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An Efficient Analysis of 3 Phase Converter

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ABSTRACT

Nowadays most of the appliances and gadget works on AC strength. If the AC supply is not to be had for constrained time period at that time we want to transform saved DC electricity in to AC strength. This will be achieved by using the electricity electronics system called as an Inverter. Basically inverter makes use of a electricity digital switch as a shape of an array. Exclusive sorts of inverters are to be had in marketplace for one-of-a-kind purpose. By using making use of exclusive patterns of switching of array offers an appropriate output. The simulation paintings for 3 phase Inverter with 180˚ conduction mode and a hundred and twenty˚ conduction mode for resistive load is offered. With the assist of MATLAB simulation, control method for one hundred eighty˚ conduction mode and 120˚ conduction mode is evolved. Simulated section voltage waveforms, line voltage waveforms and THD evaluation of inverter for both the conduction modes are represented. In the end, each the conduction modes are compared through diverse parameters associated with inverter.

Keywords:—3 Phase Inverter, 180°, 120°, Conduction mode, Mat lab.

I. INTRODUCTION

From the late 19th century thru the middle of the 20th century, DC-to-AC energy conversion changed into carried out using rotary converters or motor-generator units (M-G sets). In the early 20th century, vacuum tubes and gas filled tubes began to be used as switches in inverter circuits. The most extensively used form of tube became the thyratron. The origins of electromechanical inverters explain the source of the time period inverter. Early AC-to-DC converters used an induction or synchronous AC motor direct-connected to a Generator (dynamo) so that the generator's commutator reversed its connections at exactly the right moments to produce DC. A later improvement is the synchronous converter, wherein the motor and generator windings are combined into one armature, with slip jewelry at one give up and a commutator at the alternative and simplest one area body. The result with both is AC-in, DC-out. With an M-G set, the DC may be taken into consideration to be one after the other generated from the AC; with a synchronous converter, in a positive sense it can be considered to be "robotically rectified AC". Given the proper auxiliary and manage gadget, an M-G set or rotary converter can be "run backwards", changing DC to AC. hence an inverter is an inverted converter. DC-to AC converter is known as an inverter. The feature of inverter is to trade a DC input voltage to symmetric AC output voltage of preferred importance and frequency. The output voltage will be constant or variable at a hard and fast or variable frequency. A variable output

voltage can be obtained by means of various the dc input voltage and keeping the benefit of inverter consistent. However, if the DC input voltage is fixed and it isn't always controllable, a variable output voltage can be received by using various the gain of the inverter, that's generally executed by means of pulse with modulation, manage in the inverter. The inverter gain may be defined because the ratio of the AC output voltage to the DC input voltage.

II. Design and Implementation of Three Phase Converter Fed to Drive Three Phase Motor

Inverters are utilized in a wide range of packages; there are numerous type to be had via specific elements. By using conduction mode there also are 150˚, 180˚ & 120˚conduction mode used. However the 150˚ is a currently advanced studies. New change for the maximum not unusual, easy and nicely-recognized 3-phase six-switch voltage source inverter (VSI). In this alteration, every one of the six transistors conducts for 150˚ rather than the regarded 180˚ or 120˚ conduction modes. For a celeb related load, the output section voltage turns into a seven level, 12 steps waveform. This bring about a 50% reduction of the total harmonic distortion (THD), 75% reduction of voltage distortion element (DF), and the lowest harmonic order (LOH) turns into eleven in preference to 5. In IGBT based totally Inverter, we want to control the pulse of switching signal given to IGBTs Hex- Bridge Module. This job may be accomplished via PIC16F72 Microcontroller. Without difficulty advanced PWM pulses calculation of the PWM period and built in analog-to digital (A/D) converter module could have up to eight analog inputs for a tool. So, average the THD can be lower by use of this type of method and thee strength loss can be minimized. THD will directly proportional to the step of output voltages. So the wide variety of step will increase in output reasons low THD degree.

