

Modeling Of Converter “Single Phase to Three Phase by Using Single Phase Supply”

Manikant Kumar¹, Er. Sudhanshu Tripathi²

¹(PG student, Electrical Department, SHIATS-DU, Allahabad-211007)

²(Faculty, Electrical Department, SHIATS-DU, Allahabad-211007)

Abstract: In Industrial application, two form of Electrical Energy is used. Direct current (DC) form and Alternative current (AC) form. In this paper single phase to three phase converter model is developed with the help of SIMULINK tool box of the MATLAB software. First of all single phase AC power is converted into DC power using diode rectifier bridge after this DC power is converted into three phase AC power with the help of three arms IGBT Inverter bridge. After the three phase conversion Three phase Induction Motor is run. They are ideal for future workshops, small industry, large building. Using the simulation result output of the model can be varied as per requirement of the applications.

Keywords: AC source, two arm universal bridge, Transformer, inverter, PWM generator

I. INTRODUCTION

A wide variety of commercial and industrial electrical equipment requires three-phase power. Electric utilities do not install three-phase power as a matter of course because it costs significantly more than single-phase installation. As an alternative to utility installed three-phase, rotary phase converters, static phase converters and phase converting variable frequency drive have been used for decades to generate three –phase power from a single-phase source.

1. Single- phase –In electrical engineering, single-phase electric power refers to the distribution of alternating current electric power .unison system in which all the voltages of the supply vary in unison. Single-phase distribution is used when loads are mostly lighting and heating, with few large electric motors. A single-phase supply connected to an alternating current electric motor does not produce a revolving magnetic field. Single-phase motors need additional circuits for starting, and such motors are uncommon above 10 or 20 KW in rating.

2. Three-phase- In electrical engineering, three-phase electric power system have at least three conductors carrying alternating current voltages that are offset in time by one-third of the period. A three-phase system may be arranged in delta (Δ) or star (Y). A delta system arrangement only provides one voltage magnitude, however it has a greater redundancy as it may continue to operate normally with one of the three supply windings offline, albeit at 57.7% of total capacity. Harmonic currents in the neutral may become very large if non linear loads are connected. Power electronics is a very interesting technology to produce a circuit which is very small size. In olden days people were using a very complicated circuit, which was bulky, costly and low efficient. But power electronics has made it less weight, low cost and produce high efficiency .Embedded system is used along with power electronics to reduce the component size ,easy to handle but it require a high maintenance for the circuit.

Power electronic system is virtually in every electronics device. For example AC/DC converters (rectifiers) are used every time an electronic device is connected to television and computer. Inverter is broadly classified into two types namely voltage source inverter and current source inverter. Converting a single phase to three phase power supply uses semiconductor devices such as BJT (full form).

DC/AC converter are used primarily in UPS (full form) or emergency light .During blackout time the AC will be used to produce AC electricity at its output to power up the appliances

IGT (full form) is a current controlled device which operates only at low frequencies. The main disadvantages of using BJT is that high switching losses but lower conduction loss.

II. PROPOSED MODEL

“Single phase to three phase converter using BJT bridge” is our proposed model which uses an advanced technique such as converter to generate DC current .this paper represented single phase AC supply to converted three phase .

Converting a single phase to three phase power supply consists of two main circuits. These circuits are used to convert AC to DC supply and DC to AC supply for converting a single phase of low voltage to three phase of high voltage. They are

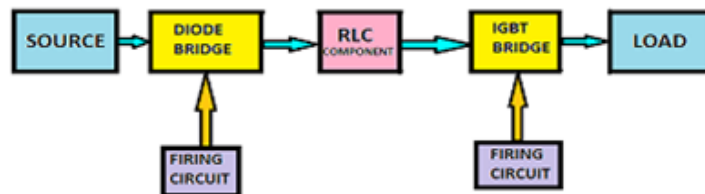
1. Power circuit
 - Rectifier circuit
 - Two arms universal bridge
 - Liner Transformer
 - 3 Φ Inverter circuit
2. Control circuit
 - Power supply circuit
 - PWM Generator

Control circuit is provided pulse three phase inverter. Power circuit is used to convert the single phase power supply to three phase power supply. It includes conversion of AC to DC supply using rectifier and DC to AC supply inverter.

