© 2015 IJSRSET | Volume 1 | Issue 2 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Study of Power Utility for Multi-Level Converter in Electric Drive System

B. Prasanna Lakshmi
Department of EEE, Siddhartha Institute of Engineering &Technology, Ibrahimpatnam, Hyderabad, Telangana, India

ABSTRACT

This paper presents a configuration with structure electrical converter with six-phase induction motor, this configuration proposes force management of 2 pole induction motor in rotating system. The model is simulated in Simulink atmosphere to guage its performance beneath load and no-load conditions. The results show reliable and smart performance of the motor. Total circuit is simulated in MATLAB simulink.

Keywords: Torque controlled configuration, multi level inverter, D-q model, six-phase induction motor.

I. INTRODUCTION

Amongst many sorts of electrical motors, induction motors still fancy a similar quality as they did a century past. many factors that embrace lustiness, low value and low maintenance have created them in style for industrial applications compared to dc and different ac motors. Another side in induction motor drives that has been researched recently is that the use of point induction motors wherever the quantity of mechanical device phases is quite 3. Here, a multi-phase system may be a system with quite 3 mechanical device phases. Among the various multi-phase induction motor drives being researched, following necessary advantage for the dual-3-phase induction motor having 2 mechanical device winding sets spatially shifted by thirty electrical degrees with separated neutral is: The dual-3- part resolution will generate higher force as compared to standard 3 part motor. This characteristic makes them convenient in high power and/or high current applications, adore ship propulsion, part applications, and electrical / hybrid vehicles (EV). [5] Output force of point induction motors is way over that of standard 3 part Induction Motor. Emil Levi [1] provides a review of the recent developments within the space of point induction control. during this paper Vector management and direct force management (DTC) square measure self-addressed and utilization of the extra degrees of freedom that exist in point machines for differing functions is delineate (higher mechanical device current harmonic injection for force improvement and management of a bunch of series-connected point motors provided from one point VSI). Asynchronous, induction motor is one among the important and wide used ac motors. Single part and 3 part each induction motors square measure in style and wide used due to its simplicity, robustness, smart performance. however point (more than three) induction motors have become in style and are being studied from a few years due to its many benefits over standard three-phase induction motors or induction motors having lesser phases. the benefits square measure higher fault tolerance[1][2][3][4], higher potency, lower current ripple, less force pulsation, reliability[5] and facility to separate certain quantity of power in to multiple phases to cut back the ability per-phase. This power ripping allows to use devices of less rating just in case of high power applications[6]. Multi-phase motors square measure employed in case of ship propulsion, traction, electrical vehicles etc. wherever high power and dependableness is needed. Simulation of symmetrical induction machinery was worn out [7]. point machines' use in electrical vehicles was studied in [8]. R. Gregor, F. Barrero, S. Toral and M.J. Durán studied induction motor drive

test-rig to get superior performance[9]. Anushree Kadaba, Shaohua Suo, Gennadiy. Sizov, Chia-Chou Yeh, Ahmed Sayed-Ahmed, Nabeel A.O. Demerdash designed reversible three-phase to six-phase induction motor[10]. A spectral technique of speed ripple analysis for a fault-tolerant six-phase squirrel-cage induction machine was conferred in [11]. Matrix device has been wont to drive six-phase induction motor in [12]. Transient analysis of three-phase induction machine victimisation completely different reference frames has been worn out [13]. Rangarajan M. Tallam, Thomas G. Habetler and Ronald G. Harley studied transient model of induction motor with winding faults[14]. [15] presents experimental investigation of a armed service propulsion drive model with the PWM-based attenuation of the acoustic and magnetic attraction noise. G.Renukadevi, K.Rajambal developed a generalized model of point induction motor with symmetrical winding displacement[16]. Use of point machines is planned in [17]. management of 5 part induction motor victimisation house vector modulation, is mentioned in [18]. [19] This paper deals with the high performance Backstepping management strategy that relies on laws permitting a definite management of system stability in closedloop operation of five-phase induction motor drives. victimisation flux-linkage model, stability analysis of 5 part induction motor has been worn out [20]. Y. Maouche, A. Boussaid, M. Boucherma, A. Khezzar studied pulsing force and harmonic parts in rotor current of six-phase induction motor underneath healthy and faulty conditions. during this paper a dynamic model of asymmetrical six-phase, cage sort induction motor is developed to review the performance of the motor well. The model is simulated in MATLAB/Simulink surroundings. The study offers an in depth idea concerning the motor and indicates towards the graceful and promising performance of the motor.

