

SIMULATION AND ANALYSIS OF AC-DC-AC CONVERSION USING SPWM TECHNIQUE

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ABSTRACT: - The research work is carried with the analysis of different single phase rectifiers. And also mention the different between diode rectifier, Thyristor rectifier, and PWM rectifier. We are using PWM rectifier in these thesis work. The research work is carried with the single phase and three phase PWM rectifier. Here we have shown the uncontrolled and controlled circuit of single phase rectifier. In an uncontrolled rectifier (taking 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 and inverter.

I. INTRODUCTION

Nowadays Energy conservation is biggest issues 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 meet 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.

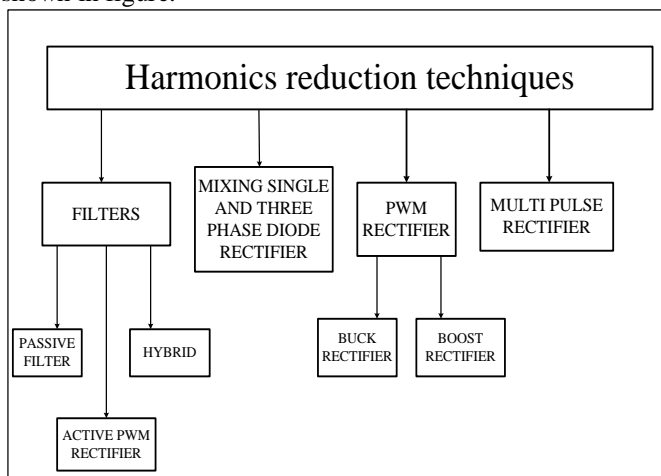


Fig:-Different harmonics reduction technique.

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 and increase the power factor

BLOCK DIAGRAM:-

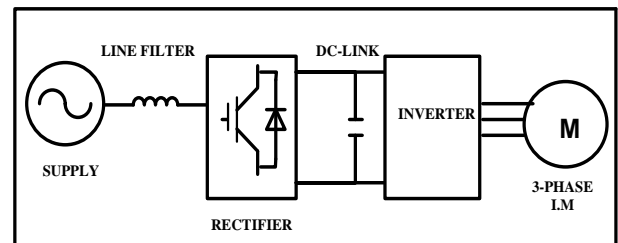
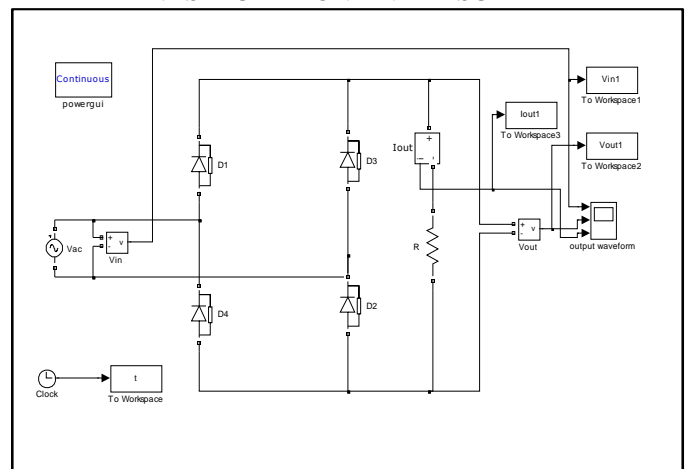


Fig:- Basic block diagram of single phase PWM rectifier
 This is the block diagram of our system. Here first unit from single phase ac supply is line filter, where we can reduce harmonics coming from our ac source. The second unit is rectifier unit, where we are converting ac supply into dc supply. Here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