III. BLOCK DIAGRAM

As we all know any invention of latest technology cannot be activated without the source of power. All the electronic or electrical components needs power supply of AC supply. So, we are converting power from single phase AC supply into three phase AC supply. Using these three phase power supply, we can drive any motor. Block diagram of converting single phase to three phase power supply units consists of.

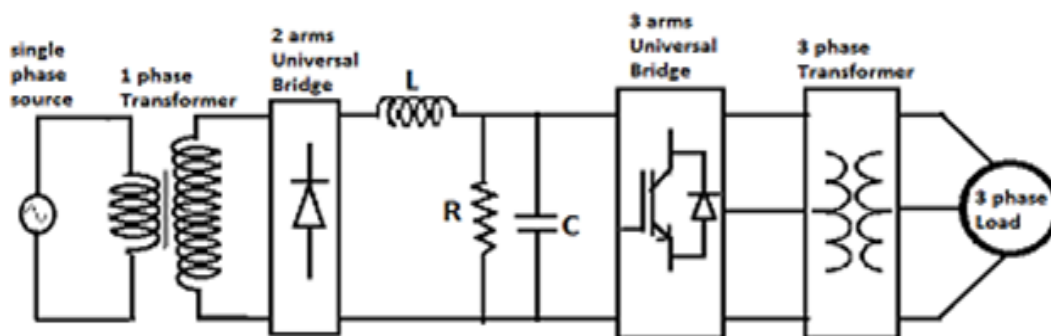
- Single phase AC supply
- Liner transformer
- Two arm universal bridge
- Rectifier
- 3 Φ inverter
- 3 Φ transformer
- Load



AC power supply of 380 volt is connected to liner transformer and liner transformer connected to two arms universal bridge converter, converter converted to DC 100 volt power supply to the rectifier .Rectifier rectifies the voltage and transferred to three arms IGBT .IGBT converts three phase power supply. It is mainly used in small industry, large building, workshop, etc.

The two arm universal bridge converter convert AC single phase power to DC power and rectifier, rectified DC power an inverter invert three phase power supply

IV. CIRCUIT EXPLANATION



Power supply units consist of

- 1 Single phase supply
- 2 Liner transformers
- 3 Bridge circuit

When AC voltage is applied to the primary of the transformer, it can be stepped up depending upon the value of AC voltage needed. In our circuit the transformer of 380 volt and supply three phase power 180 volt. Changing transformer rating and three phase power also change. A commonly used circuit for supply AC source is bridge rectifier. A bridge rectifier of four diodes is used to achieve full wave rectification. Two diode will conduct during the positive half cycle and other two will conduct during negative half cycle. The AC voltage at the output terminals of bridge rectifier is less than 90% of RMS value.

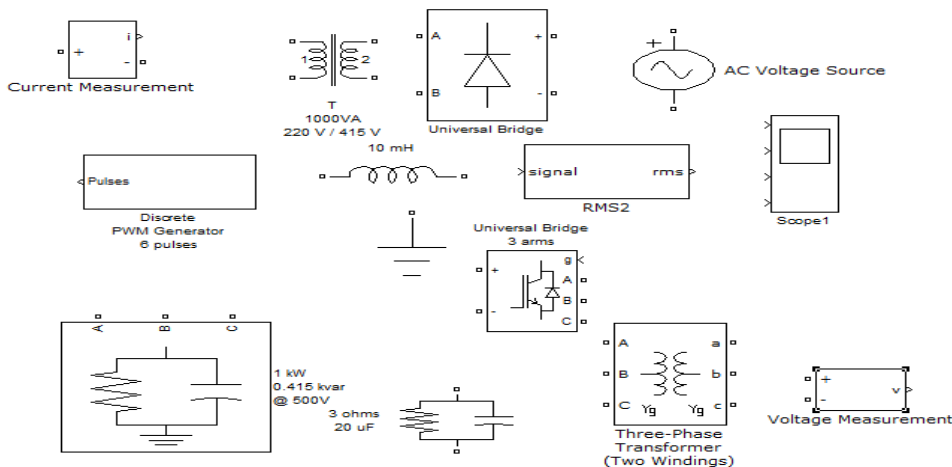
The inverter converts DC supply to AC supply. Three winding transformer is connected with inverter to step up the voltage from the output and feed it to rectifier.