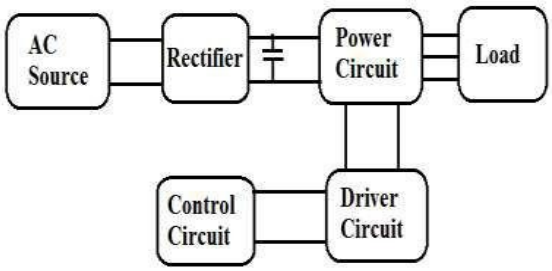

Figure 1: Block diagram of Inverter

AC Source

An ac source is ordinary supply of rectifier, which has any frequency and voltage rating which is practically constant supply of 3 phase or 1 phase. Before this block there is switch to operate supply and protection system by fuse.

2.1.1 Rectifier

A rectifier is converts alternating current (AC) to direct current (DC). A diode is like a one-way valve that allows an electrical current to flow in only one direction. This process is called rectification.

2.1.2 Power circuit

Power circuit consists of bridge of six switches. For 3 phases it has 3 legs. In each leg it has two switches. Basically the switch is IGBT or MOSFET.

2.1.3 Driver Circuit

In contrast to bipolar transistors, MOSFET's do not require consistent energy input, so long as they're no longer being switched on or off. The isolated gate electrode of the MOSFET forms a capacitor (gate capacitor), which ought to be charged or discharged on every occasion the MOSFET is switched on or off. As a transistor calls for a specific gate voltage as a way to switch on, the gate capacitor need to be charged to at the least the specified gate voltage for the transistor to be switched on. Similarly, to replace the transistor off, this

charge must be dissipated, i.e. the gate capacitor must be discharged.

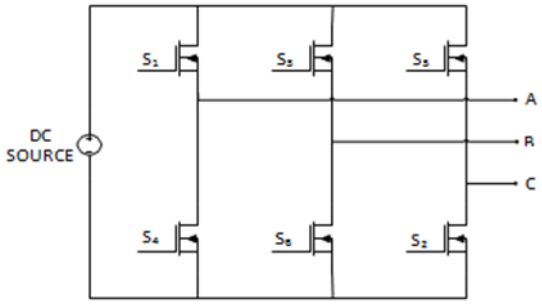

Figure 2 : Circuit Diagram of Three Phase Inverter

2.2. Operation of Three Phase Inverter

A. 180° Degree Conduction Mode

Table 1: Switching of 180 Degree Conduction mode

Mode	S_1	S_2	S_3	S_4	S_5	S_6
1st	ON	OFF	OFF	OFF	ON	ON
2nd	ON	ON	OFF	OFF	OFF	ON
3rd	ON	ON	ON	OFF	OFF	OFF
4th	OFF	ON	ON	ON	OFF	OFF
5th	OFF	OFF	ON	ON	ON	OFF
6th	OFF	OFF	OFF	ON	ON	ON

Within the 3 section inverter of every transfer conduct 180° of cycle, thyristor pair in each arm i.e. S1, S4; S3, S6 and S5, S2 are became on with a time c program language period of 180°. It means that S1 behavior for a hundred and eighty° and S4 for the following 180° of a cycle. Transfer within the top group i.e. S1, S3, S5 conduct at an interval of 120°. It implies that if S1 is fired at ωt=0°, then S3 must be fired at ωt=120° and S5 at ωt=240°. Identical is proved decrease organization of switches. On the premise of this firing scheme, a table in prepared as proven at the top. In this table, first row display that S1 from top group conducts for 180°, S4 for the following one hundred eighty° and however S1 for 180° and so on. Within the 2d row, S3 from the higher organization is shown to begin accomplishing 120° after S1 starts conducting. After S3 conduction for a hundred and eighty°, S6 conducts for the next 180° and once more S3 for the next 180° and so forth. In addition, in the 0.33 row, S5 from the top institution begin carrying out 180° after S3 or 240° after S1. After S5 conduction for 180°, S2 conducts for the 180°, S5 for the following 180° and so forth. In this manner, the pattern of firing the 6 transfer is recognized. Tis desk show that S5, S6, S1 ought to be gated for step I; S6, S1, S2 for step II ; S1, S2, S3 for step III ;S2, S3, S4 for step IV and so forth. for that reason the collection of firing the thyristor is S1, S2, S3, S4, S5, S6; S1, S2…. it is visible from the table this is every step of 60° period, best 3 switch are carrying out one from higher organization and two from the decrease group or from the upper institution and one from the decrease organization.