II. SIMULATION AND RESULT



Simulation of single phase uncontrolled rectifier

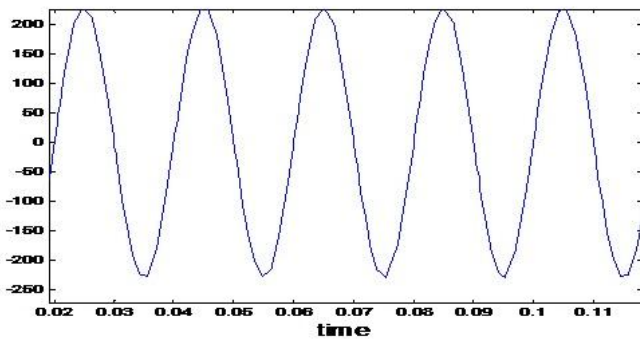
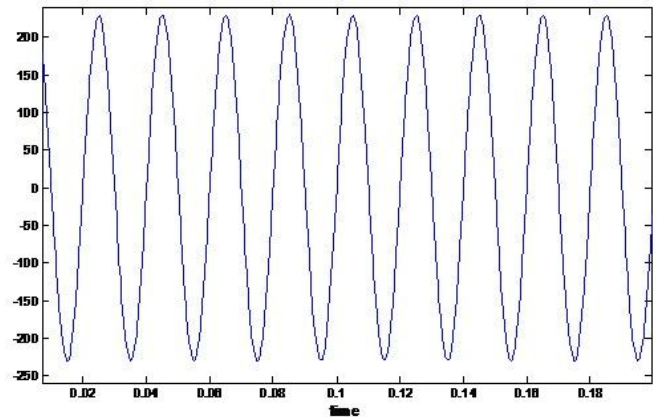
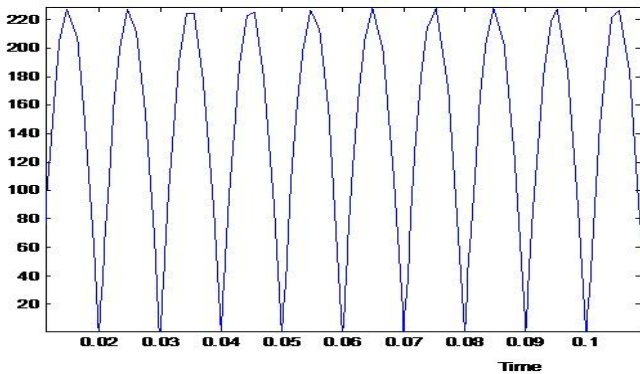


