IMPLEMENTATION OF 15 LEVEL 10 SWITCH DC SOURCE SWITCHED INVERTER AND COMPARISON OF ITS PARAMETER WITH 15 LEVEL 16 SWITCH H-BRIDGE INVERTER BY SIMULATION.

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Abstract : Harmonic content is one of the most important aspects of multilevel inverters. Total harmonic distortion (THD) is directly proportional to number of switches used to convert DC to AC and inversely proportional to number of levels in output voltage waveform. The amount of harmonics introduced in switched DC source 10 switch inverter (proposed) is lesser as compared with those of common multilevel inverters. In this paper a system using 10 switches to generate 15 output levels for getting less distorted and smooth waveform is implemented. Less switches leads to less switching time and improved system. Also it reduces the complexity and cost of the system. 3 DC voltages (6V,12V,24V) are used to produce 15 output levels. The system is simulated in MATLAB simulation. A comparison in MATLAB is done between Cascaded H-bridge 16 switch 15 level inverter and Switched DC source 10 switch 15 level inverter for output voltage, output current and THD.

IndexTerms **- Total harmonic distortion (THD), Multilevel Inverter (MLI), harmonics**

I. INTRODUCTION

The Inverter is an electrical device which converts direct current (DC) to alternate current (AC). The inverter is used for emergency backup power in a home and industrial applications. The inverter is used in some aircraft applications to convert a portion of the aircraft DC power to AC. The AC power is used mainly for electrical devices like radio, motor, lights, radar and other devices. The many industrial applications require very high power for their operations. Some appliances in the industries however require medium or low power for their different operation. By Using a high power source for all industrial loads may prove beneficial to some motors requiring high power, while it may damage the other loads. Some medium voltage motor drives and utility applications require medium voltage for operation. The multilevel inverter has been introduced since 1975 as alternative in medium voltage and high power situations. The Multilevel inverter is like an inverter and it is used for industrial applications as alternative in medium voltage and high power situations.

Multilevel inverter technology is a very important alternative in high-power and high voltage applications. They have a unique structure which makes it possible with less harmonic content. Harmonic content of the output waveform decreases as the number of output voltage level increases. Research is going on to enhance their capabilities further through optimized control techniques, and to minimize both component count and manufacturing cost. The main advantages are lower Total harmonic distortion (THD) and less stress on power switches and higher efficiency. The multilevel inverters are used in motor drives, power conditioning devices, renewable energy generation and distribution.

