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SPWM Based THD Controlling of Induction Motor Drive

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Abstract — ***This work is carried out with the analysis of different single phase rectifiers. We have mention the different between diode rectifier, thyristor rectifier and PWM rectifier. [1] We are using PWM rectifier in these thesis work. The research work is carried with the single phase and three phase PWM rectifier. [3] Here we have shown the uncontrolled and controlled circuit of single phase rectifier. In an uncontrolled rectifier (take switch as diode) is working as unidirectional means power is not gone back from load to source. And also shown controlled rectifier (taking switch as IGBT) is working as bidirectional. The SPWM technique is used for providing triggering pulse to the PWM rectifier as well as inverter. [2]***

Keywords- SPWM, IGBT, PWM, THD, FFT

I. INTRODUCTION

Nowadays Energy conservation is the biggest issue through the world. There are lots of debates taking place as to how to save energy. One of the best solutions to ever increasing energy crisis is to improve energy utilization efficiency. In a power conversion process the main task is to minimize energy losses and maximize the conversion efficiency. The requirement of regulated dc power supply in power electronic technology is because of market's huge demand. Fast development and demand of computers, communication equipments and consumer appliances require better regulated dc supply with quality and uninterruptable power supply. To overcome the power demand different types of rectifier topologies with different control strategies have been introduced. There are many harmonic reduction methods exist, they are as shown in figure.1

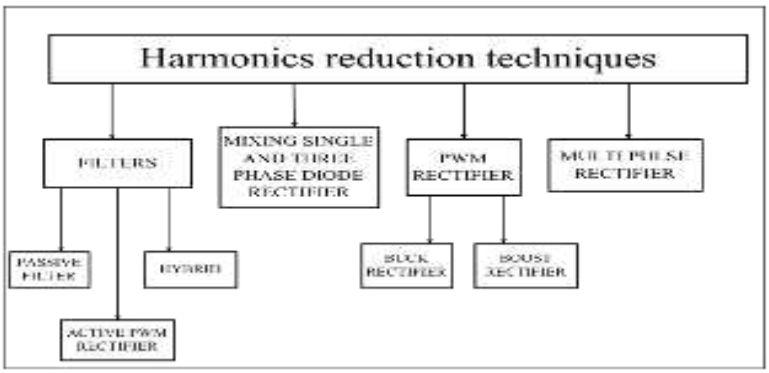

Fig 1:-Different harmonics reduction technique. [7]

The main objectives of the work carried out are:
1. To study and analysis of single phase rectifier.
2. How balancing capacitor is boosting up voltage from single phase to three phase AC/DC/AC conversion
3. To utilize PWM rectifier for reducing the THD.

II. BLOCK DIAGRAM

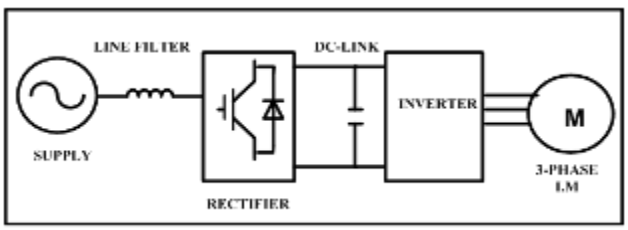

Fig 2:- Basic block diagram of single phase PWM rectifier [2]

Figure.2 is the block diagram of our system. Here first unit from single phase ac supply is line filter, where we can reduce harmonics coming from our ac source. The second unit is rectifier unit, where we are converting ac supply into dc supply.

Here third unit is dc link capacitor coming in our circuit which will filter harmonics coming from rectifier unit and fed regulated dc supply converted by rectifier unit to inverter unit. This unit will convert further dc supply into ac supply which is demand of our load. We have used induction motor as a load.