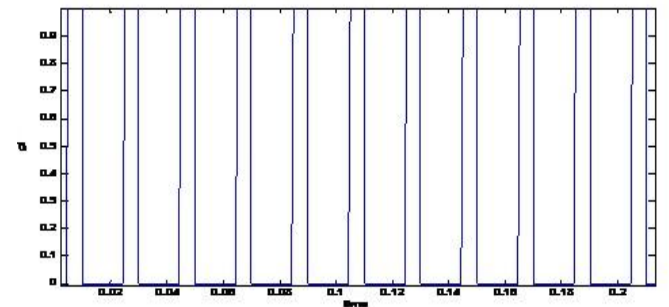
Fig Result of input supply voltage



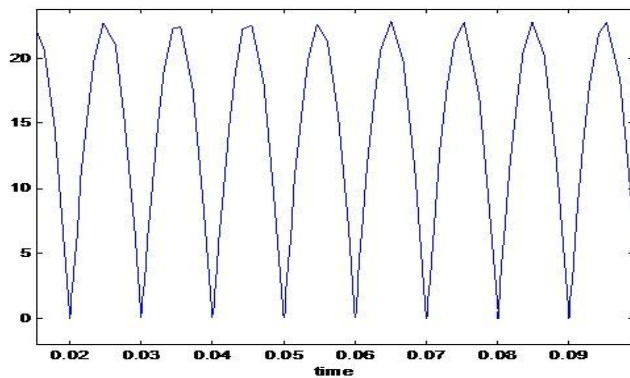
Result of Input Supply voltage



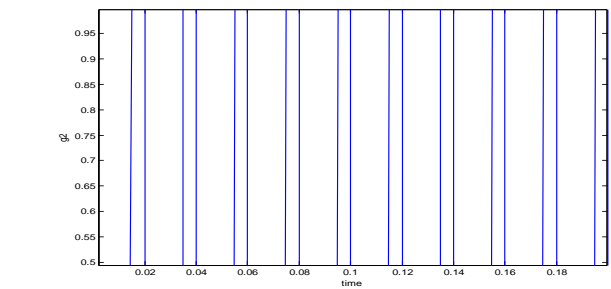
Result of output voltage



Result of Gating plus g1



Result of Output Current



Result of Gating plus g2

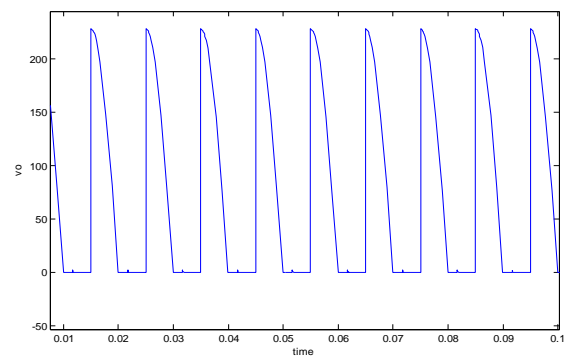
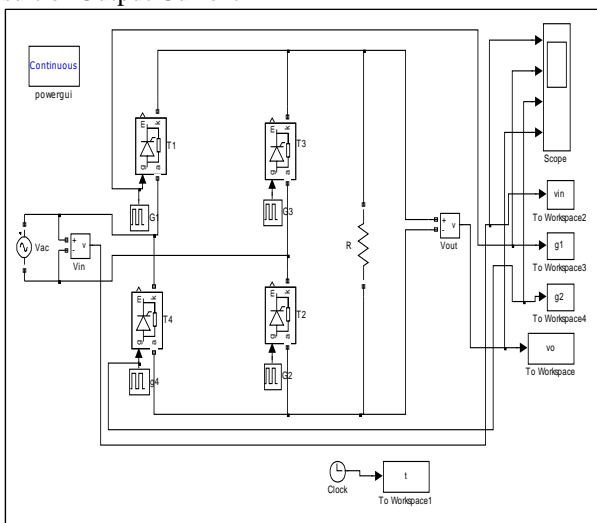


Fig Result of Output Voltage



Simulation of Single Phase Controlled Rectifier

We have shown the simulation circuit of single phase PWM rectifier in AC drive for locomotive application. These circuits are divided into main four parts rectifier, dc link capacitor, inverter and induction motor. The result cant made up of this circuit which we required.