Three Phase Inverter

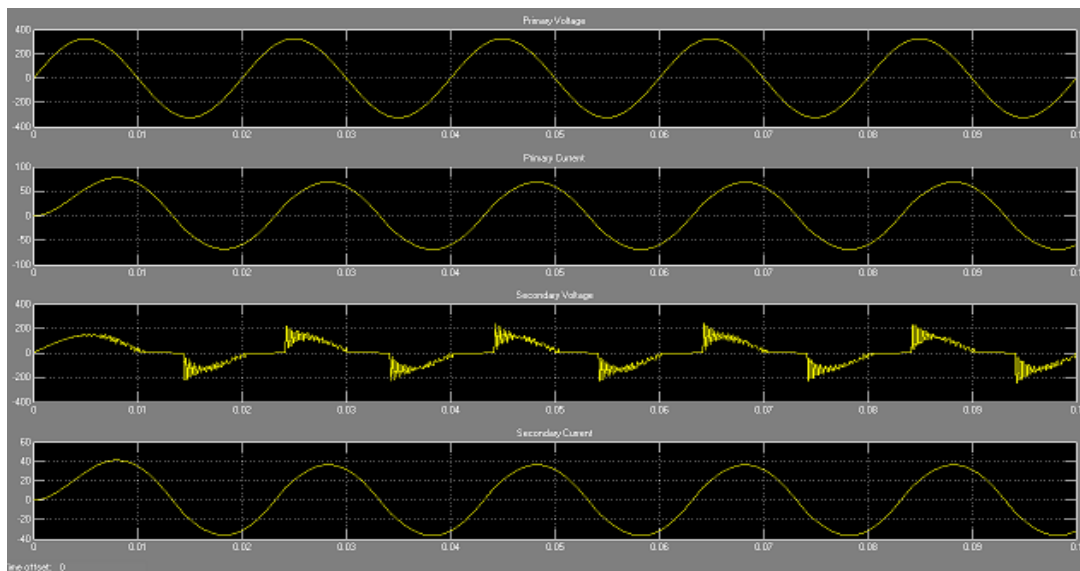
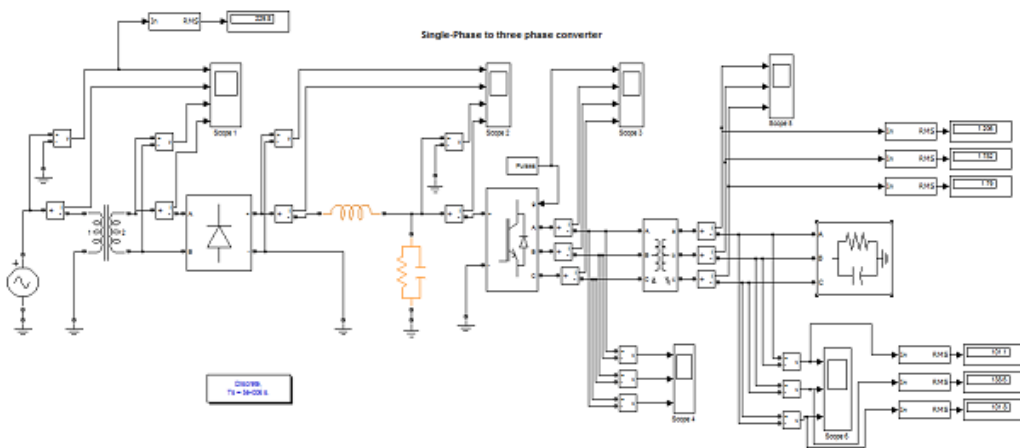
In three phase inverter there are three types they are

