INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

# SPWM METHOD FOR FOUR-LEG VOLTAGE SOURCE INVERTER FED UNSYMMETRICAL TWO-PHASE INDUCTION MOTOR

**SONALI LANDGE[1], SANDEEP MAHAJAN[2]**

1. Department of Electrical Engineering, G.H Raisoni Institute of Engineering and Technology for Women, Nagpur, India.
2. Assistant Professor, Department of Electrical Engineering G.H Raisoni Institute of Engineering and Technology for Women, Nagpur, India.

**Accepted Date: 05/03/2015; Published Date: 01/05/2015**

**Abstract:** Major goal of the unbalanced PWM technique for four-leg VIS unsymmetrical induction motor modulation technique has been applied for balanced control four-leg voltages sources inverter simulation give to behavior of unbalanced PWM technique for four-leg VIS unsymmetrical induction motor continuous and discontinuous versions of PWM unipoler modulation technique open-loop V/F control the constant Volt/Hertz method with sinusoidal Pulse With Modulation (PWM) and shows the advantages and disadvantages that is possible to achieve with this new method compared with the currently used method.

**Keywords:** Unbalanced Pwm Technique, Four –Leg Vsi, Induction Motor, Volt/Hertz Method.

**Corresponding Author: MS. SONALI LANDGE**

**Access Online On:**

www.ijpret.com

**How to Cite This Article:**

Sonali Landge, IJPRET, 2015; Volume 3 (9): 10-15

***PAPER-QR CODE***

**INTRODUCTION**

Two phase induction motors are most widely used motors for any industrial control and automation. It is always need to control the output voltage of inverter for the constant voltage/frequency (V/F) control of an induction motor. PWM (Pulse Width Modulation) based firing of inverter provides the

Best constant V/F control of an induction motor. Through the various PWM techniques, the sinusoidal PWM is good enough and highly popular that provides smooth changeover of V/F, four quadrant operation, harmonic elimination, etc in both closed and open loop applications. Two-phase induction motors are reliable, robust, and highly efficient. The two phase induction motor gain cost effectiveness in both running and initial cost. The initial cost is reducing due to dispensing the need for manufacturing the designed two-phase symmetrical motor and improving the output power of the single-phase motor. With the help of reduction in motor losses the running cost can be reduce and power factor will improve and motor efficiency will increase.

Proposed SPWM method is applied to the four-leg VSI which is linked to an unsymmetrical two-phase induction motor. The presentation will reside of two single-phase inverters, at which the two windings of the machines are individually attached. In the conventional PWM technique, the unbalanced two-phase four-leg VSI established on bipolar modulation method which shows output voltage waveforms. These output voltages of two-phase PWM waveforms have phase displacement of $90^0$ linking the negative and positive dc voltages. The preferred PWM technique of unbalanced two-phase four-leg VSI is built on a unipolar modulation method. The two-phase output waveforms will have a phase difference of $90^0$, and the modulation is ground on an SPWM technique. While the four-leg two-phase VSI with those SPWM techniques provide noteworthy over other topologies in phrase of low current distortion and good dc utilization, also there is pitfall in a number of switching devices which leads to complicated structure and increasing cost. Accordingly, a developed PWM technique is still necessitating for drive suitability [1].

The recommended system provides lower total harmonics and good dc utilizations for both motor current and voltage of two-phase windings equate with other topologies. In this paper, a SPWM method is evolve for the four-leg VSI fed two-phase induction motor using the conventional open loop V/F control. It can generate unbalanced two-phase output voltage waveforms where the phase angle between the two output voltages is set to $90^0$. Therefore

recommended two-phase VSI can be petition to unbalanced loads counting unsymmetrical two-phase induction motor with auxiliary and main windings.

