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COMPARISON BETWEEN TWO LEVELS AND THREE LEVEL INVERTER FOR DTC OF INDUCTION MOTOR DRIVE

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ABSTRACT:

The method of direct torque control is a powerful means for controlling a specially designed asynchronous motor. Today, direct control of the moment with the most popular digital signal processors in controlling the AC motor, especially electric induction drives. Fast response and smooth control of the DSP are used to perform real-time simulation of the motor variables to alternating current, so that the electromagnetic moment, flow, mechanical speed, etc. In this article, the implementation of the engine management technique is known for high performance induction. As a direct torque control (DTC) using a three-level inverter and a comparison between the base model and the fault code, the DTC circuit has changed (three levels of the inverter) to minimize the sampling time of the embedded drive system, In DTC drives. The experimental results of this drive system are high-performance on a standard asynchronous a5hp engine to meet expectations and are consistent with theoretical work.

INDEX TERM: motor, 3phase, inductance 5HP, voltage inverter.

I. INTRODUCTION:

Induction motor control technology using direct torque control (DTC) has been introduced there for about a few years, a relatively simple control structure and a broad structure, at least as well as the FOC method. It is also known as the DTP drive, which is less sensitive to changing parameters. The DTC method is mainly based on the theory of the spatial vector by choosing the appropriate space of the vector voltage throughout the sampling period. The control requires the flow and the stator torque is obtained. The diagnostic trouble code of the drive consists of a DTC controller, a torque and flow calculator and an inverter voltage source (VSI), as shown in Figure 1. The configuration is much simpler than the FOC systems. This method can be easily implemented using hysteresis controllers for the pair and for the flow. The implementation of DTC instant messaging, although simple, but requires a fast processor to perform simulation in real time of electromagnetic torque and stator flux based on terminal samples, variables. However, microcontrollers are widely used in scalar or vector control of alternating current machines. However, for AC motor drives of high induction efficiency and smooth control, the use of a fast processor is not required. The solution to this problem is to use a processor that can perform fast calculations of the estimated values in the case of DTC is the torque and stator flux. With the current trend of research in motion management, no doubt, a system based on DSP dominates the problem. This is especially true, for example, with DSPs and newly introduced TMS320F2407 DSP controllers specifically designed for digital engine management.

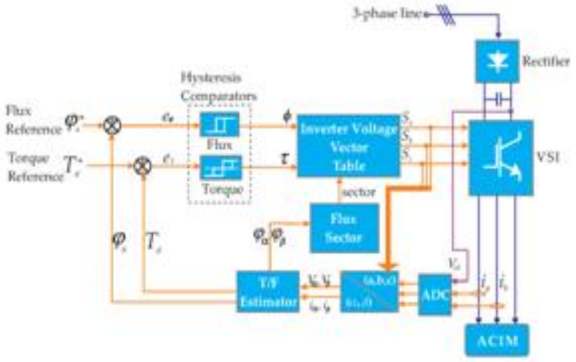

Figure1. Basic Direct Torque Induction Scheme

II. CONCEPT OF DIRECT TORQUE CONTROL:

The induction motor with VSI connection has eight possible configurations of six switching devices in the inverter. Accordingly, there are eight vectors available for input voltage before instant messaging. In order to control the stator flux and the DTC torque, eight possible stator voltage vectors are used.

SWITCHING STATES OF PHASE LEG A OF VSI:

$V_{ab} = V_a - V_b$ ------------ (1)

$V_{bc} = V_b - V_c$ ------------ (2)

$V_{ca} = V_c - V_a$ ------------ (3)

III.MODELING OF THREE PHASE TWO LEVEL INVERTER:

DC to AC converters are known as inverters, according to the type of power source and allied topology of the power circuit, inverters are categorized as a voltage source inverter (VSI) and current source inverters (CSI). Single-phase VSI have short-range energy applications and three-phase VSIs have medium to high power applications. The main purpose of three-phase topologies is to deliver a three-phase voltage source in which the amplitude, phase and frequency can be controlled. Three-phase converters are widely used in engines, active filters and power flow regulators combined in power systems UPS, etc. A standard three-phase inverter shown below includes six switches whose switching is dependent on the modulation scheme.