II. BRIEF CONSTRUCTIONAL DETAILS OF INDUCTION MOTOR

A poly part induction motor consists primarily of 2 major components, the stator coil and also the rotor. the development of every one is largely a laminated core supplied with slots that house windings. once one in all the windings is exited with AC voltage, a rotating field is about up. This field produces associate degree voltage (Electromotive Force) within the different winding by electrical device action that successively circulates current within the later if it's short circuited. The currents flowing within the second winding move with the sphere made by the primary winding thereby manufacturing a force that is chargeable for the rotation of the rotor. primarily a 3 part Induction motor consists of stator coil and rotor. The Induction motor is made-up by nice individual Nikol Tesla. a group of insulated electrical windings square measure placed within the slots of the laminated magnetic path in stator coil. The cross-sectional space of those windings should be giant enough for the facility rating of the motor. For a 3-phase motor, three sets of windings square measure needed, one for every part. like the stator coil, the rotor consists of a group of slotted steel laminations ironed along within the kind of a cylindrical magnetic path and also the electric circuit. There square measure 2 styles of motor rotors: The wound rotor and coop rotor. thanks to the convenience of winding, coop induction motor is meant.

III. ACTUAL DESIGN OF PROTOTYPE SIX PHASE INDUCTION MOTOR

To begin with, associate m-phase symmetrical induction machine, such that the spatial displacement between any two consecutive stator phases equals $\alpha = 2\pi/m$, is taken into account. mechanical device winding is treated as m–phase and it's assumed that the windings square measure sinusoidally distributed, so all higher abstraction harmonics of the magneto-motive force are often neglected. The part range m are often either odd or perhaps. once the quantity of phases is six, i.e. m = 6, there square measure 2, 3 part windings. The two, 3 part windings square measure displaced by 600 in symmetrical style however there's a drag of magnetic current currents. thus asymmetrical style is enforced within which 2, 3 part

windings square measure displaced by three hundred , that eliminates (6n + 1) order harmonics, wherever n = one,3,5……. [1]. A six part machine are often simply created by cacophonic the 600 part belt into 2 parts every spanning three hundred .The winding distribution issue will increase from zero.965 for 3 part to one.0 for 6 part for split part belt association.[8] a real six part that retains constant winding pitch and distribution issue is shown within the table1 below. Table1 polyphase Winding configuration The six-phase machine uses constant magnetic frame with the baseline machine. thus ab initio the mechanical device dimensions, mechanical device size, rotor size etc. were unbroken same as three part, three HP induction motor. and therefore the same mechanical device is rewound for creating six part it's clear that the torsion of six part induction motor is additional and located to be some one.6 times quite equivalent 3 part motor. conjointly potency of six part induction motor is one.4 times quite that of equivalent 3 part induction motor.The torsion of six part induction motor is way beyond equivalent 3 part induction motor. example six part induction motor torsion is one.6 times that of equivalent 3 part motor. In [1]-[6] torsion improvement is obtained by third harmonic current injection. Third harmonic current injection desires giant inductors. the applying of polyphase induction motor is principally in high power-high current applications therefore the use of inductance for current injection is uneconomical. tho' the initial value of six part induction motor is enlarged as compared to a few part induction motor however at constant time potency and torsion square measure considerably improved. conjointly torsion improvement with third harmonic current injection is one.4 times that of equivalent 3 part induction motor [1]-[6] whereas the developed example six part induction motor torsion is one.6 times that of equivalent 3 part induction motor. because the motor rating will increase it's tedious to rearrange third harmonic current. 1. Same style are often extended in multiples of 3, e.g. for nine part there'll be 3 sets of 3 part windings with two hundred part shift. 2. the planning is applicable for even part range solely. 3. wanting to the world of application i.e. high powerhigh current application tho' the initial value is beyond that of equivalent 3 part however potency and torsion square measure abundant higher. 4. From the no load and cargo tests conducted severally on ABC's and XYZ, it's obvious that the example motor is extremely reliable: If one in all the 3 part sets isn't provided the motor can still run as 3 part and continuity of operation is maintained because the neutrals square measure separate. 5. rather than copper conductors, atomic number 13 conductors could also be accustomed cut back the price, therefore creating it additional economical.