B. 120° Degree Conduction Mode

Table 2: Switching of 120 Degree Conduction mode

Mode	S_1	S_2	S_3	S_4	S_5	S_6
1st	ON	OFF	OFF	OFF	OFF	ON
2nd	ON	ON	OFF	OFF	OFF	OFF
3rd	OFF	ON	ON	OFF	OFF	OFF
4th	OFF	OFF	ON	ON	OFF	OFF
5th	OFF	OFF	OFF	ON	ON	OFF
6th	OFF	OFF	OFF	OFF	ON	ON

The electricity circuit diagrams of this inverter is similar to that proven. For the 120° diploma mode VSI, every thyristor conducts for 120° of a cycle. Like 180° mode, 120° mode inverter additionally requires 6 steps, every of 60° length for completing one cycle output AC voltage.

For this inverter too, a desk giving the sequence of firing the 6 thyristor is prepared as

shown inside the top. In this desk, shown that even conducts for 120° and for the subsequent 60° neither S1 nor S4 conducts. Now S4 is became on at ωt=180° is similarly conducts for 120°, i.e. from ωt=180° to at ωt=300°. This means that for 60° interval from ωt=120° to ωt=180°, to ωt=180°, collection connected switch S1, S4 do now not conduct. At ωt=300°, S4 is grew to become off, then 60° c program language period elapses before S1 is became on once more at ωt=360°. Inside the 2d row, S3 is grew to become on at ωt=120° as in 180° mode inverter. Now S3 conducts for 120°, then 60° conducts language period elapses all through which neither S3 nor S6 conducts. At ωt=three hundred°, S6 is grew to become on, it conducts for 180° and then 60° interval elapses and then S3 is grew to become on once more. The third row is also finished is similarly. This table display that S6, S1 ought to be gated for step I ; S1, S2 for step II ; S2, S3 for step III and so on. The series of firing the 6 thyristor is similar to for the a hundred and eighty mode inverter. At some stage in each step, simplest thyristors conducts for this inverter one from the higher group and one from the lower institution; but in a hundred and eighty° mode inverter, 3 thyristors conduct in each step.