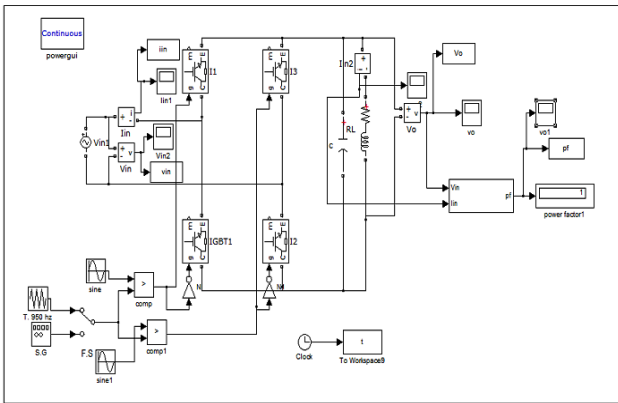


Fig: Single phase PWM rectifier

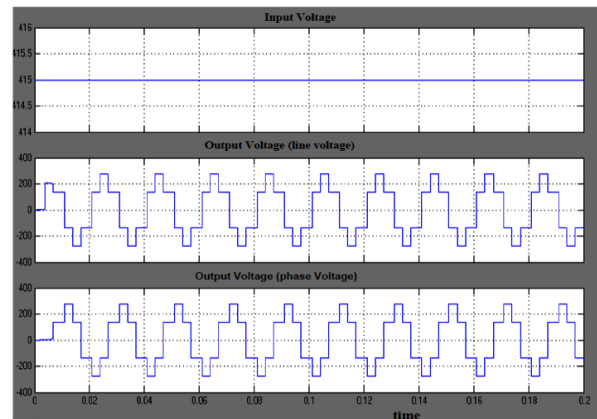


Fig :-Waveform of three phase inverter

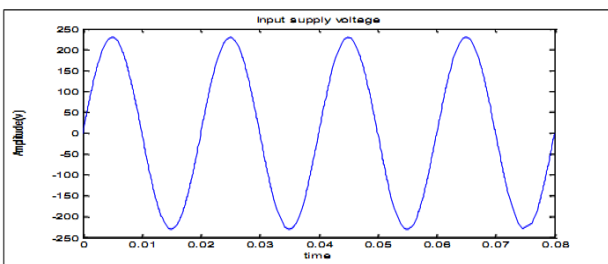


Fig: Input Supply Voltage

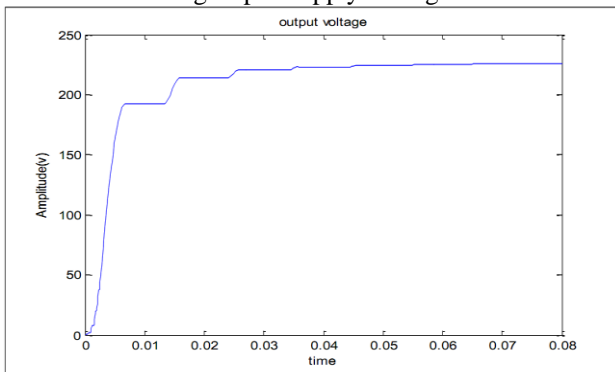


Fig: Output Supply Voltage

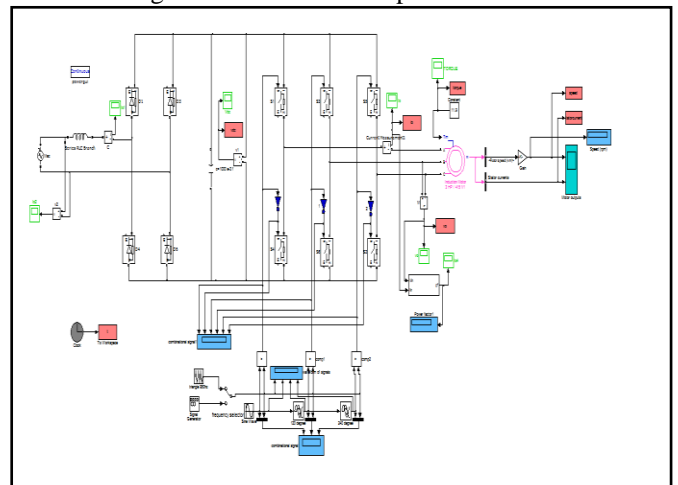


Fig: Conventional Single Phase Rectifier used in AC Drive
 The simulation of conventional single phase rectifier is done in traditional method which utilize single phase uncontrolled rectifier at the source side of the power circuit. Power factor measurement block is used in line side. Capacitor is connected 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.

$$rpm = \frac{\omega m * 60}{2 * \pi}$$

Results

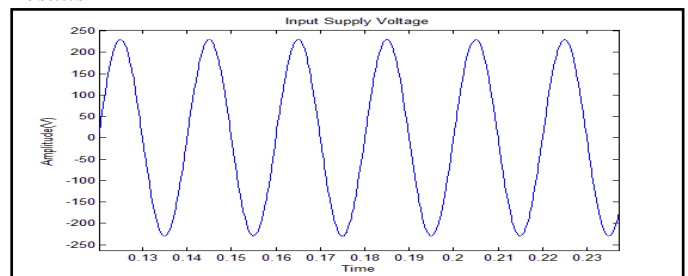


Fig:- Supply Voltage- Conventional Single Phase Rectifier in AC Drive System.

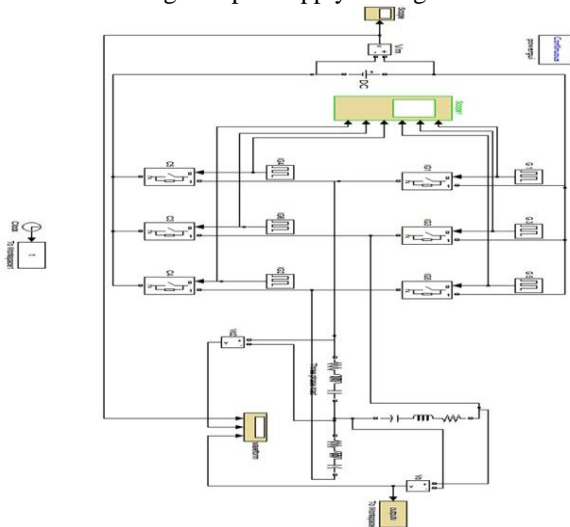


Fig :- Simulation of Three phase inverter

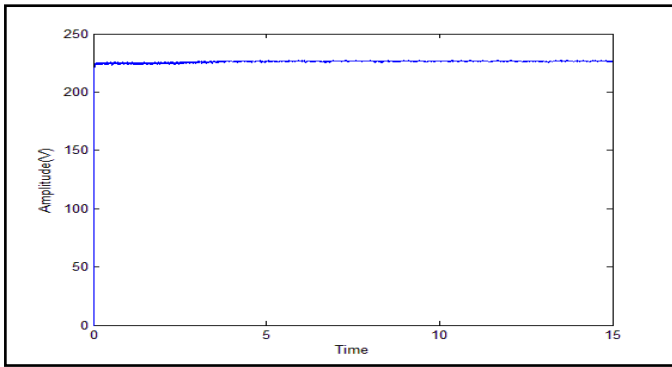


Fig - Dc Link Voltage- Conventional Single Phase Rectifier in AC Drive System.