II. PROPOSED ARCHITECURE

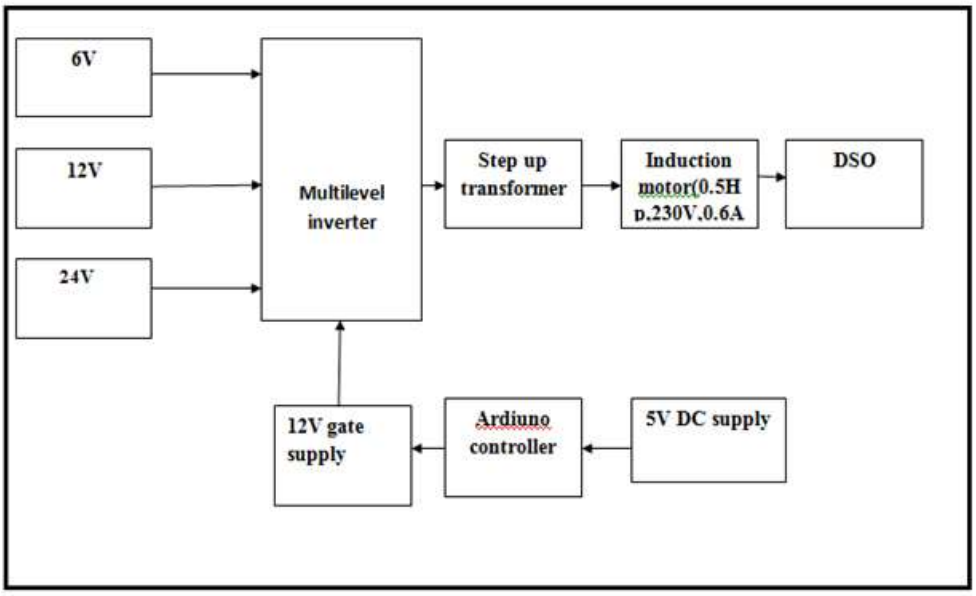

Fig 1 Block diagram of proposed system

6V, 12V and 24V are separate DC sources used in this system. This are fed to the control logic and a series of switches which comprises the inverter. The output is 15 different levels of AC output. Inverter consists of

1. Switches: there are 10 switches present in this system. The MOSFET switches are used in this system since they can handle large power and are more accurate than any other type like IGBT or conventional transistor type (NPN or PNP).
2. Control logic: control logic is used to control the state of switch.

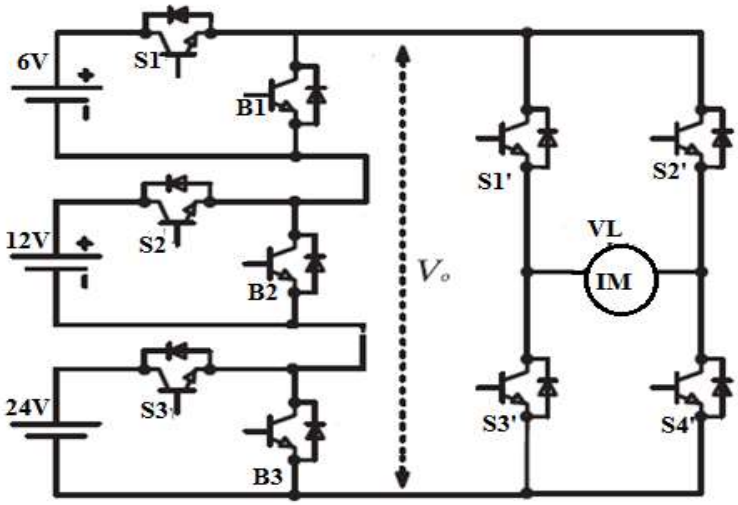

Fig 2 circuit diagram of proposed system

Fig 5.2 shows the circuit diagram of (E-Type) Asymmetric Multilevel Inverters with Reduced Components. The circuit diagram includes 10 Switches namely S1,S2,S3, B1,B2,B3,S1',S2',S3',S4'. The switches are made up of MOSFET (metal oxide semiconductor field effect transistor), we are using this switches to convert input to 15 levels AC output. DC power supply for proposed circuit diagram where 6Volt, 12 Volt and 24 Volt.

Hardware components :

1) MOSFET
2) DC power supply (Batteries)
3) Transformer
4) Opto-coupler
5) Oscilloscope
6) Ardiuno (controller)
7) Induction motor

Working: A multilevel inverter with 10 switches operate with DC batteries. Arduino as controller is programmed for switching sequences of MOSFET. DC batteries gives gate supply and Circuits starts .Alternate switching turn on and off , of switches takes place. Inverter generate 42V Ac voltage. This 48V AC voltage is step up to 230V using a transformer to run an induction motor. The output voltage waveform of 15 level is observed on DSO.THD is measured through power analyzer.