IV. MULTILEVEL INVERTER

Multilevel power conversion was first introduced 20 years ago [1]. the overall thought involves utilizing the next variety of active semiconductor switches to perform the facility conversion in tiny voltage steps. There area unit many blessings to the present approach in comparison with ancient (two-level) power conversion. The smaller voltage steps result in the assembly of upper power quality waveforms and additionally scale back the dv /dt stresses on the load and scale back the magnetism compatibility (EMC) considerations. Another vital feature of structure converters is that the semiconductors area unit wired during a series-type association, that permits operation at higher voltages. However, the series association is often created with clamping diodes, that eliminates overvoltage considerations. what is more, since the switches don't seem to be actually series connected, their change may be staggered, that reduces the change frequency and therefore the change losses. One clear disadvantage of structure power conversion is that the larger variety of semiconductor switches needed. It ought to be discovered that lower voltage rated switches may be utilized in the structure device and thus the active semiconductor price isn't appreciably enhanced in comparison with the 2 level case. However, every active semiconductor supplemental needs associated gate drive electronic equipment and adds additional

complexness to the device mechanical layout. Another disadvantage of structure power converters is that the tiny voltage steps area unit usually created by isolated voltage sources or a bank of series capacitors. Isolated voltage sources might not continuously be without delay obtainable and series capacitors need voltage balance. To some extent, the voltage reconciliation may be self-addressed by exploitation redundant change states, that exist thanks to the high variety of semiconductor devices. However, for an entire resolution to the voltage-balancing downside, another structure device is also needed [2–4] Before continuing with the discussion of structure modulation, a general multilevel power converter structure will be introduced and notation will be defined for later use. though the first focus of this chapter is on power conversion from DC to associate AC voltages (inverter operation), the material presented herein is also applicable to rectifier operation. The term multilevel converter is used to refer to a power electronic converter that may operate in an inverter or rectifier mode. shows the overall structure of the structure device system. during this case, a three-phase motor load is shown on the AC aspect of the device. However, the device might interface to an electrical utility or drive another style of load.