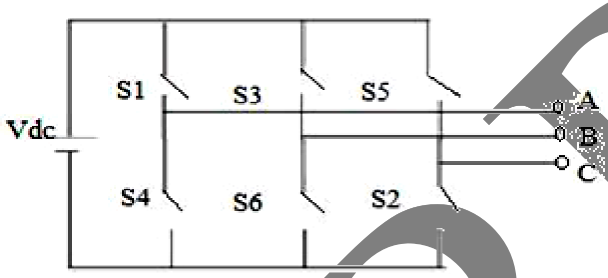

Figure 2: Basic Three Phase inverter

The inverter has eight switch states as given in the below table.

$\Delta\Psi_s$	ΔC_e	S_1	S_2	S_3	S_4	S_5	S_6
1	1	V_2	V_3	V_4	V_5	V_6	V_1
	0	V_7	V_0	V_7	V_0	V_7	V_0
	-1	V_6	V_1	V_2	V_3	V_4	V_5
0	1	V_3	V_4	V_5	V_6	V_1	V_2
	0	V_0	V_7	V_0	V_7	V_0	V_7
	-1	V_5	V_6	V_1	V_2	V_3	V_4

In order to satisfy KCL and KVL, both of the switches in the same leg cannot be turned ON at the same time, as it would short the input voltage violating the KVL. Thus the nature of the two switches in the same leg is complementary.

$S_{11}+S_{12}=1$ ------------(4)

$S_{21}+S_{22}=1$ ------------(5)

$S_{31}+S_{32}=1$ ------------(6)

IV. THREE LEVEL INVERTER:

In three levels (multi-level), harmonic analysis of the converter with a view of the total harmonic distortion for various topologies of power circuits for asynchronous motors. The inverter is the most neutral point common inverter of a multilevel, a flying capacitor inverter and an inverter H-bridge cascade. After analyzing the performance of multi-level inverters of the control topologies of various technical multilevel inverters, the results of the simulation are superior to the drives based on the modulation of the two-level pulse width.

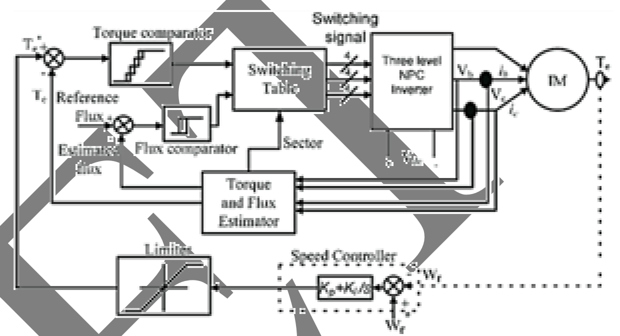

Figure 3:Block diagram of three level inverter fed DTC induction motor drive.