- 2 Level output
- 3 Level output
- 5 Level output

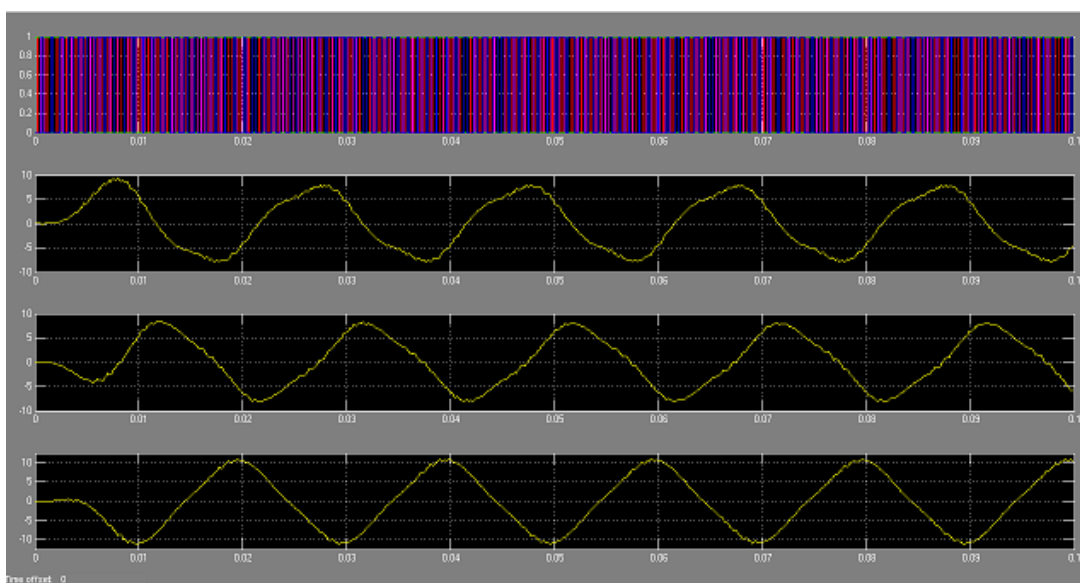
Matlab Simulink Tools



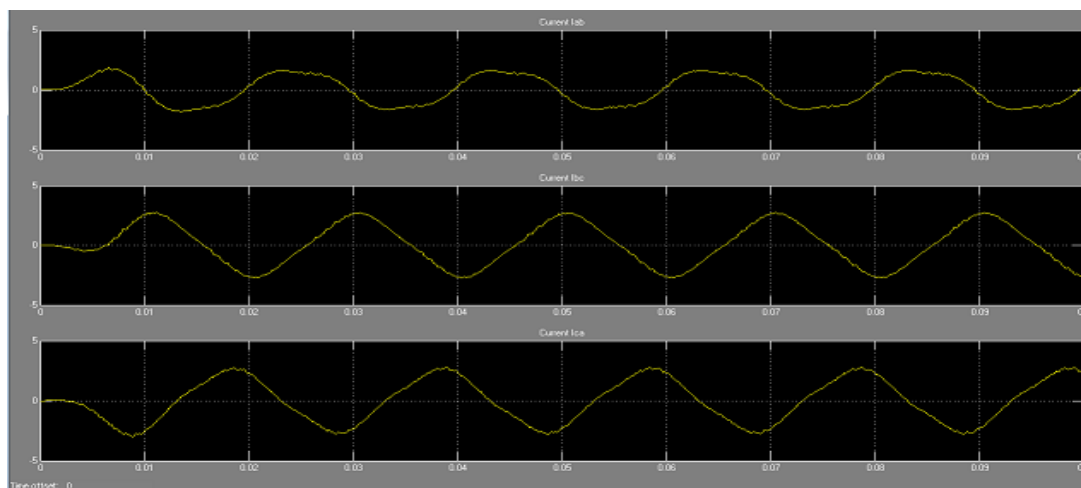
AC source	Peak amplitude(V) 325, frequency(HZ)50
Liner transformer	Nominal Powe1000 VA ,frequency 50 HZ, primary winding voltage 220,resistance(pu)0.01,inductance(pu)0.002 ,secondary winding voltage 415,resistance o.01,inductance 0.02,magnetization resistance 25(pu) and reactance 25(pu0
Two arm universal bridge	Snubber resistance 25(ohms), snubber capacitance 0.1e-6(F), power electronics diode
Three arms IGBT diode bridge	Snubber resistance 100(ohms),forward voltage device I, forward voltage diode1
Three phase transformer	Nominal power 1000 VA, Power frequency 50 HZ, primary winding voltage220, resistance0.002, inductance 0.04, secondary winding voltage 770,resistance 0.002,and inductance 0.04