III. HARDWARE

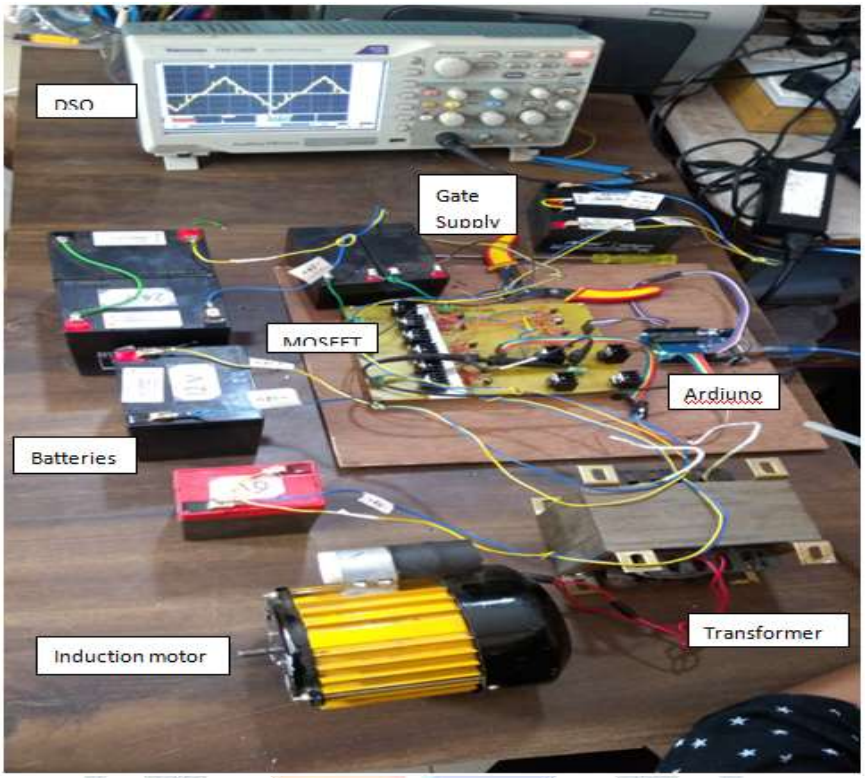

Fig 3 hardware model of proposed system

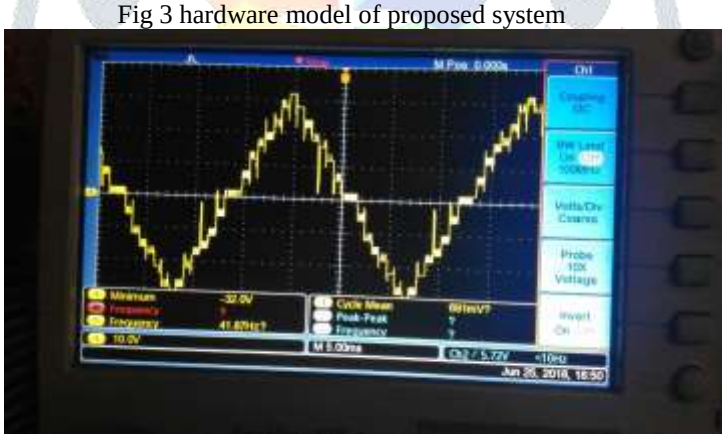

Fig 4 output voltage waveform on DSO

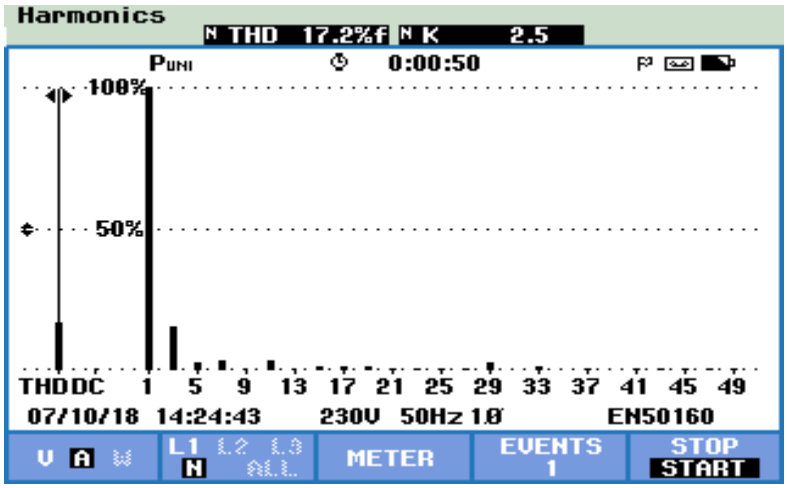

Fig 5 THD in output voltage of 10 switch inverter on harmonic analyzer

Table 1 Hardware results

SR.No	Quantity	Value
1	RMS voltage [Vrms]	16.73V
2	Maximum voltage	32V
3	Minimum voltage	-32V
4	Peak to peak voltage	64V
5	Frequency	41.89Hz
6	THD	17.2%