V. SIMULATION DIAGRAM:

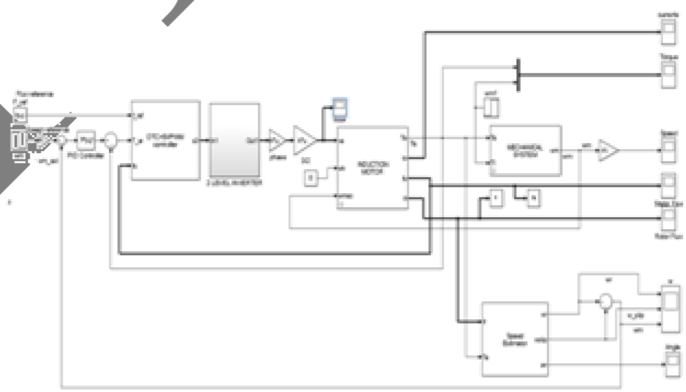

Figure 4: Simulation Diagram of Two Level Inverter

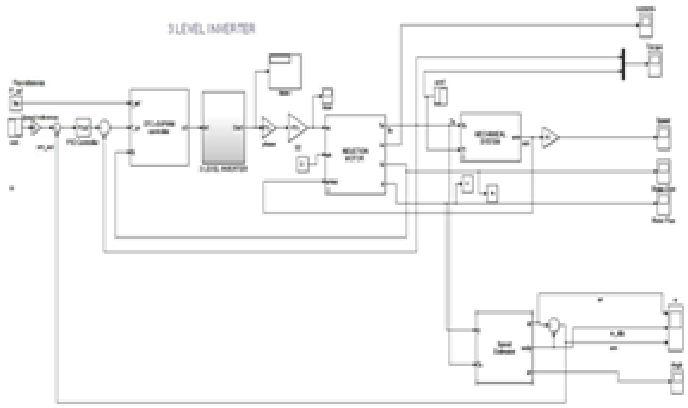

Figure 5: Simulation Diagram of Three Level Inverter

VI. SIMULATION RESULTS OF TWO LEVEL INVERTER:

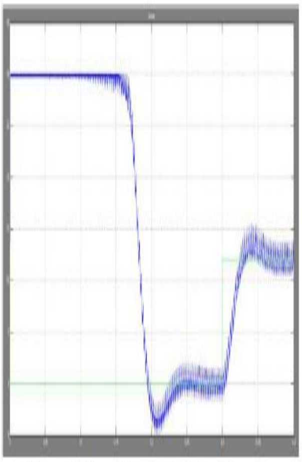

Figure 6: Torque Plot of Two Level Inverter

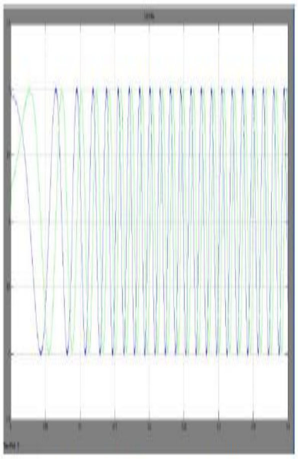

Figure 7: Stator Flux Plot of Two Level Inverter

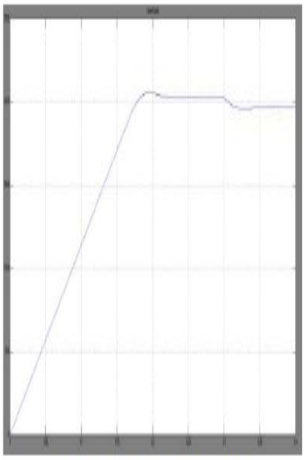

Figure 8: Speed Plot of Two Level Inverter

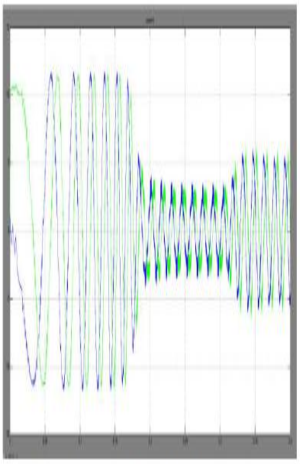

Figure 9: Currents Plot of Two Level Inverter

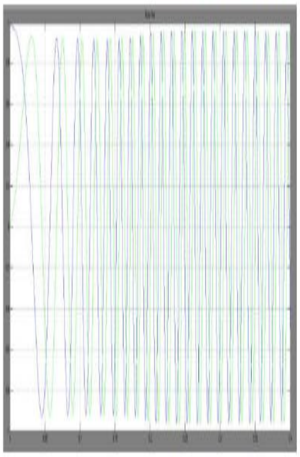

Figure 10: Rotor Flux Plot of Two Level Inverter

Above figures shows the results of two level inverter For DTC Induction Motor Drive.