III. SIMULATION ANALYSIS AND RESULTS

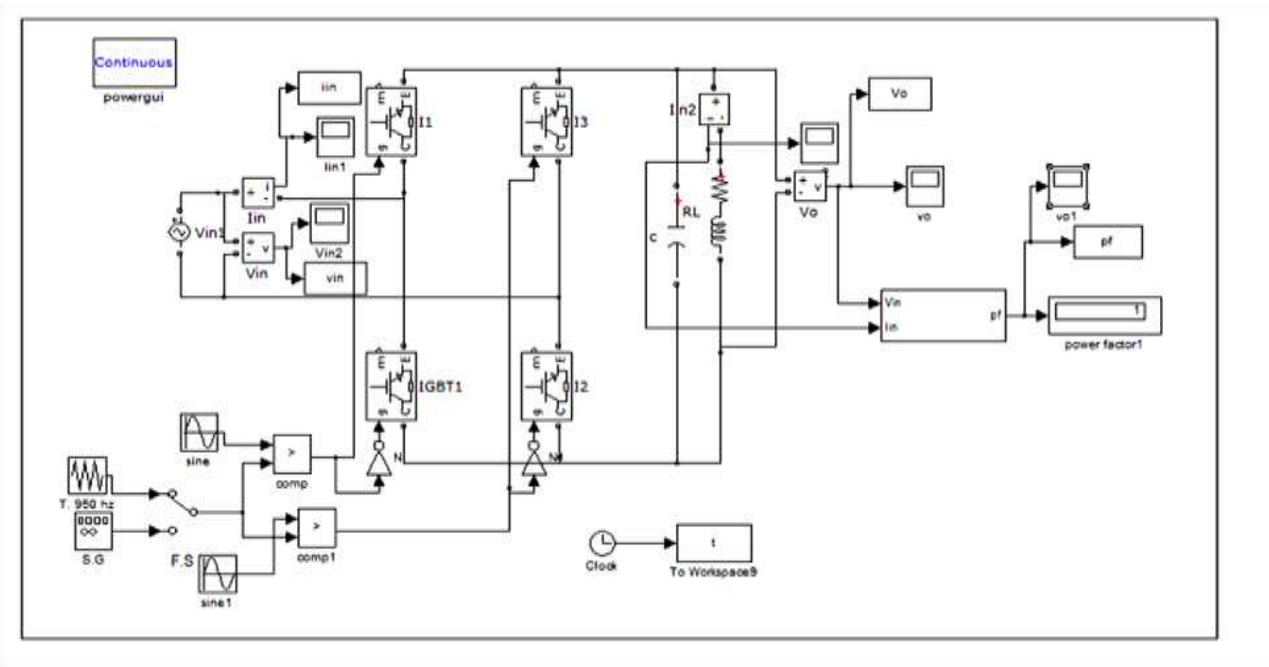

Fig 3:- Single phase PWM rectifier

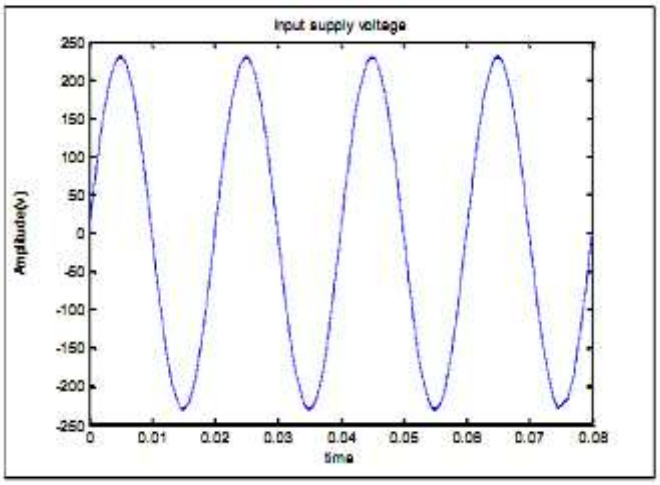

Fig 4:-Input Supply Voltage

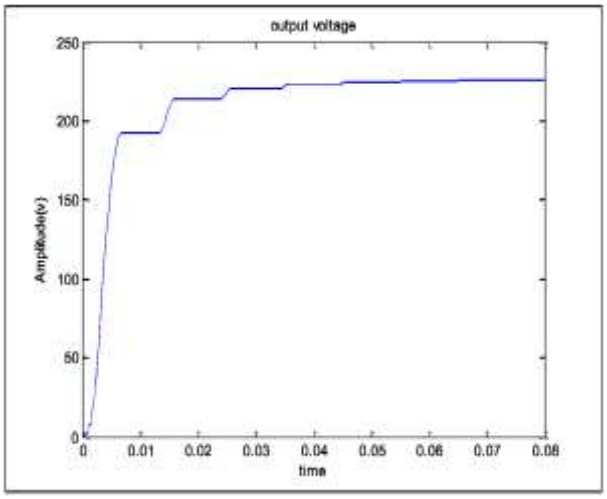

Fig 5:-Output Voltage

Here we have simulated single phase PWM rectifier. Where we have given 230 V ac supply and SPWM technique is used. We are comparing sine wave with triangular wave and generated signal is given to IGBT's Gate. Here four IGBT switch is making rectifier circuit, which convert ac supply into dc supply (shown in figure.3, 4, 5 simulation result).
Here we are giving 230 V ac which is converted into 230 V dc supply**.**