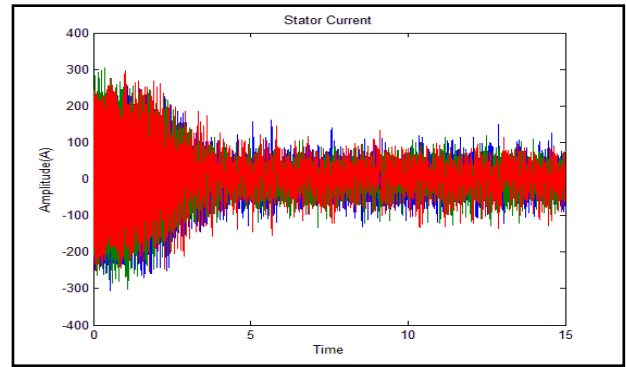


Fig :-Stator Current- Conventional Single Phase Rectifier in AC Drive System.

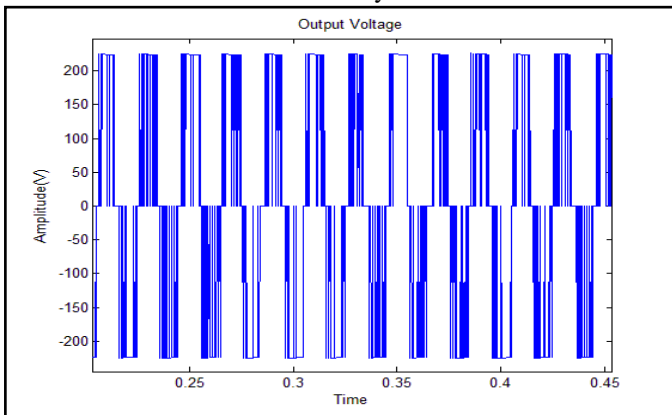


Fig :-Output Voltage- Conventional Single Phase Rectifier in AC Drive System.

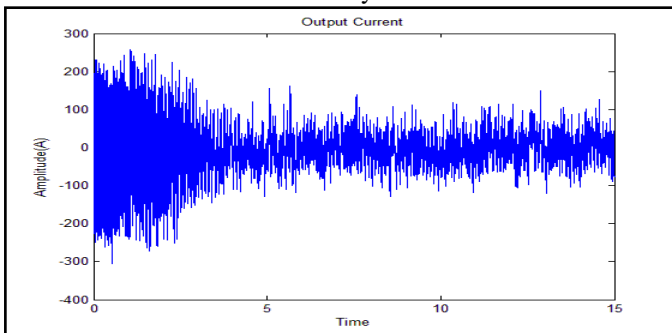


Fig :-Output Current- Conventional Single Phase Rectifier in AC Drive System.

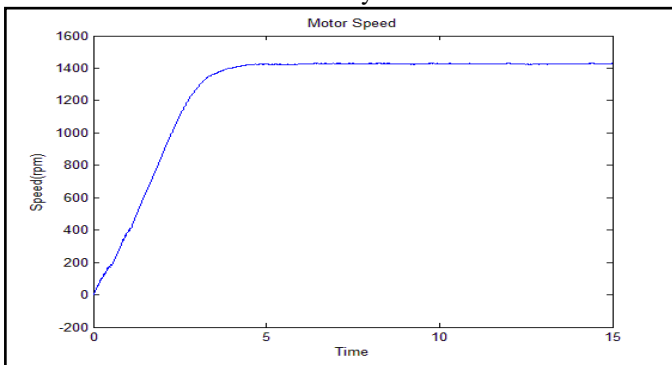
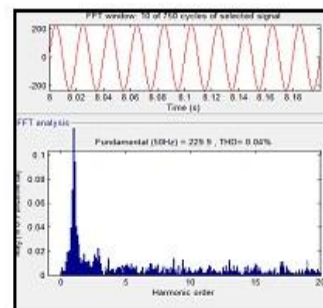


Fig :- Motor Speed- Conventional Single Phase Rectifier in AC Drive System.