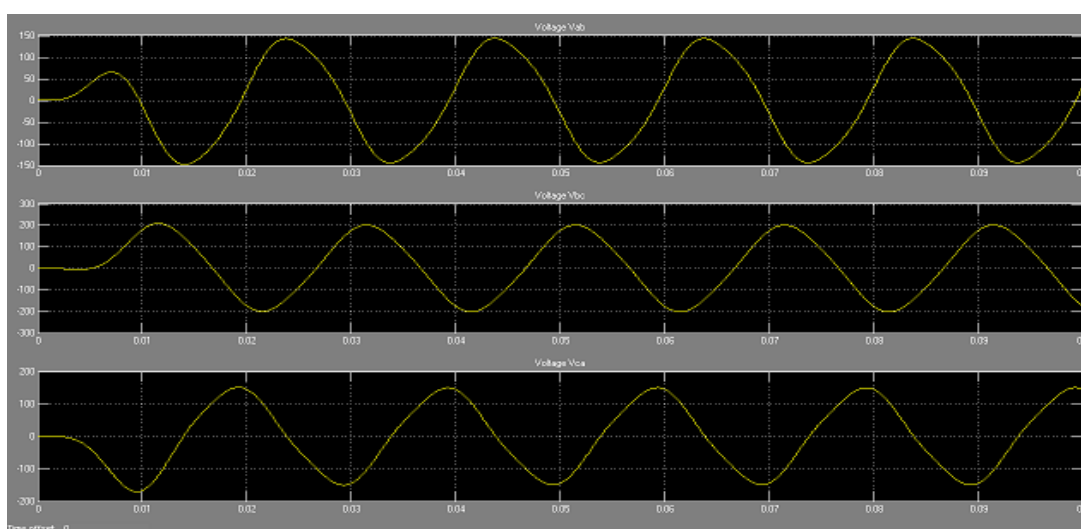
Transformer primary and secondary voltage and current



Pulses and inverter current



Phase currents I_{ab} , I_{bc} , I_{ca}



Phase voltage V_{ab} , V_{bc} , V_{ca}

V. CONCLUSION

The propose model of single phase to three phase converter is mainly used in starting three phase induction motor, small industry, large building , workshop areas. The main advantage of our model is input AC single phase source but output is three phase supply. The output of the proposed model is increased by increasing the transformer rating and other components involved in converting single phase to three phase converter using inverting cost is also increased according to the required output. Simulation result is shown using MATLAB software is used to verify operation principle.

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Manikant Kumar is a research scholar pursuing M.Tech in Power Electronics from Sam Higginbottom Institute of Agriculture Technology & Science Allahabad ,(U.P) India. He Secured Degree of B.Tech in Electrical Engineering from V.B.S.P.U Jaunpur (U.P) India 2012



Sudhanshu Tripathi presently working as Assistant Professor in Electrical & Electronics Engineering at Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad, (U.P) India. The degree of B.Tech secured in Electrical & Electronics Engineering from U.P TECH University 2004 and M.Tech. in Digital Communication I from National Institute of Technology, Bhopal in 2007.