## I. proposed methdology

A four-leg voltage source inverter is proposed variable voltage variable frequency of the unsymmetrical two-phase induction motor drives. Most motors are designed to for sine wave AC supply and the inverter output should be as near to sinusoidal as feasible. Therefore it is best to select the control wave with sine shape to give a PWM pattern in which the pulse width is sinusoidal modulated throughout the half cycle. Pulse width modulated three-phase inverters shape and controls the three-phase output voltages in magnitude and frequency with an essentially constant input voltage. To obtain balanced three-phase output voltages in a three-phase PWM inverter, the identical triangular voltage waveform is compared with three sinusoidal control voltages that are 120° out of phase. The voltage source inverter is used with the help of PWM technique.

### *A. THREE-LEG VOLTAGE SOURCE INVERTER*

The topology of a three-leg voltage source inverter is shown in Fig.1. Because of the constraint that the input lines must never be shorted and the output current must always be continuous a voltage source inverter can assume only eight distinct topologies. Six out of these eight topologies assemble a non- zero output voltage and are known as non-zero switching states and the remaining two topologies assemble zero output voltage and are known as zero switching state.

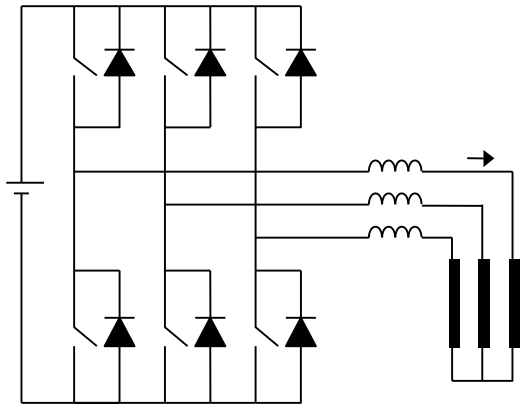

**Fig. 1. Three-leg voltage source inverter**

*B. FOUR-LEG VOLTAGE SOURCE INVERTER*

The schematic diagram of four-leg voltage source inverter is given in the figure 2. This topology is producing balanced output voltage even under unbalanced load condition. Due to additional leg, a four-leg inverter can assume sixteen topologies which is a twice a number of topologies of a conventional three-leg inverter. The topologies are alike three-leg inverter with the four-leg being attached either to the positive rail or negative rail. Each of these topologies is mention to as a switching state. Therefore four-leg can provide sixteen switching state.

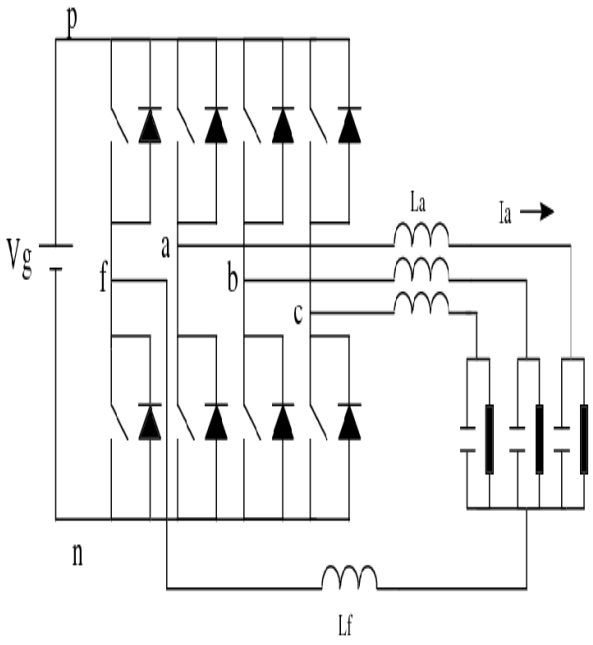


**Fig.2. Four-leg voltage source inverter**

In this paper four- leg voltage source inverter method is used because four-leg voltage source inverter method is more dominant than three-leg voltage source inverter as might e the greater utilization of DC link voltage, autonomy of the modulation factor of load current and prevention of superposition of a DC component with the AC output voltage.