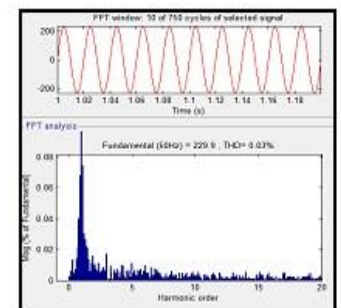
THD Analysis.

When Ma: 1

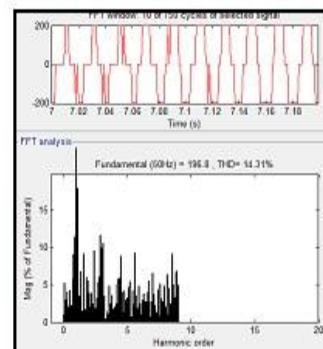


THD V input = 0.04 %

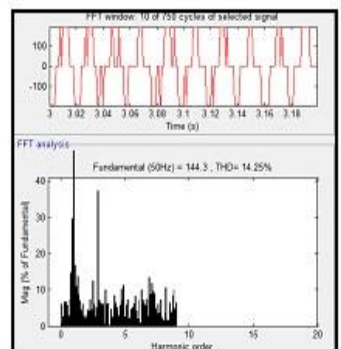
When Ma: 0.8



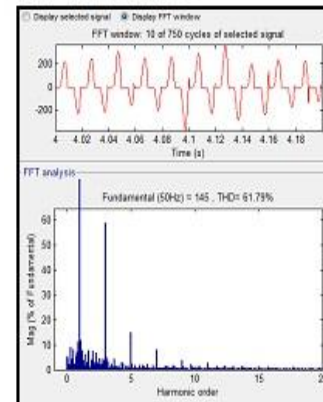
THD V input = 0.03 %



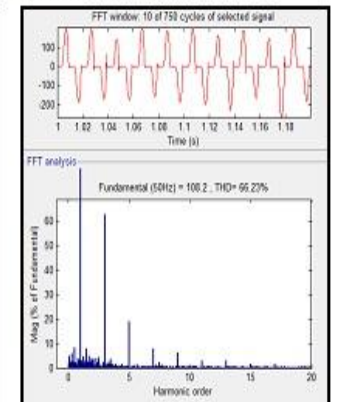
THD V output = 14.31 %



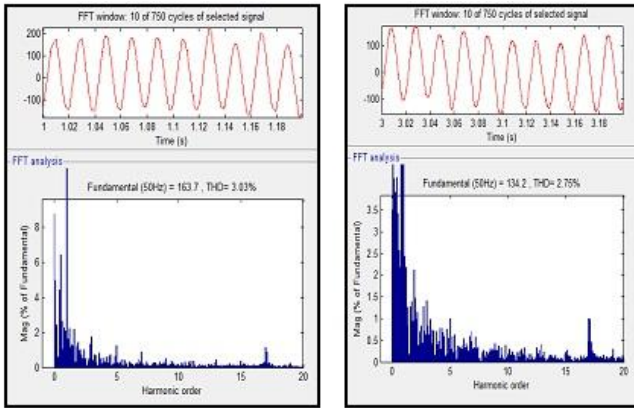
THD V output = 14.25 %



THD I input = 61.79 %



THD I input = 66.23 %



THD I output = 3.03%

THD I output = 2.75%

5.6 Simulation of Proposed Single Phase Rectifier Used in AC Drive.

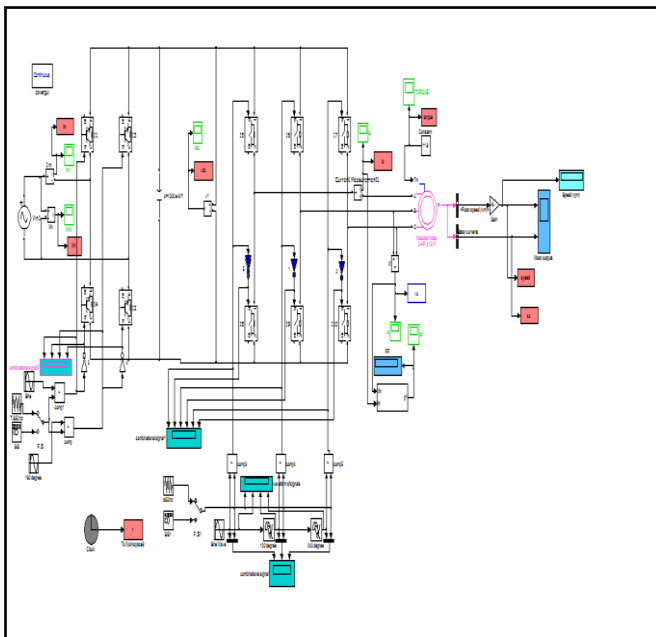


Fig:-Proposed Single Phase Rectifier Used in AC Drive.

