct Current and may differ in magnitude and frequency. The conversion sometimes involves multiple stages with two or more converters connected in a cascade. The aims of a power electronic converter are to maximize conversion efficiency, reduce size and weight, and achieve acceptable output regulation. On the basis of input and output, power electronic converters are classified as DC-DC, DC-AC, AC-DC, and AC-AC, with the first portion referring to the input and the second part relating to the output. The front end of most low-power converters is a diode bridge rectifier. The process is known as rectification, and it converts line frequency ac (such as from a wall outlet) to an unregulated DC voltage. Input and output voltages are both DC in a DC-DC converter, and in the simplest instance, the output voltage must be regulated in the presence of changes in load current and input voltage.

A diode bridge front end, followed by a DC-DC converter, transforms line frequency ac voltage to many regulated DC voltages in a computer power supply [1]. A line frequency rectifier is followed by a DC to high-frequency AC converter with a frequency range of 20 to 100 kHz, whose output is coupled to a resonant tank circuit that contains the load in electronic ballasts for compact fluorescent bulbs. The input to an adjustable-speed motor drive is a three-phase ac supply, and the output is a three-phase ac with variable magnitude and frequency for optimum steady-state operating and dynamic requirements.

There are two types of cascaded bridge configurations. 1) Cascades on a half-bridge There are two options: Cascaded Full Bridge or Cascaded H-Bridge.

II. PROPOSED CONCEPT

Harmonic content in the electrical system is one of the most serious difficulties in terms of power quality, however Multilevel Inverters may help with that [6]. Multilevel inverters have lately emerged as a viable option for controlling high-power medium-voltage electricity [7]. AC power supplies and AC motor drives that use switch-mode DC-to-AC inverters [8]. Where the goal is to create a sinusoidal ac output that can be regulated in both magnitude and frequency [3] .

A. Incremental Cascade H-Bridge Fed

- **Induction Motor**

The incremental cascade H-bridge fed induction motor is an architecture based on the cascade H-bridge (Fig. 1). It enhances the number of output waveform levels, lowering low-order harmonics, switching losses, and THD significantly [3].

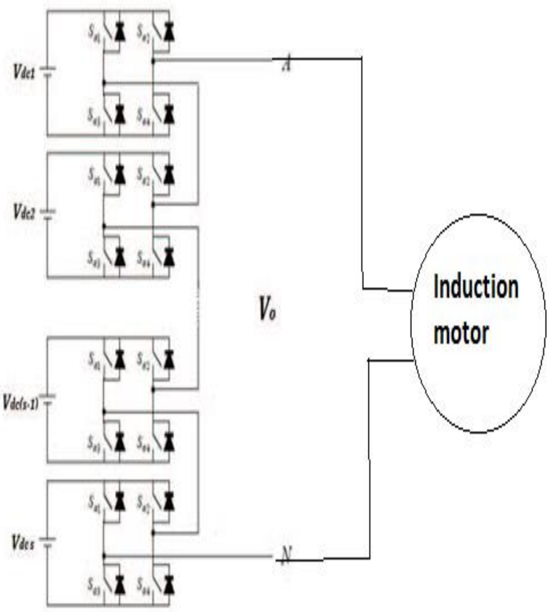

Fig. 1: Cascade H-Bridge Multilevel Inverter fed Induction Motor

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One of the structure's benefits is that the stage with greater DC-link voltage has fewer commutations, which minimizes related switching losses on the one hand and, on the other hand, reduces the number of switching devices by employing a specific approach. The number of output levels is 2S+1, where S is the number of separated dc sources or cells.

III. SIMULINK DEVELOPMENT OF PROPOSED INVERTER

Firstly, go to MATLAB and open SIMULINK new file then take the required components and paste them in the right new file and connected them according to the circuit diagram the figure 2 will be in shown below:

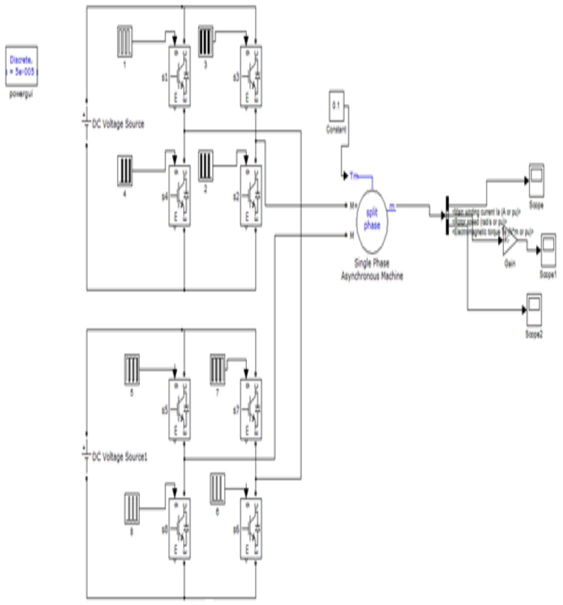

Fig. 2: Incremental Cascade H-Bridge Fed Induction Motor

Switching sequence for cascade H-Bridge with induction motor is shown in table1

vout	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
3vdc	H	H	L	L	H	H	L	L
2vdc	L	H	L	H	H	H	L	L
Vdc	H	H	L	L	L	H	L	H
0	L	H	L	H	L	H	L	H
-vdc	L	L	H	H	L	H	L	H
-2vdc	L	H	L	H	L	L	H	H
-3vdc	L	H	H	H	L	L	H	H

Table 1

IV. RESULTS AND DISCUSSIONS

Torque, speed, current characteristic waveforms for Incremental Cascade H-bridge fed induction motor are shown below:

A. Current waveform

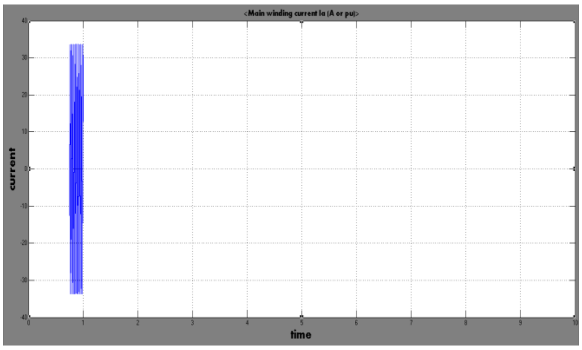

Fig. 3: Current waveform Characteristic for Incremental Cascade H-bridge fed Induction Motor

B. Speed waveform

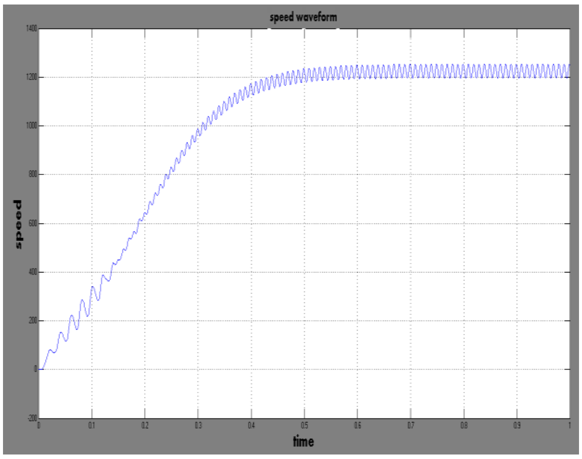

Fig. 4: Speed waveform Characteristic for Incremental Cascade H-bridge fed Induction Motor

C. Torque waveform

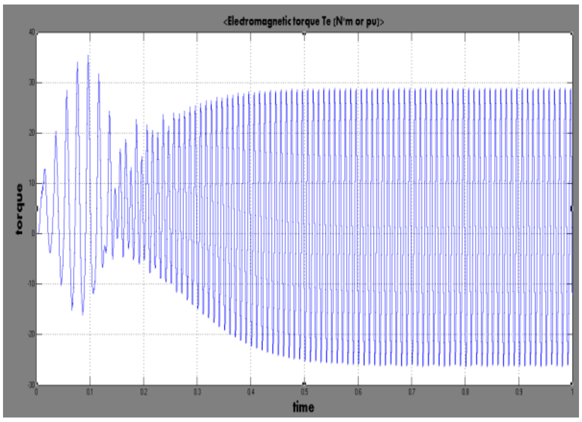

Fig. 5: Torque waveform Characteristic for Incremental Cascade H-bridge fed Induction Motor

V. CONCLUSION

In this paper incremental cascade H-bridge fed induction motor is proposed and the simulation results showed that the harmonics and the THD are reduced. It's preferred that the output voltage has no lower order harmonics because their filtering is so hard.

It’s clear that magnitude of induction motor torque is also improved

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