IV. SIMULATION

1) Simulation diagram for Cascaded H-Bridge 16 switch inverter

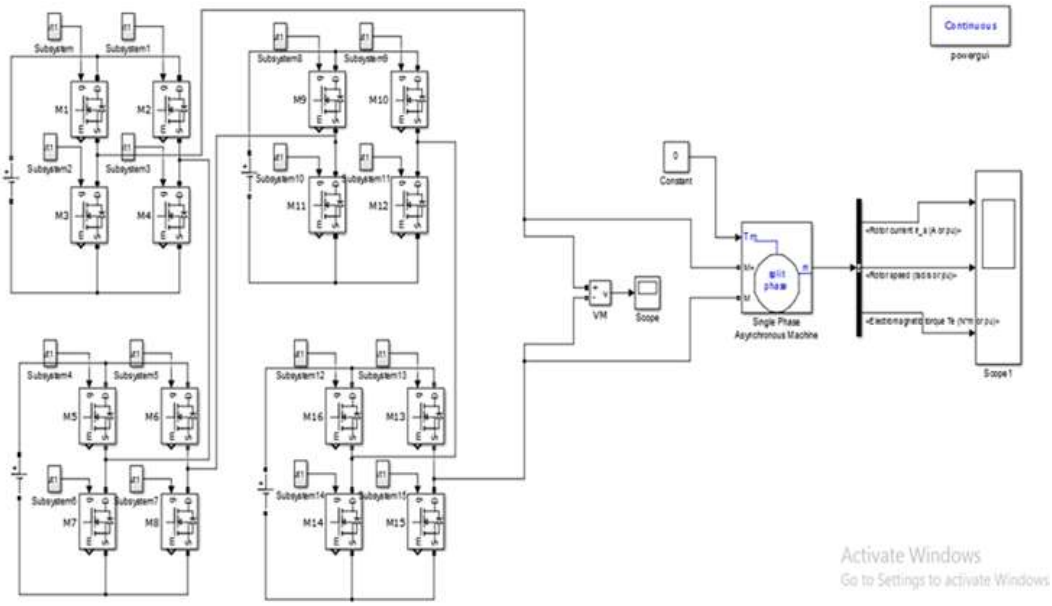

Fig 6 MATLAB simulation diagram for Cascaded H-bridge 16 switch inverter

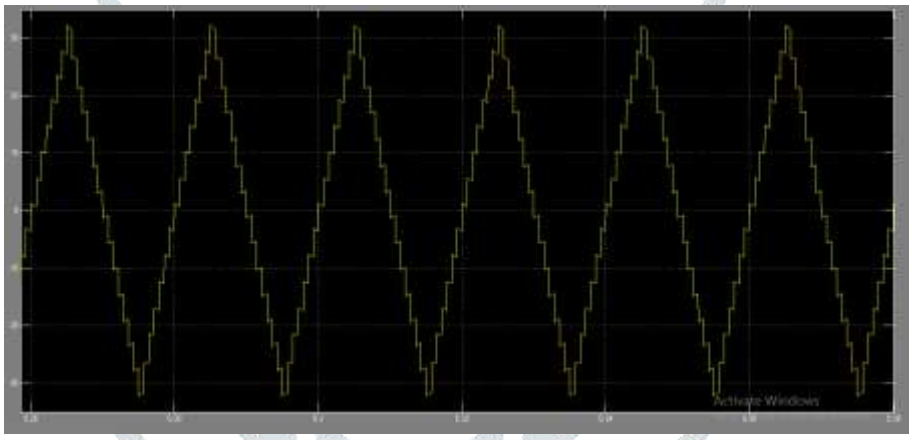

Fig 7 Output voltage waveform for 16 switch multilevel inverter

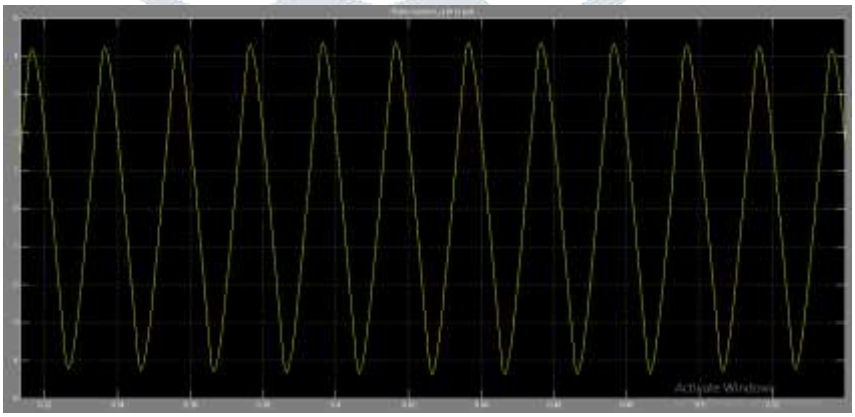

