

TABLE OF CONTENT

1. Smart Solar Hybrid Led Streetlight Aman Jha, Manoj Kumar, Jitendra Jain, Indar Prakash Singhal	1
2. Dynamic Stability Algorithm for A Hexapod Robot B.Veekshan Sree Sesha Sai, B. Akshay Kumar, Nippun Kumaar A. A.	7
3. Design of Signed Distance Method Based Fuzzy Logic Controller for Tito Process Aprajita Singh, P. S. Londhe	13
4. Non-Intrusive Load Monitoring Based on Graph Signal Processing Amit Kumar, Hemant Kumar Meena	18
5. Hdl And Timing Analysis of Amba Ahb On Fpga Platform Anshu Gaur, Piyush Sharma, Shiv Pratap Pandey	22
6. Efficient Clear Air Turbulence Avoidance Algorithms Using Iot For Commercial Aviation Amlan Chatterjee, Hugo Flores, Bin Tang, Ashish Mani, Khondker S. Hasan	28
7. Investigation of The Effect of Transverse Crack on The Modal Properties of Cantilever Beams with Different Geometries Using Finite Element Analysis Sameera Mufazzal, S M Muzakkir	34
8. A Data Driven Approach for Scheduling the Charging of Electric Vehicles Anjali Jain, Ashish Mani, Anwar S. Siddiqui, Sharad Sharma, Hemender Pal Singh	39
9. Novel Architecture for Area and Delay Efficient Vedic Multiplier Aayush Goel, Ankit Gupta, Maninder Kumar, Neeta Pandey	45
10. A Generalized Bus Dependency Matrix Based Centrality Measures for Reactive Power Compensation Dibya Bharti, Mala De	49
11. Modelling of Dc Linked Pv/Hydro Hybrid System for Rural Electrification Anuradha, Akhilendra Yadav, S.K.Sinha	55
12. Fuzzy Logic Based Pitch Angle Controller for Scig Based Wind Energy System K. A. Naik, C. P. Gupta	60
13. A New General Topology for Asymmetrical Multilevel Inverter with Reduced Number of Switching Components Kamaldeep Boora, Dr. Jagdish Kumar, Himanshu	66

14. An Improved Centroid Dv Hop Based Algorithm	
Harshit Agarwal, Ananya Dwivedi, Amanpreet Kaur	72
15. Analysis of Active Magnetic Bearing Using Finite Element Method	
Sudipta Saha, Mashuq-Un-Nabi	76
16. Robust Sliding Mode Control for Hydraulic Generator Regulated System with Uncertainty: A Comparative Study	
Deepika, Dr. Shiv Narayan, Dr. Sandeep Kaur	80
17. Dds Quality of Service Optimization for Jdl Based Naval C4i Systems	
Amit Mathur, Preeti Suman, Hitanshu Punj, Sovan Maiti	85
18. High Linearity and High Input Impedance Matching Common Gate Cmos Lna in 2.4ghz Ism Band	
Aditi, Malti Bansal	90
19. High Linearity and Low Noise Shunt Resistive Feedback Cmos Lna in 2.4ghz Ism Band	
Aditi, Malti Bansal	95
20. Numerical Study on Enhancement of Heat Transfer by Turbulence	
Muhammad Azmain Abdullah, Ar Rashedul, Mohammad Ali	100
21. Design of Optimized Hybrid Active Power Filter For Electric Arc Furnace Load	
Rajkumar Jhapte, R.N. Patel, D.D. Neema	105
22. Hdl Implementation of High Performance 16 Bit Processor on Fpga	
Ashutosh Gupta, Pradeep Kumar, Nikita Saxena	111
23. Artificial Intelligence Based Maximum Power Point Tracking Algorithm for Photo-Voltaic System Under Variable Environmental Conditions	
Mohammad Junaid Khan, Lini Mathew	114
24. Grid Connected Energy Efficient Building with Roof Top Spv	
Mohammed Ali Khan, Sachin Mishra, V.S.K.V. Harish	120
25. Multi Agent Based Energy Management System for Smart Microgrid	
Sujil A, Rajesh Kumar	125
26. Implantable Bio-Mems Applications: A Review	
Shifali Kalra, Mashuq-Un-Nabi	131
27. A Review on Modeling of Few Mems Devices and Further Issues	
Ananya Roy, Mashuq-Un-Nabi	137
28. Sliding Mode Controller Based Quadratic Boost Converter for Fuel Cell System	
Ashish Tiwari, Omprakash Jaga, Shakti Singh Soni	142
29. Voltage Stability Analysis Using Phasor Measurement Unit	