The main difference between the earlier simulation models and this one is clearly visible from the figure 5.3. Here active PWM rectifier is used in line side of the power circuit. The other parameters are as above simulation circuit.

Results

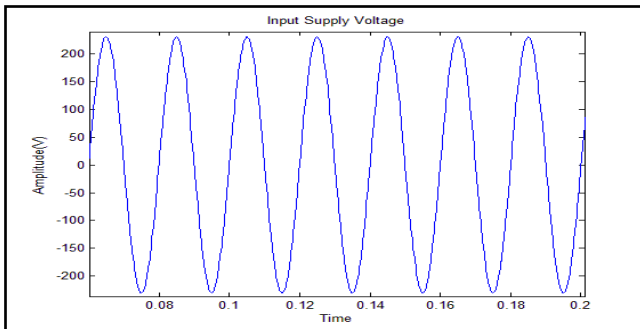


Fig :- Input Supply Voltage- Proposed Single Phase Rectifier Used in AC Drive System.

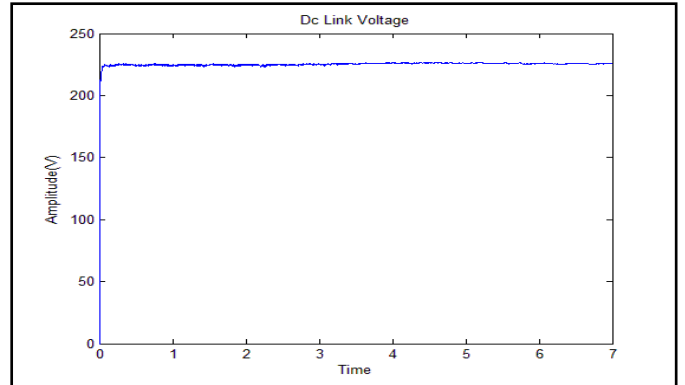


Fig :-Dc Link Voltage- Proposed Single Phase Rectifier Used in AC Drive System.

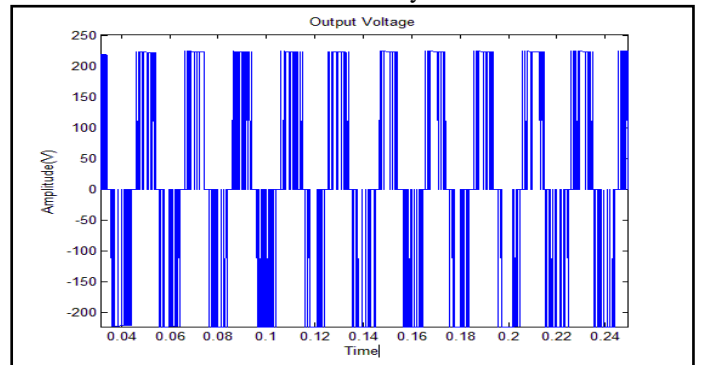


Fig :- Output Voltage- Proposed Single Phase Rectifier Used in AC Drive System.

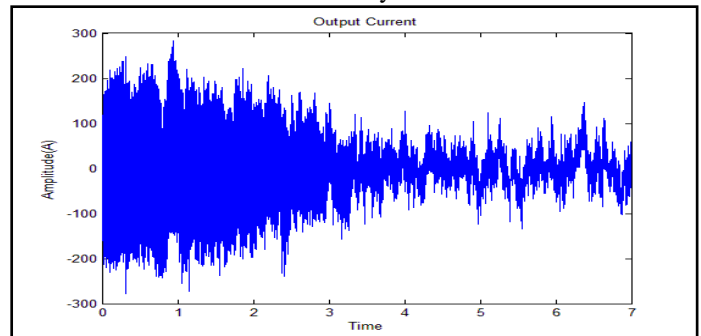


Fig :-Output Current- Proposed Single Phase Rectifier Used in AC Drive System.