Fig 8 Output current waveform for 16 switch multilevel inverter

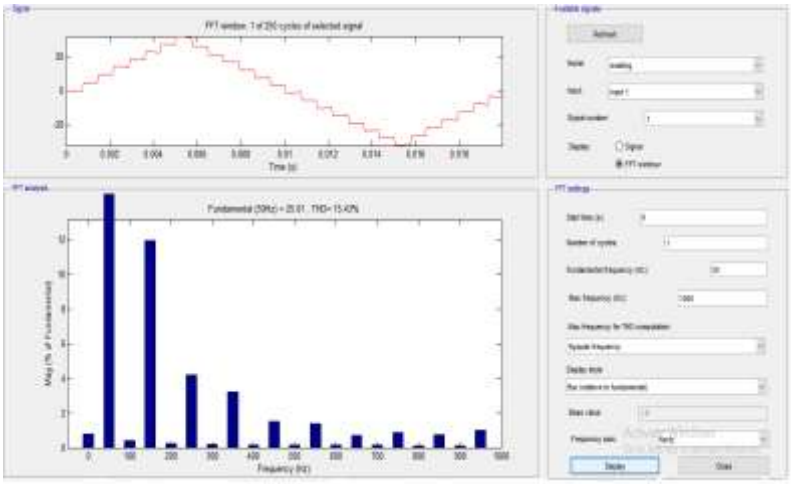

Fig 9 FFT analysis for 16 switch inverter

Table 2 simulation result for 16 switch multilevel inverter

SR.No	Quantity	Value
1	R.M.S voltage[Vrms]	22.63V
2	R.M.S Current [Irms]	2.89 Amp
3	Maximum voltage[Vmax]	32V
4	Minimum voltage [Vmin]	-32V
5	Peak to Peak Voltage [Vpp]	64V
6	THD	15.43%