	Dolly Chouhan, Kasongo Hyacinthe Kapumpa, Varsha Jaiswal	147
30.	A Fuzzy Logic Based Mppt for 1mw Standalone Solar Power Plant	
	Kasongo Hyacinthe Kapumpa, Dolly Chouhan	154
31.	Power Flow Analysis of Balanced Radial Distribution System with Composite Load Model	
	Shradha Singh Parihar, Nitin Malik	160
32.	Enhanced Loading Ability of Distribution System by Concurrent Ac-Dc Power Transmission	
	Md Danish Raza Ansari, Rahul Pandey, Shimpy Ralhan, Dr. S.P. Shukla	166
33.	Improving Stability in Power System Network Using Tuned Controller	
	Mahesh Singh, Sakshi Mishra, Shimpy Ralhan, B. Chiranjeev Rao	172
34.	Triangular Function Based Analysis and Solution of Inverted Pendulum Problem	
	Bedatri Moulik, Himadri Basu, Ranatosh Chowdhury, C.K.Raman, Anindita Ganguly	177
35.	Implementation of Space-Time Block Code in Mimo System Using Antenna Diversity	
	Kritika Gautam	182
36.	Ethernet Based Smart Energy Meter for Power Quality Monitoring and Enhancement	
	Himshekhhar Das, L.C. Saikia	187
37.	Internet of Things: A Literature Review	
	Naved Alam, Prashant Vats, Neha Kashyap	192
38.	Improvement of English-Hindi Machine Translation Using Conceptnet	
	Mani Bansal, Goonjan Jain	198
39.	Speed Control of Blcdc Motor Through Mobile Application Via Secured Bluetooth	
	Arindam Bhattacharjee, Gaurav Ghosh, Vijay Kumar Tayal, Pallavi Choudekar	203
40.	Selection of Lv Motor Feeder Component Based on Iec Standards	
	M.Nataraj, J. Arockiya Xavier Prabhu, P.Vinoth Kumar, M.G.Manjunath	207
41.	Simulation Analysis of Two-Level and Three-Level (Npc) Converter Based Sapf For Different Current Control Schemes	
	Kawal Preet Kaur Kalra, M. T. Shah	212
42.	Optimization of Size of Pv/Wind/Biodiesel by Using Artificial Bee Colony (Abc) Algorithm	
	Shwetagoyal, Sachin Mishra, Anamika Bhatia	220
43.	A New 21- Level Asymmetrical Multilevel Inverter Topology with Different Pwm Techniques	
	Nikhil Agrawal, Praveen Bansal	224
44.	Fault Analysis of a Distribution System Embedded with Plug-In Electric Vehicles	
	Ranjeet Kumar, Dipti Saxena	230
45.	A Review on Evolution of Acoustic Noise Reduction in Mri	
	Manpreet Singh Takkar, Manoj Kumar Sharma, Ravi Pal	235

46. A New Simplified Control Strategy for Switched Reluctance Motor	
Gyanendra Kumar Sah, Shefali Jagwani, L. Venkatesha	241
47. Series Facts Controllers for Power Oscillations Damping of Power System	
Ritika Arora, Vijay Kumar Tayal, H.P. Singh	245
48. Performance Analysis of Ieee 9 Bus System Using Tesc	
Salil Sharma, Naga Sai Velgapudi, Kamlesh Pandey	251
49. Comparative Analysis of Dual Active Bridge Isolated Dc to Dc Converter with Double Phase Shift and Triple Phase Shift Control Techniques	
Anupam Kumar, Dr. A.H.Bhat, Dr .Pramod Agarwal	257
50. Distribution System Planning with Optimal Conductor Selection	
Deepak Joshi, Satyanarayana Burada And Khyati D. Mistry	263
51. Blood Bank Information System Using Android Application	
Neetu Mittal, Karansnotra	269
52. Facial Expression Recognition Using Wavelet Based Support Vector Machine	
Jhilmil Mathur, U.S. Pandey	275
53. A Control Algorithm for Co-Operatively Aerial Survey by Using Multiple Uavs	
Shivam Kumar Gupta, Pramit Dutta, Naveen Rastogi, Shashank Chaturvedi	280
54. Three Phase Power Metering Using Maxq3183	
Pushendra Yadav, L.M. Saini	286
55. Advanced PWM For Balancing Dc-Link Voltages in Seven-Level Chb Inverter Based Active Filter	
Soumyadeep Ray, Nitin Gupta, R. A. Gupta	291
56. Power Quality Improvement of Grid Using Pv Solar Farm by Voltage Injection Method	
Abhishek Kumar Sinha, Sachin Mishra	297
57. Performance of Mimo System Under Different Fading Channels with Zf And Mrc	
Aishwary Jain, Pankaj Shukla, Lokesh Tharani	302
58. Asset Optimization with Effective Design and Evaluation of Solar and Wind Hybrid System	
J S Chandok, Dr Viresh Dutta	308
59. New Vdccc Based Electronically Tunable Grounded Frequency Dependent Negative Resistance Simulator Employing Grounded Passive Elements	
Mayank Srivastava, Ajay Roy, Ramendra Singh, Pranjal Gupta	313
60. Human Guided Mobile Luggage	
Jagjot Singh Khokhar, Manish Sharma, Rajesh Singh Jauneet Singh, Tanya Bhardwaj	318
61. Modelling of Hybrid Photovoltaic System	