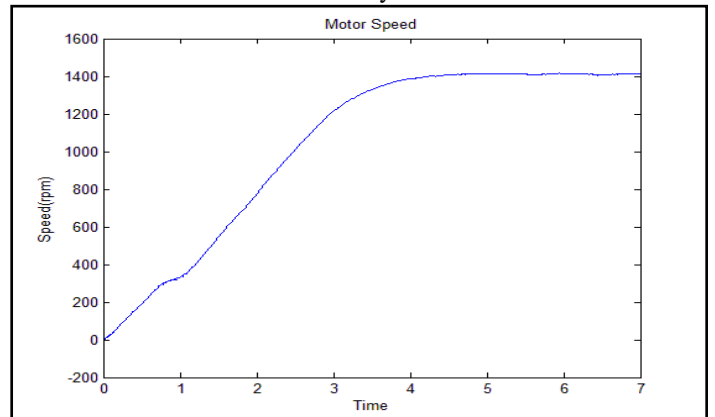


Fig :-Motor Speed- Proposed Single Phase Rectifier Used in AC Drive System.

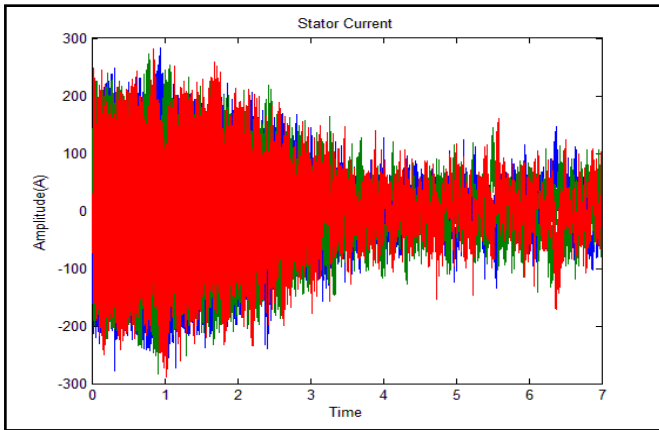
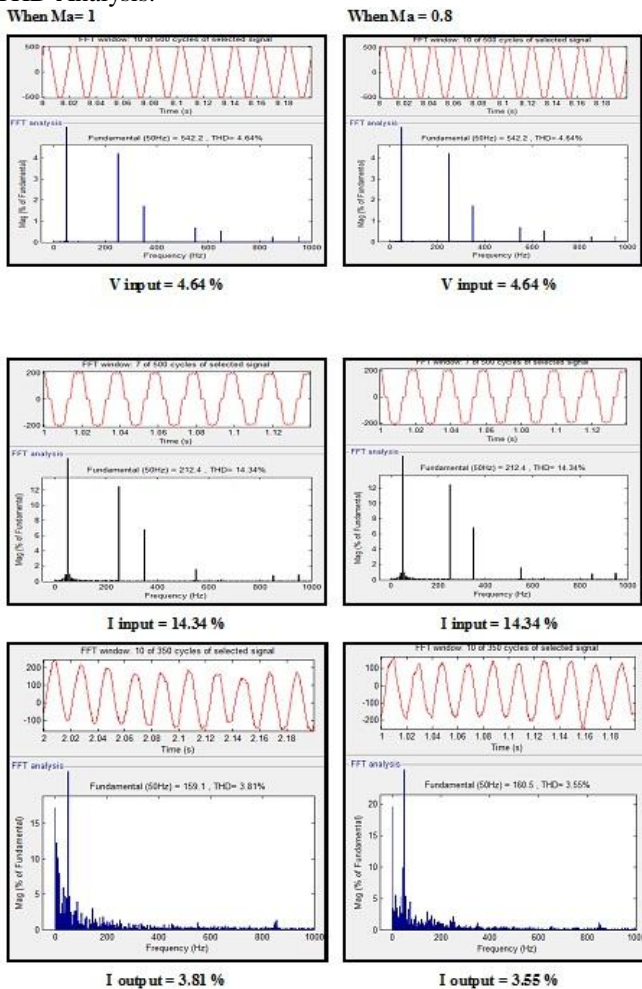


Fig :- Stator Current- Proposed Single Phase Rectifier Used in AC Drive System.

THD Analysis.



III. CONCLUSION

Generally there are different control strategies to operate the traction motor as load. With a 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 day 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.

RESEARCH PAPERS

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