2) Simulation diagram Switched DC source 10 switch inverter

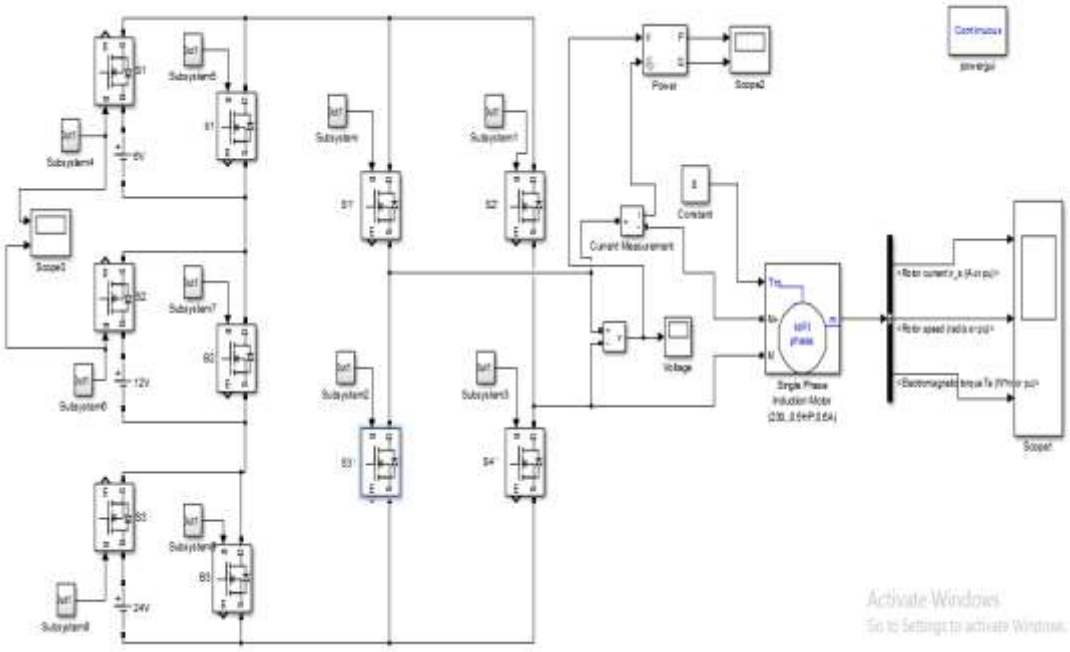

Fig 10 simulation diagram for 15 level 10 switch multilevel inverter

Table 3 switching sequence of proposed system

Volt	S1	B1	S2	B2	S3	B3
0	0	1	0	1	0	1
6	0	1	0	1	1	0
12	0	1	1	0	0	1
18	0	1	1	0	1	0
24	1	0	0	1	0	1
30	1	0	0	1	1	0
36	1	0	1	0	0	1
48	1	0	1	0	1	0

