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Improving Quality of 3 Phase Supply Generation Using MOSFET and Capacitor Combination for Driving Induction Motors

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ABSTRACT:The four switch three phase based inverter have less switching losses of the DC-AC conversion system. FSTP inverter functional operation at half the DC input voltages, so the output line voltage cannot increase beyond this value. The proposes a design for the FSTP overcome this problems and produced pure sinusoidal without need of filter in output side. The proposed topology produce output line voltage which can be extended up to full value of the DC line voltage. with proposed topology to ensure the robustness of the systemFour switch 3 phase inverters or FSTP has been used extensively for conversion of DC input to 3 Phase AC output. FSTP has various advantages over conventional methods like, speed of generation, lower harmonic distortion and generation of high quality supply for driving motors and other high power components. In this paper, we discuss about a method to improve the quality of 3 phase generation using a combination of FSTP and a capacitor circuitry. The first 2 phases are generated using the FSTP while the last phase is generated using the capacitor circuit. Using the capacitor circuit allows the system to reduce the harmonics, and get a smoother 3 phase supply at the output. We used the developed circuit to drive a 250W 3 Phase induction motor, and found that the power efficiency of the motor was improved by 10% when compared to conventional FSTP circuit.

KEYWORDS:FSTP, capacitor, harmonics, induction motor, phase generation

I.INTRODUCTION

The six-switch three-phase (SSTP) voltage source inverter shown in Figure 1 has found industrial tenders in various forms such as lift, cranes, conveyors, motor drives, renewable energy conversion systems, and active power filters. However, in some low power range applications, reduced switch count inverter topologies are considered to alleviate the volume, losses, and cost. Some research efforts have been directed to develop inverter topologies that can achieve the aforesaid goal. By the results obtained it shows that it has a possibility to implement a three-phase inverter with the usage of only four Switches. four- switch three-phase FSTP inverter, two of the output load phases are in from the two inverter legs, while the middle point of the DC-link of a split-capacitor bank is connected to the third load phase. The FSTP inverter has special features like its performance, ease of control, and applications. Compared to the out-dated SSTP inverter, the FSTP inverter has various benefits such as reduction in cost and reliability increased due to the reduction in the number of switches, conduction and switching losses is reduced by 1/3, where one complete leg is omitted, and compact number of interface circuits to supply PWM signals for the switches. The FSTP inverter can also be operated in fault tolerant control to solve the open/short circuit fault of the SSTP inverter. On the other hand, there are some drawbacks of the conventional FSTP inverter which should be taken into consideration. Similar propertites to the conventionalSSTP inverter, the FSTP inverter achieves only buck DC-AC conversion. However, this adds major difficulty and hardware to the power conversion system and waste the merits of the reduced switch count. Also, the FSTP inverter nomenclature is not symmetrical; while the two inverter legs are directly connected to the two load-phases, the center tap of split DC-link capacitors is connected to the third load-phases. This forces the current of the

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third phase to flow through the DC-link capacitors, hence a fluctuation will predictably seem in the two capacitors' voltages, which correspondingly changes the output voltage. Additionally, if the DC-link split-capacitors have not equal values, there is aopportunity of over-modulation of the pulse-width modulation process in order to compensate this difficulty .The converter is a fourth-order nonlinear system that is widely used in step-down or step-up DC-DC switching circuits, photovoltaic maximum power point tracking , and power factor correction circuits due to its encouraging features as the non-inverting output voltage buck-boost capability and lower input current ripple content. Based on the above-mentioned advantages, converter has been recently researched by scholars in various topologies in many diversified studies.

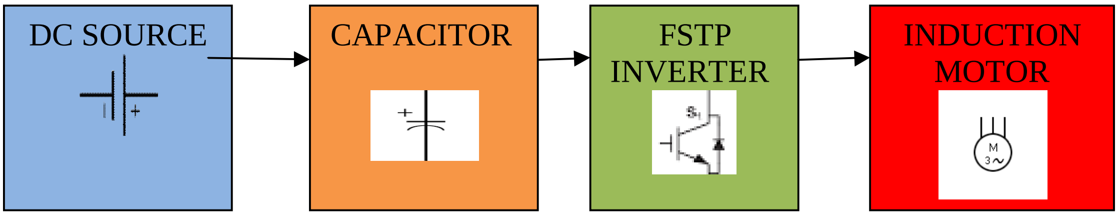

Fig. 1 Block diagram of FPTS based induction motor driving system

II. FSTP INVERTER DESIGN

.The FSTP inverter circuit diagram shown in Fig.2.inverter consist of two converter, the input DC source and the three phase output load. inverter achieves DC- AC conversion in Fig.3. In inverter, one phase is directly connected to the DC input source and the other two phases are connected to converter. Each converter in the phase is shifted 120° and the DC-bias is exactly equal to the input DC voltages. DC converter produces a unipolar voltage, the differential DC voltage across load is zero and the voltage generated across the load is bipolarThe bi-directional converter includes DC input voltage Vdc, input inductor L1 ,two complementary bi-directional switches S1,S1', coupling capacitor C1, output inductor L2, and output capacitor C2, load resistance R0.