VI. SIMULATION RESULTS OF TWO LEVEL INVERTER:

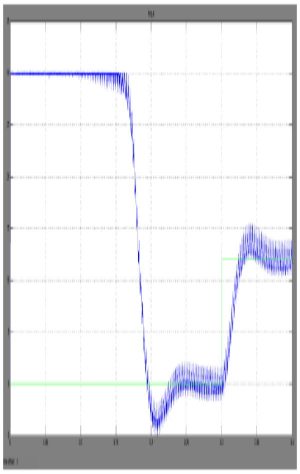

Figure 11: Torque Plot of Three Level Inverter

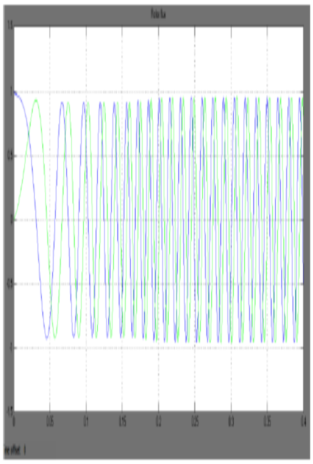

Figure 12: Stator Flux Plot of Two Level Inverter

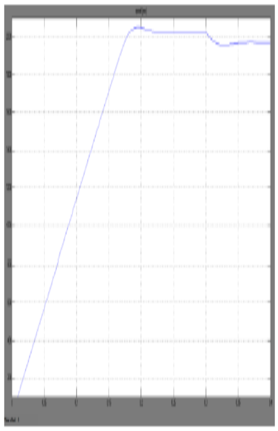

Figure 13: Speed Plot of Three Level Inverter

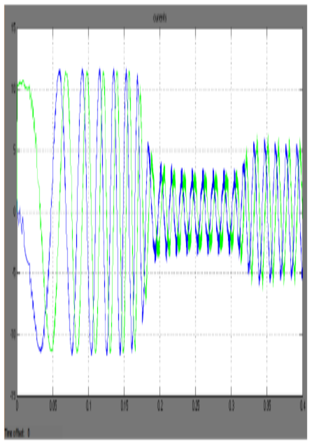

Figure 14: Currents Plot of Three Level Inverter

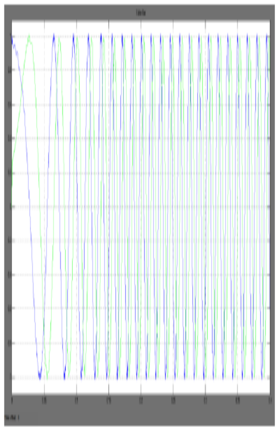

Figure 15: Rotor Flux Plot of Three Level Inverter

Above figures shows the results of three level inverter For DTC Induction Motor Drive

VII. CONCLUSION

This article proposes a modification to the method of direct torque control (DTC) for fast and excellent dynamic torque response. Taking into account the effect of load and engine speed, an optimized switching table (OCT), which is an important factor in choosing the appropriate vector, is proposed to change the torque. In addition, the vectors of choice among the vectors are appropriate based on the output of the torque ripple less. Following are the determination of OST; the closed loop control strategy is designed to control the voltage difference of the capacitors, which is limited to a predetermined limit. The results of the simulation show that the use of the proposed method allows achieving this even with a pulsating moment. Comparing the main DTC method, it is based that the implementation of the. proposed method has a simple implementation and the possibility of reducing the capacitor in the DC link

REFERENCES:

1) Yatim A.H.M ;Idris N.R.N "*Implementation of Direct torque control of induction machine utilizing TMS320C31digital signal processor",*Signal Processing and Its Application, Sixth International,Symposium,2001volume :2 digital object identifier; 10.1109/ISSPA.2001.950223,publication year:2001,pages:627-630.
2) Toh, C.L.; Idris, N.R.N.; Yatim, A.H.M.;Muhamad,N.D.; Elbuluk, M."*Implementation of New Torque and Flux controllers for Direct Torque Control (DTC) of Induction Machine Utilizing Digital Signal Processor (DSP)",* Power Electronics Specialists Conference, 2005, Pages: 1594-1599. P ESC"05 IEEE 36th digital Object Identifier: 10.1109 /PESC.2005.1581843Publication Year: 2005, Page(s): 1594 – 1599.
3) Toh,C.L.;Idris,N.R.N.;Yatim,A.H.M.;Muhamad,N.D;Elbuluk,M *" Implementation of a New Torque and flux Controllers for Direct Torque control of Induction Machine Utilizing Digital Signal Processor and Field programmable Gate Arrays" Power Electronics Zhou, L.Q. " DSP- controlled Direct Torque Control of Induction Machines"* ,Industrial Electronics and Application, 2007.ICIEA 2007.2nd IEEE conference on Digital Object Identifier: 10.1109/ICIEA.2007.4318718, Publication year :2007,pages:1790-1793IEEEconference Publication.
4) H. Ibrahim ; M.Aktas. "*Direct torque control of induction machine drives using adaptive hysteresis band for constant switching frequency",* Electric machines & Drives Conference,2007,IEMDC 07.IEEE International volume:2 Digital Object Identifier:10.1109/IEMDC.2007.383697 Publication Year:2007,page(s) :1762-1767.
5) Habetler, T.G.; Profumo, F.; Pastorelli, M. " *Direct torque Control of induction machine over a wide speed range* ", Industry Application Society Annual Meeting 1992.,Conference Record of the 1992 IEEE.,Digital Object Identifier : 10.1109/IAS.1992.244340 Publication Year: 1992 , Page(s): 600 - 606 vl.1 Cited by: 8 IEEE Conference Publications

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