	Syed Mohd Adnaan, Mukul Chankaya	322
62.	New Topologies for Otrra Based Programmable Precision Half-Wave and Full-Wave Rectifiers Sirish Oruganti, Yatin Gilhotra, Neeta Pandey, Rajeshwari Pandey	327
63.	Adaptive Neuro-Fuzzy Based Agc Of Hydro Thermal Reheat Deregulated Power System Varsha Kushwaha, Kamlesh Pandey, Sumeet Schrawat, Devashish Sharma	332
64.	Implementation of Mppt Technique for Solar Pv System Using Ann Suman Kumar Roy, Shoeb Hussain, Mohammad Abid Bazaz	338
65.	Design and Implementation of a Novel Energy Management Algorithm in Vehicle to Grid System Design Rinkesh Patel, Avni Sharma	343
66.	Simulation and Analysis of Power Synchronization Control for Voltage Source Inverter Vijaya Raghavan S, Dr. Jayabarathi R	348
67.	Elimination of Harmonics Using Bacterial Foraging Optimized Shunt Active Power Filter Anju Sharaf, Rahul Pandey, Mahesh Singh, Rajkumar Jhapte	354
68.	Breach Detection and Mitigation of Uavs Using Deep Neural Network Shijith N, Prabakaran Poornachandran, Sujadevi V G, Meher Madhu Dharmana	360
69.	A Review on Video Steganography Techniques in Spatial Domain Disha, Khushil Saini	366
70.	Performance Analysis of Blind Eigen Value with Multiple Antenna Based Spectrum Sensing in Cognitive Radio P. K. Verma, Priyanka Jain, S. K. Soni	372
71.	PV-Active Power Filter Combination Mitigating Harmonics Using Flc Darshana R. Chaudhari, Shruti Gour	378
72.	Comparative Analysis of Dual Active Bridge Isolated Dc to Dc Converter with Flyback Converters for Bidirectional Energy Transfer Anupam Kumar, Dr. A.H.Bhat, Dr .Pramod Agarwal	382
73.	Study and Implementation of Boost-Derived Hybrid Converter with Simultaneous Dc and Ac Outputs Prabal Pratap Singh, Subhash Chandra, Ashish Tiwari	388
74.	Improved Load Frequency Characteristics in Isolated Power System with Genetically Tuned Battery Energy Storage S Zahid Nabi Dar, Mairaj-Ud-Din Mufti	394
75.	Performance of Cascaded Diode Bridge Integrated Hbridge13 Level Multilevel Inverter Shweta Nagar, Shazma Khan, And Balvinder Singh	399

76. Whether Colour, Shape and Texture of Leaves Are the Key Features for Image Processing Based Plant Recognition? An Analysis!	404
Jibi G Thanikkal, Ashwani Kumar Dubey, Thomas. M.T	
77. Analysis of Different Filters for Noise Reduction in Images	410
Bhawna Dhruv, Neetu Mittal, Megha Modi	
78. Performance Optmization Of Self Excited Induction Generator: A State of Art	416
Swati Paliwal, Sanjay Kumar Sinha, Yogesh Kumar Chauhan	
79. Optimal Tuning of Pss And Statcom-Based Controllers Using Differential Evolution Algorithm	421
Jitendra Bikanaria, Dr. Sanjeev Kumar Sharma, Kapil Parkh, Nishant Dhakre	
80. Voltage and Frequency Controller for Seig Based Battery Storage System	427
Vasundhara Tripathi, Monika Jain	
81. Overview of Architecture for Gps-Ins Integration	433
P Srinivas, Wg Cdr (Retd) Dr. Anil Kumar	
82. Development of Web Based Gas Monitoring System Using Labview	439
Neeraj Khera, Priya Sharma, Divya Shukla, Ishfaq Gaffar Dar	
83. Deep Learning Lstm Based Ransomware Detection	442
Sumith Maniath, Aravind Ashok, Prabaharan Poornachandran, Sujadevi Vg, Prem Sankar a U, Srinath Jan	
84. Predictive Analysis Using Hybrid Clustering in Diabetes Diagnosis	447
Kanika Bhatia, Rupali Syal	
85. Comparative Study of Dual Active Bridge Isolated Dc to Dc Converter with Single Phase Shift and Dual Phase Shift Control Techniques	453
Bhimisetty Manoj Kumar, Anupam Kumar, Dr. A.H.Bhat, Dr.Pramod Agarwal	
86. Automized Gamma Correction for Shadow Removal in Color Aerial Images	459
Vertika Jain, Ajay Khunteta	
87. Analysis of Pwm Techniques on Multilevel Cascaded H-Bridge Three Phase Inverter	465
B. Hemanth Kumar, Makarand. M Lokhande	
88. A Methodology For 11-Level Ac Output Voltage Generation for Stand-Alone/ Grid Tied Solar Pv Applications	471
Vani Bhargava, Sanjay Kumar Sinha, M P Dave	
89. Investigation of Pedestrian Collision Avoidance with Auto Brake	477
Avinash. R, Niresh. J, Harish Kumar. V, Neelakrishnan. S	
90. Regenerative Braking Energy Storing Phenomena in Fuel Cell Based Electric Vehicle	