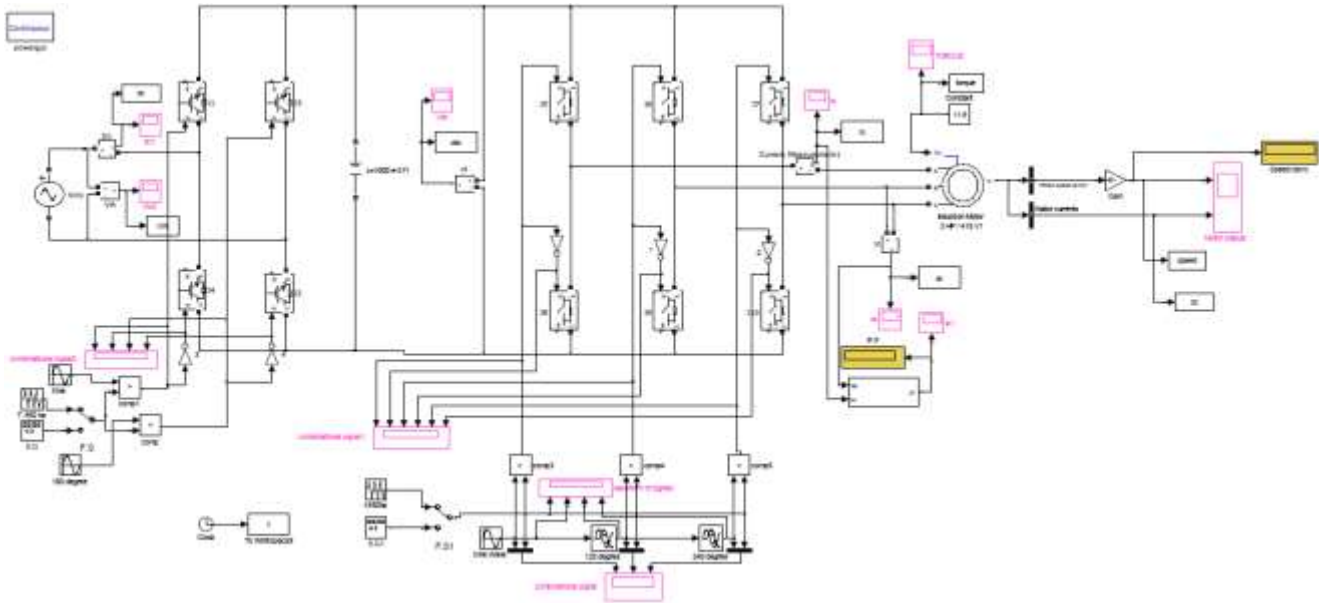

Fig 6:- Conventional Single Phase AC-DC-AC conversion

The simulation of conventional single phase rectifier is done in traditional method which utilize single phase uncontrolled rectifier at the source side of the power circuit. Power factor measurement block is used in line side. Capacitor is connected in parallel for removing fluctuation from the dc bus voltage. Diodes are used for the rectifier and IGBT for the inverter. PWM generator is used for triggering the IGBT as shown in fig (5.2). Nominal fixed load torque of 11.9 N-m is given to the motor. This will give speed in angular terms hence to get the rpm a gain speed converter is used uses the below expression for converting speed.

So here we have given 230 V ac to rectifier unit which convert it into 230 V D.C. This 230 V dc is output of our rectifier unit as well as input of our inverter unit, which further convert this 230V D.C. into 230 V ac which is requirement of our induction motor. Here we have done this AC-DC and DC-AC conversion to minimize harmonics current flowing through induction motor which we can see from result. Here input side THD current is 61.79% and output side it is only 3.03 % which is as per IEEE standard.(AS IEEE standard THD should be less than 5%)