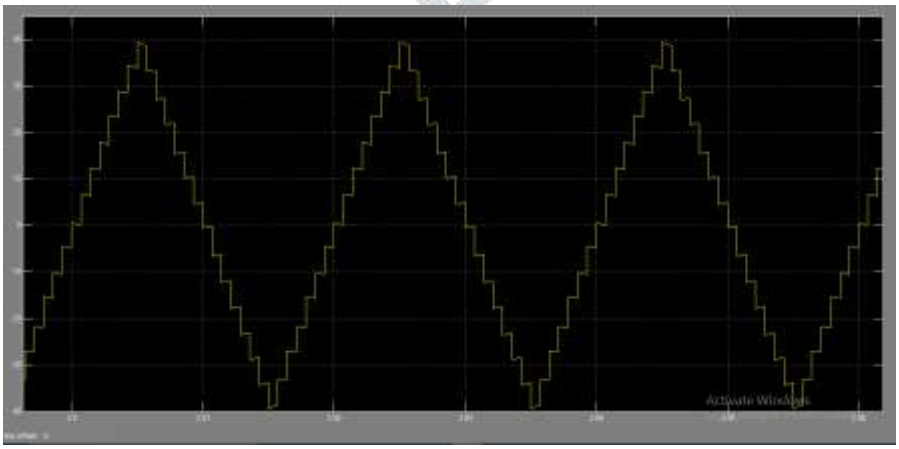

Fig 11 output voltage waveform for 15 level 10 switch multilevel inverter

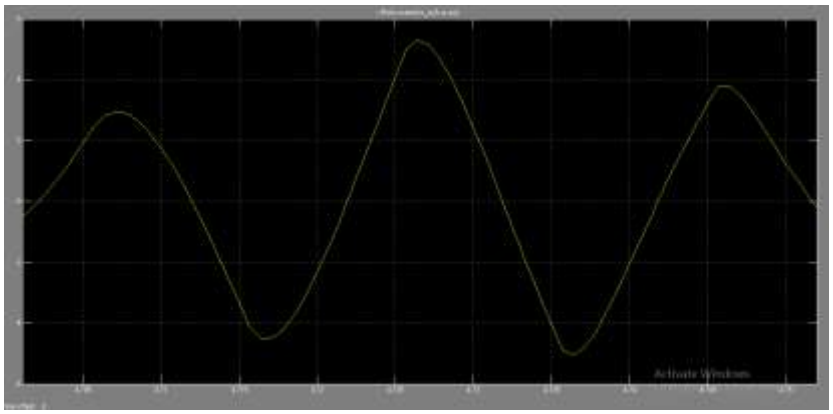

Fig 12: Output current waveform for 10 switch multilevel inverter

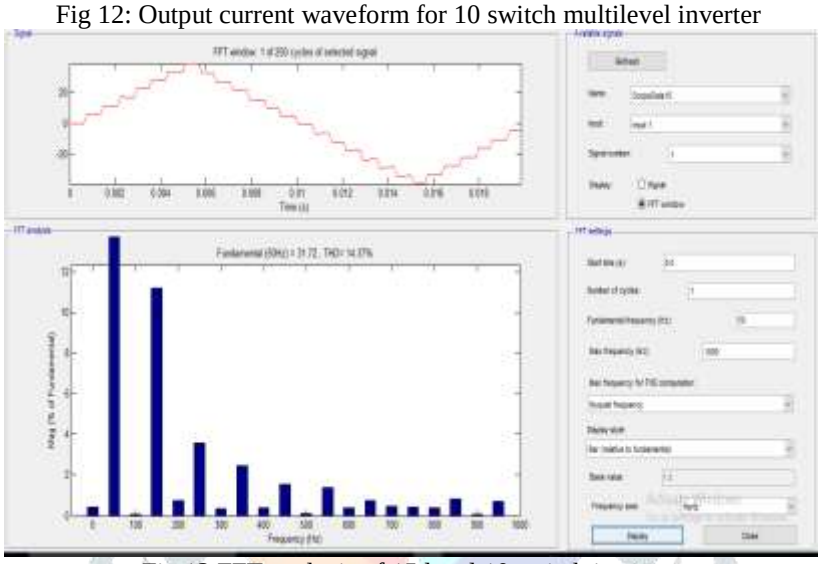

Fig 13 FFT analysis of 15 level 10 switch inverter

Table 4 simulation results for 10 switch multilevel inverter

SR.No	Quantity	Value
1	R.M.S voltage[Vrms]	28.28V
2	R.M.S Current [Irms]	2.9 Amp
3	Maximum voltage[Vmax]	40V
4	Minimum voltage [Vmin]	-40V
5	Peak to Peak Voltage [Vpp]	80V
6	THD	14.37%

V. Conclusion

This paper presented a new MLI topology that can generate 15 levels with reduced components. It can be used in high-voltage high-power applications with unequal dc sources. The proposed scheme reduces number of power switches. As less no of switches used for construction, switching losses and cost for the switches are less. From simulation of 10 switch multilevel inverter and 16 switch inverter , it is clear that, THD for output voltage is less as compared to 16 switch inverter, though the output level waveform is of same levels i.e. 15.RMS output voltage and RMs output current for 10 switch inverter is more than

that of 16 switch inverter. THD for Cascaded H-bridge 16 switch inverter is 15.43% and THD for Switched DC source 10 switch multilevel inverter is 14.37% .The system is applicable in applications like Dynamic Voltage Restorer, Static VAR compensator, active power filters and high-power motor drives.

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