Given Fig. 3 shows the block diagram of proposed system,

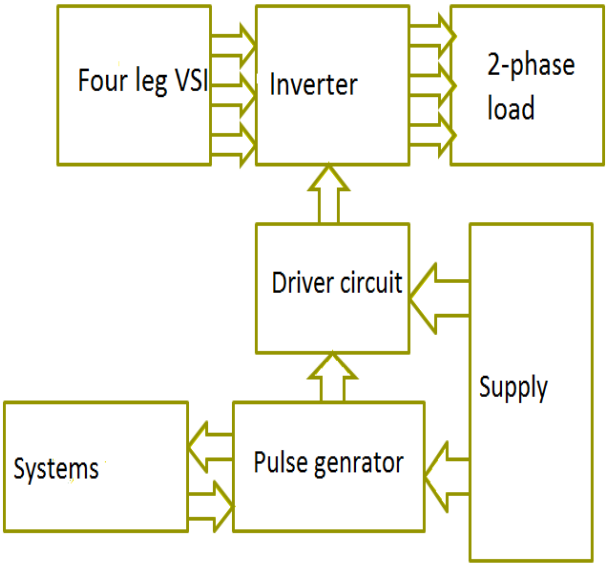


**Fig.3 Block diagram**

II. Expected outcome

From the idea of the proposed system we are clear with these outcomes. They are discussed below.

*1)* The improvement of the rotor speed is achieved by the unbalanced two-phase output voltages.

*2)* At a low-speed range, it can handle a wider applied load range.

*3)* As a result of which efficiency will increase and losses will decrease.

III. Conclusion

Preferred paper gives the SPWM method for four-leg voltage source inverter fed unsymmetrical two-phase induction motor. The proposed control scheme will allow independent magnitude controllability and quadrature phase angle for unbalanced two-phase output voltages. Thus, the modulation algorithm fabricates the four-leg VSI inequitable with unbalanced two-phase loads. Simulation and experimental results will confirm the feasibility of the control method for the inverter. The two phase voltages are obtained by tapping the output from terminal pairs. At the same load torque, the rotor speed regulation of the machine supplied with the preferred method is much better than that supplied with SVPWM technique of the three-leg VSI.

**REFFERENCES**

1. Y. Kumsuwan, S. Premrudeepreechacharn and V. Kinnares, "A carrier-based unbalanced PWM method for four-leg voltage source inverter fed unsymmetrical two-phase induction motor," IEEE Transaction on Industrial Electronics, vol.60, NO. 5, MAY 2013.

2. J. Kim and S. Sul, "A carrier-based PWM method for three-phase four-leg voltage source converters," IEEE Trans. Power Electron., vol. 19, no. 1, pp. 66–75, Jan. 2004.

3. K. Zhou and D. Wang, "Relationship between space-vector modulation and three-phase carrier-based PWM: A comprehensive analysis," IEEE Trans. Ind. Electron., vol. 49, no. 1, pp. 186–196, Feb. 2002.

4. A. M. Hava, R. J. Kerkman, and T. A. Lipo, "Carrier-based PWMVSI over modulation strategies: Analysis, comparison, and design," IEEE Trans. Power Electron., vol. 13, no. 4, pp. 674–689, Jul. 1998.

5. L. Mhango and G. Creighton, "Novel two-phase Inverter-fed induction motor drive," Proc. Inst. Elect. Eng.—Elect. Power Appl., vol. 131, no. 3, pp. 99–104, May 1984.

6. F. Blaabjerg, F. Lungeanu, K. Skaug, and M. Tonnes, "Two-phase induction motor drives," IEEE Ind. Appl. Mag., vol. 10, no. 4, pp. 24–32, Jul./Aug. 2004.

7. E. Muljadi, Y. Zhao, T. H. Liu, and T. A. Lipo, "Adjustable AC capacitor for a single-phase induction motor," IEEE Trans. Ind. Appl., vol. 29, no. 3, pp. 479–485, May/Jun. 1993.