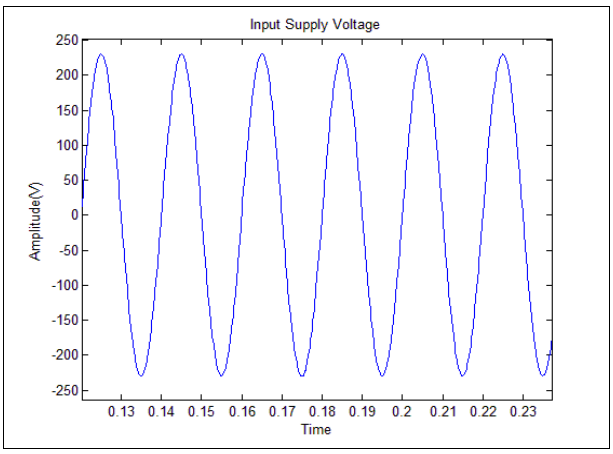

Fig 7:- Supply Voltage

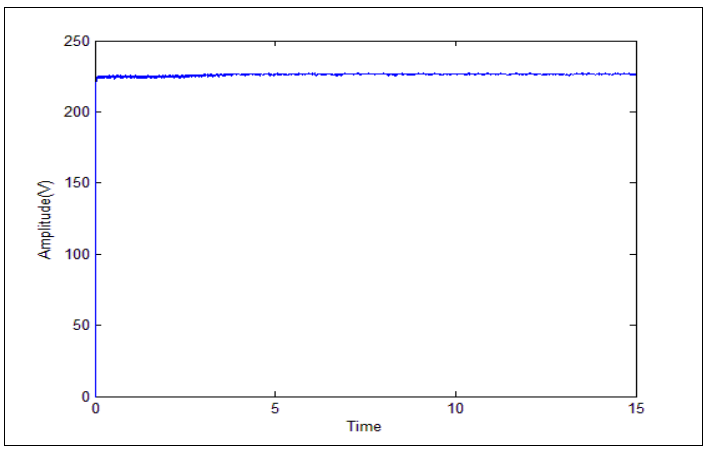

Fig 8:- Output Voltage of Rectifier Unit

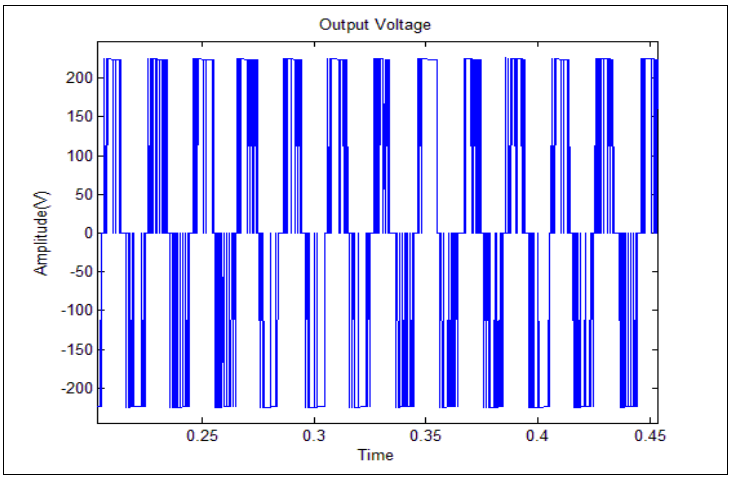

Fig 9:-Output Voltage of Inverter Unit

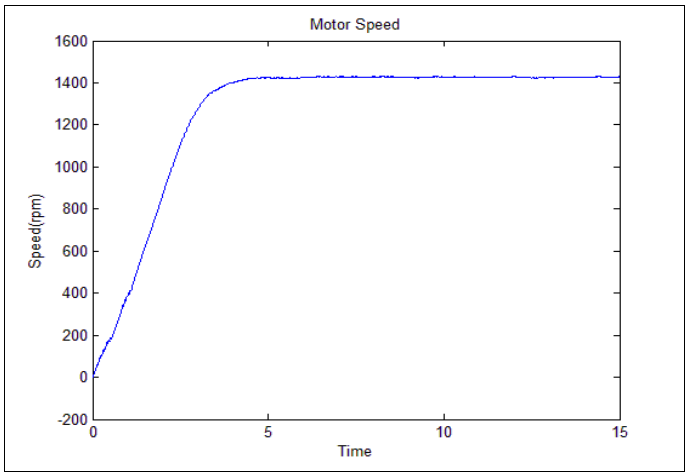

Fig 10:-Speed of Induction Motor

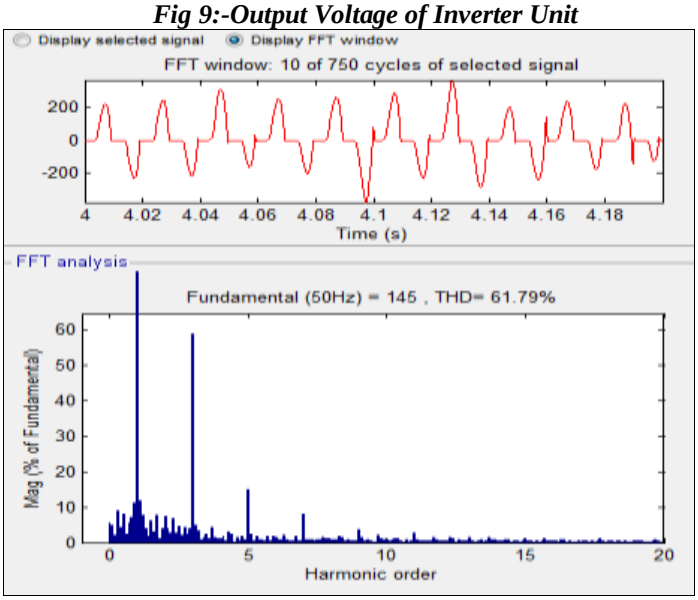

Fig 11:-THD I $_{input}$=61.79%

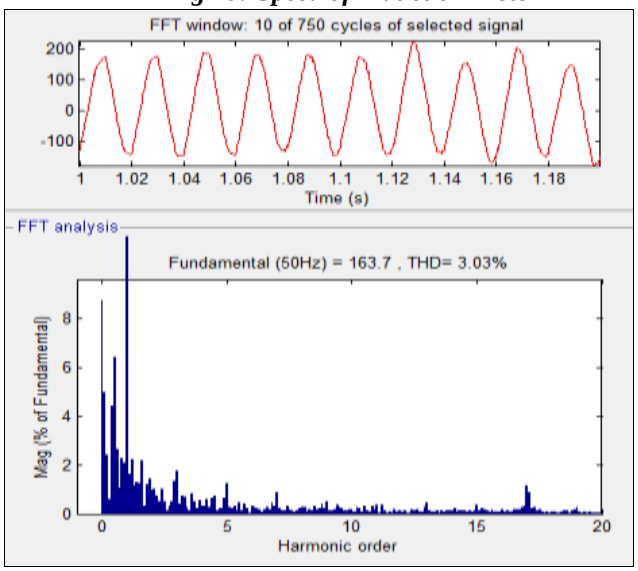

Fig 12:-THD I $_{output}$=3.03%

IV CONCLUSION

Generally there are different control strategies to operate motor as load. With the help of power electronics we can convert the AC/DC, DC/AC power at controllable mode. And for this controlling we uses different power electronics devices such as rectifier and inverter or as we say such as converter. Now a days we are going to use a controllable switch in converter. This is actively participating in the switching time. On the other hand AC/DC converter is controllable device in line side converter for controlling the regular dc input in dc link. The AC/DC Converter is used here for solves the problem of poor power factor and it also helps to achieve the better THD profile especially in controllable switching modes.

REFERENCES