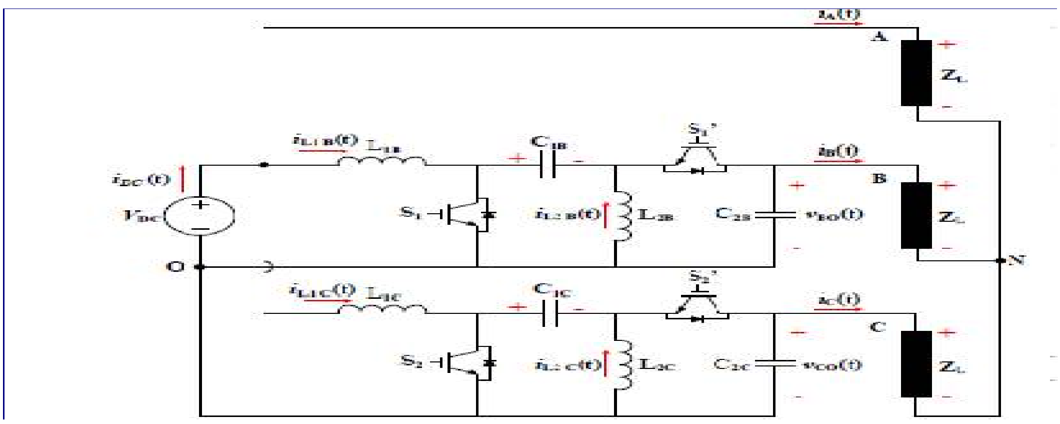

Fig. 2 Circuit diagram of FPTS based induction motor driving system

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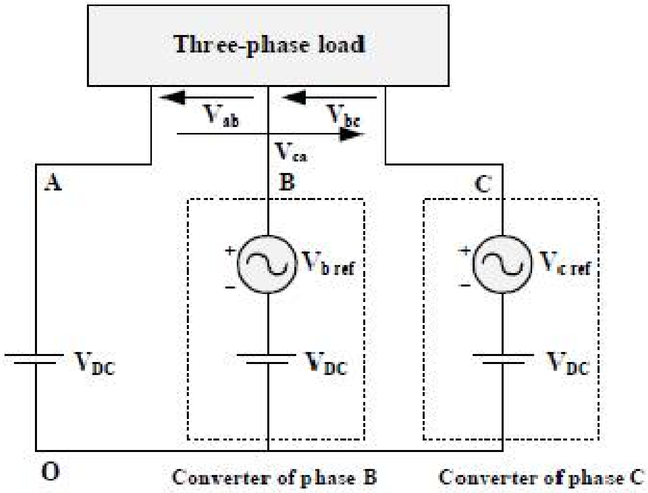

Fig. 3 . DC–AC conversion

III.PWM SIGNAL GENERATION & CALCLULATION

PWM signals are unitly generated from the micro-controller by writing computer program to regulate these four switches The section voltage is set by the duty cycle of the PWM signals. The change signal parameters particularly change frequency, the duty quantitative relation and also the range of pulses area unit simply controlled via embedded C artificial language. The temporal arrangement of PWM pulses area unit generated by the given equations a little sleep-time is given between change off the higher switch and change on the lower switch and the other way around. This ensures that each switches aren't conducting once they amendment states from on to off, or the other way around. For the induction motor drive, the 3 section voltage references in a very balanced set area unit given by the following equations.

$$V_{AB}(t) = V_{DC} - [V_{DC} - V_{mL-L}\sin(\omega t)] = V_{mL-L}\sin(\omega t$$

$$V_{BC}(t) = V_{DC} - V_{mL-L}\sin(\omega t) = V_{mL-L}\sin(\omega t - 2\pi/3)$$

$$V_{CA}(t) = V_{DC} + V_{mL-L}\sin(\omega t + 2\pi/3) - V_{DC}$$

$$= V_{mL-L}\sin(\omega t + 2\pi/3)$$

IV.RESULT AND DISCUSSION

Real time implementation model of FSTPI fed induction motor drive has been developed by victimization embedded C and MOSFET parts. The implementation work has been performed for this drive system at completely different load conditions. Total harmonic distortion (THD) has been wont to measure the performance of the FSTPI with load and while not load conditions during this simulation work. This FSTPI fed drive system consists of a three-phase diode bridge rectifier, a split electrical device, four switch 3 section electrical converter and 3- section coop Induction Motor. Input offer voltage: 3-phase, 415 V (rms), fifty Hz; three section Induction Motor: 250w 415 V, 50 Hz, 1430 rpm. The complete hardware setup of system is shown in the following figure. In conventional PWM control, the output variable is regulated by comparing a modulating function with that of a carrier signal. The comparison process effectively modulates the time duration of a pulse controlling the on/off position of a switch which in turn determines the duty ratio. In synthetic ripple modulation, the carrier signal utilized in the comparison process is derived from a system parameter unlike the traditional approach of using external oscillators.This figure consists of two blocks. shift pulses block generates the PWM pulses for 4- switches of FSTPI at the terminals Out1 to Out4 and FSTPI with IM block

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contains Diode bridge rectifier, The circuit contains 3-phase input AC power offer, diode bridge rectifier, split electrical condenser, 4-MOSFET switches and 3-phase 3hp IM. The output line voltage waveform Vab of FSTPI is shown in the following figure.

Fig. 4 .output waveform

From the speed and torque characteristics of induction motor it is observed that the speed increases linearly and reaches the rated speed (1430 rpm) at steady state in 0.75 sec. At starting the torque increases and reduces to a minimum value when the speed reaches the rated value. The Total Harmonic Distortion (THD) with load and without load conditions is found to be, THD without load 4.35% and with load 5.24%.

V.CONCLUSION

In this work we have obtained very low THD values, in future researchers can try to replace the upper or lower MOSFETs with capacitors in the middle segment and the upper or lower capacitor with MOSFET in the left segment in order to get more optimum results. The analysis of such a circuit can be done using simulink models and then implemented in real time to test the performance.

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