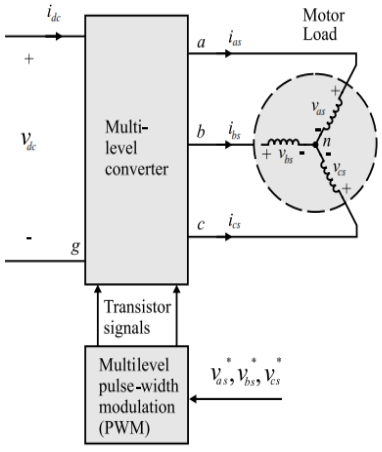

Figure 1. proposed configuration

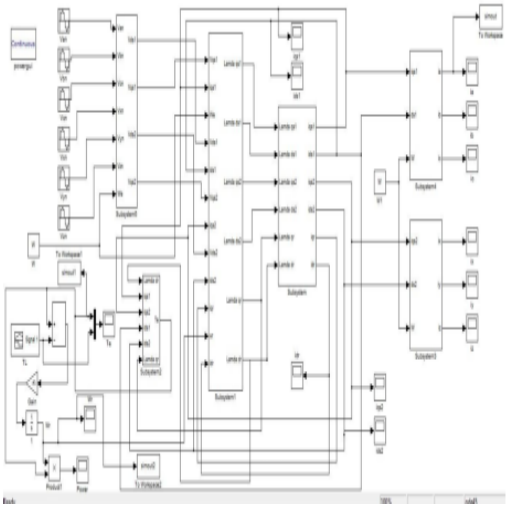

Figure 2. simulink model for proposed circuit

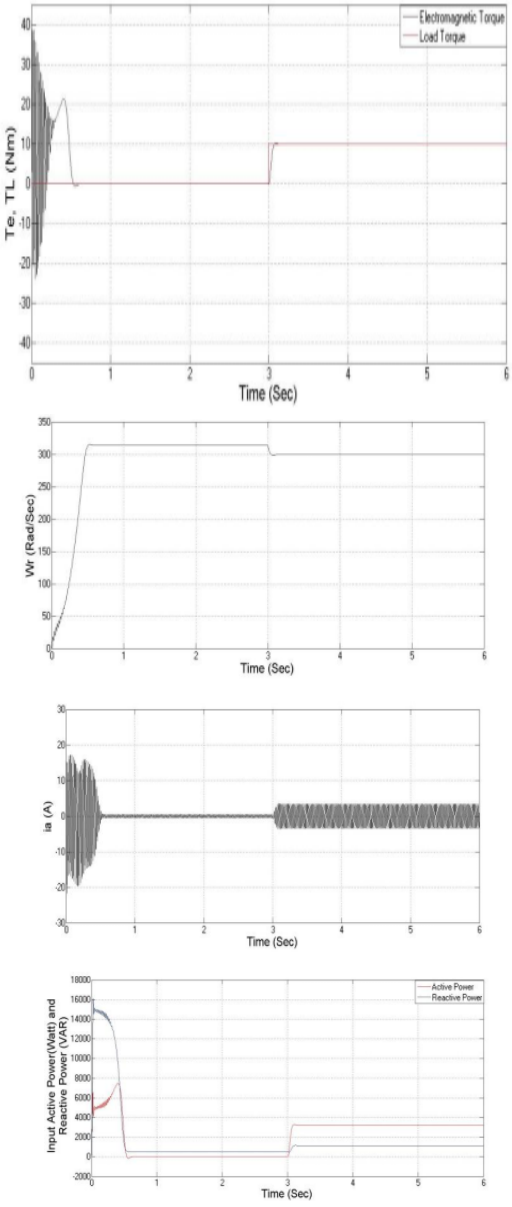

Figure 3. simulation results

V. CONCLUSION

The result indicates towards high performance, sensible potency, less current per part. torsion generation is sleek. torsion and speed ripples ar negligible at steady state. As part currents don't seem to be high and potency is sweet, it's appropriate for top power applications. With relevancy 3 part motor devices of less rating is used per part surely quantity of power The result indicates towards high performance, good efficiency, less current per part. torsion generation is sleek. torsion and speed ripples ar negligible at steady state. As part currents don't seem to be high and potency is sweet, it s appropriate for top power applications. With relevancy 3 part motor devices of less rating is used per part surely quantity of power.

VI. REFERENCES

[1]. Emil Levi, "Recent Developments in High Performance VariableSpeed Multiphase Induction Motor Drives" Sixth International Symposium Nikola Tesla, Belgrade, Serbia. 18th-20th October, 2006.

[2]. Robert H. Nelson, Thomas A. Lipo, and Paul C. Krause, "Stability Analysis of a Symmetrical Induction Machine" IEEE Transactions on Power Apparatus and Systems, Vol. 88, No. 1, November 1969.

[3]. L. Romeral, "Motion Control for Electric Drives" XVI Journal of Conference in Electronics Engineering, JCEE-2002, Terrasa, Spain, pp 26-30. November 2002.

[4]. Samir Hamdani, Omar Touhami, Rachid Ibtiouen, " A Generalized Two Axes Model of a squirrel-Cage Induction Motor for rotor Fault Diagnosis" Serbian Journal Of Electrical Engineering Vol. 5, No. 1, 155-170. May 2008.

[5]. K. Gopalkumar, Mahopatra, "A novel scheme for six phase induction motor with open end windings." 28th Annual Conference of IEEE Industrial Electronics Society, Spain. 5th - 8 th November, 2002.

[6]. Renato O. C. Lyra, Thomas A. Lipo, "Torque Density Improvement in a Six-Phase Induction Motor With Third Harmonic Current Injection" IEEE Transactions on Industry Applications, Vol. 38, no. 5, pp. 1351-1360, September-October, 2002.

[7]. G. K. Singh, S. K. Lim, "A Simple Indirect Field-oriented Control Scheme for Multiphase Induction Machine", IEEE Transactions on Industrial Electronics, Vol. 52, No. 4, August 2005.