[1] J. Bauer "*SINGLE PHASE PULSE WIDTH MODULATED RECTIFIER*" Acta Polytechnica Vol. 48 No. 3/2008.

[2] K. Thiyagarajah, V. T. Ranganathan, Member, IEEE, and B. S. Ramakrishna Iyengar "*A High Switching Frequency IGBT PWM Rectified Inverter System For AC Motor Drives Operating From Single Phase Supply*" IEEE TRANSACTIONS ON POWER ELECTRONICS. VOL.6, NO.4. OCTOBER 1991

[3] OMAR STIHI & BOON TECK OOI "*A Single phase controlled current PWM rectifier*" IEEE TRANSACTION ON POWER ELECTRONICS, VOL. 3, NO. 4, OCTOBER 1988.

[4] Lubomir Grman, Martin Hrasko, Jozef Kuchta & Jozef Buday. "*SINGLE PHASE PWM RECTIFIER IN TRACTION APPLICATION*" Journal of ELECTRICAL ENGINEERING, VOL.62, NO.4, 2011, 206-212

[5] S. Arivarasan "Analysis and Design of Controller For PWM Rectifiers" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol.3, Issue 2, April 2014.

[6] Jose R. Rodriguez, Juan W. Dixon, Jose R. Espinoza, Jorge Pontt,& Pablo Lezana "PWM regenerative rectifiers state of the art" IEEE Transactions on Industrial Electronics, vol 52, No. 1, Feb 2005

[7] Mahasweta Bhattacharya "*Improvement of Power Quality Using PWM Rectifier*" International Journal of Scientific and Research Publications, Volume 4, Issue 7, July 2014 ISSN 2250-3153.