2.3 Circuit Simulation & Results

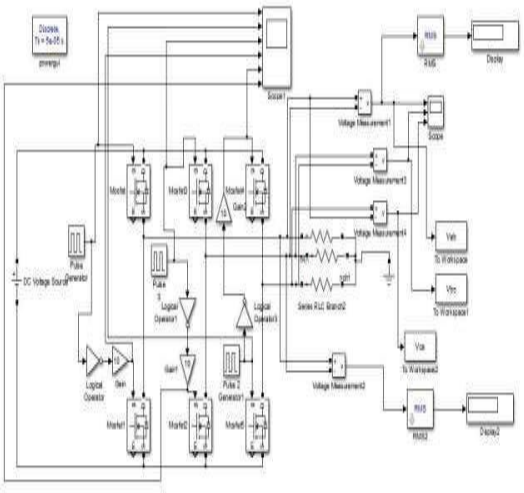

Figure 3: Simulink Model of Three Phase Inverter

A. Simulation Results for 180° Conduction Mode:

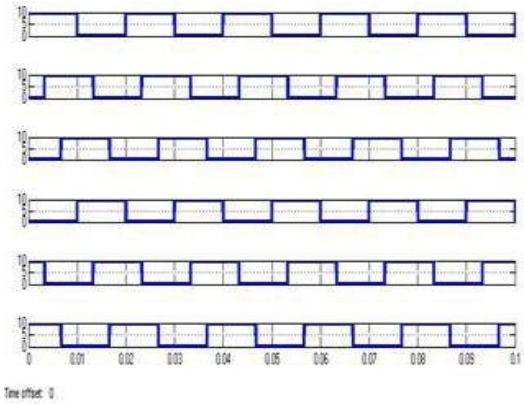

Figure 4: Gate Voltage Waveforms

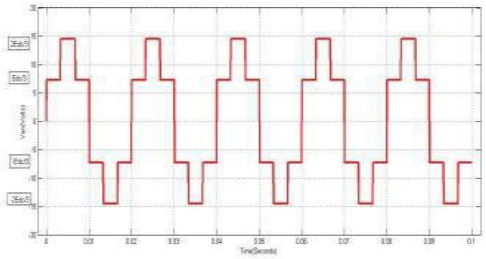

Figure 5: Voltage Waveform of Phase-A

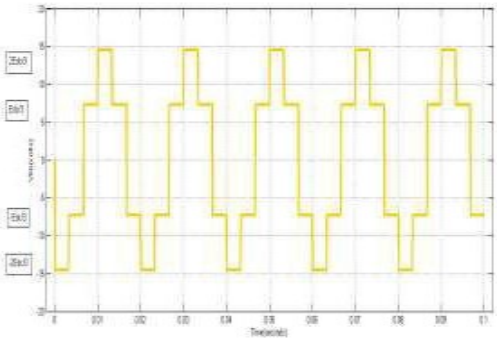

Figure 6: Voltage Waveform of Phase-B

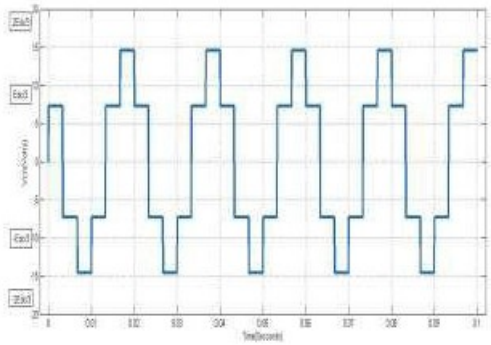

Figure 7: Voltage Waveform of Phase-C

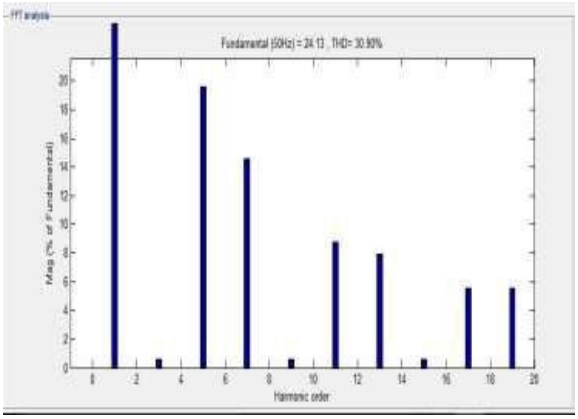

Figure 8: FFT Analysis of Line Voltage Waveform

Fast Fourier transform analysis is shown in above fig. The contribution of 5th harmonic is 19%, 7th harmonic is 15% and so on. The total harmonic distortion is 30.90%. The effect of harmonics of multiple of 3rd is minimized in line voltage waveforms

III. CONCLUSION

From the above experiments it could be concluded that for a hundred and eighty conduction mode importance of output voltages greater then 120 conduction mode. In 120 conduction mode it is require to offer a lifeless time mode between switches in one leg whilst in a hundred and twenty conduction mode there's no requirement of useless time mode is close to equal.

Table 3: Comparison of Result

Parameter	Theoretical	Practical
Phase Voltage	11.31	10.34
Line Voltage	19.59	17.8
Line/Phase Current	16	10.26
Fundamental Phase Voltage	10.82	11
Fundamental Line Voltage	18.72	14.68
T.H.D.(Phase)	30.99	30.71
T.H.D.(Line)	30.99	30.71

* * * * *

REFERENCES:

[1] Bandana Bhutia, Dr S.M. Ali and Narayan tiadi, Design of Three Phase PWM Voltage Source Inverter For Photovoltaic Application, ijireeice,Vol. 2, Issue 4,April 2014.

[2] Navdeep Singh, Comparative Study between Traditional Inverers, ijareeie, Vol. 3, Issue 6, June 2014

[3] Ananya Dutta Some Aspects on 3 Phase Bridge Inverter (180 Degree Modes, ijeijournal., Volume 3, Issue 4(November2013) PP:18-21

[4] Xiangli Li, Zhaoyang Yan, Yanni Gao, Hanhong Qi, "The Research of Three-phase Boost/Buck-boost DC-AC Inverter," Energy and Power Engineering, SciRes 2013, 5, 906-913

[5] Bhimbra P.S., "Power Electronics", Khanna Publishers, 4th edition

[6] David Tam, "New 1200 V Integrated Circuit Changes the Way 3-Phase Motor Drive Inverters are Designed", International Rectifier, E1 Segundo, California.