Lokesh Chaturvedi, D. K. Yadav And Gargi Pancholi	482
91. Performance Analysis of Sapf Based on Self Tuned Harmonic Filter With Fuzzy Logic Controller	
Seema Agrawal, Dheeraj Sharma, D. K. Palwalia	487
92. Switching State Prediction for Residential Loads with Weather Data for Smart Automated Demand Response	
Ajay Singh, Shashank Vyas, Rajesh Kumar	493
93. Dynamic Stability Improvement of Alkali Fuel Cell Integrated System Using Pso Optimized Pid Control Design	
Yogita Dwivedi, Vijay Kumar Tayal	499
94. Comparison of Intelligent and Conventional MPPT Algorithms for PhotoVoltaic system under Partially Shaded Conditions	
Pallavi Verma, Priya Mahajan, Rachana Garg	505
95. Integration of Dfig In Damping Lfc Characteristics in Wind Penetrated Power System	
S Zahid Nabi Dar, Mairaj-Ud-Din Mufti	511
96. Sliding Mode Controller Based Interleaved Boost Converter for Fuel Cell System	
Ashish Tiwari, Omprakash Jaga, Shakti Singh Soni	516
97. Modelling and Analysis of a Harmonic Filter For a Grid Connected Dfig Under Fault Condition	
Priyanka Patnaik, Dillip Kumar Mishra, Abhimanyu Mohapatra, Asit Mohanty	521
98. Optimal Sizing of Hybrid Ship Power System Using Variants of Particle Swarm Optimization	
Divyajot, Rajesh Kumar, Manoj Fozdar	527
99. Wireless Data Acquisition For Industrial, Scientific and Medical Purposes	
Tanya Bhardwaj, Manish Sharma,Rajesh Singh	533

A New 21-Level Asymmetrical Multilevel Inverter Topology with Different PWM Techniques

Nikhil Agrawal¹, Praveen Bansal²

^{1,2}Department Of Electrical Engineering, Madhav Institute of Technology & Science, Gwalior, India

¹nikhilag.agrawal@gmail.com, ²pbansal444@gmail.com

Abstract—This paper presents an asymmetrical multilevel inverter topology with Different PWM techniques. This paper used one cell of conventional cascade H- Bridge Multilevel inverter structure with additional switch and voltage source to obtain high voltage level. The aim of this paper to enhance the voltage level at the output with using less switch. To improve the output voltage harmonic spectrum, the pulse width modulation (PWM) techniques used. The advantage of this proposed topology to reduce the circuit complexity and total harmonic distortion. The results of proposed 21-Level Asymmetrical multilevel Inverter are shown using MATLAB/SIMULINK software.

Keywords— H- bridge multilevel inverter, Total harmonic Distortion (THD), Pulse width modulation (PWM).

I. INTRODUCTION

IN the last few decades the multilevel inverter widely used in electrical and electronics market due to high power and high voltage application. The multilevel comes in the existing during between the 1970s and 1980s [1]. The word multilevel inverter made from two words, first is multilevel and second is inverter. As inverter is electronics device which converts the DC Power into AC Power with desired frequency, its output has high harmonic distortion, to reduce this the output voltage level increase by which the output voltage is less distorted. The multilevel inverter starts with 3 voltage Levels.

The Multilevel inverter have an advantage over two level inverter such as, low switching losses, low switching frequency, low common mode voltage, high efficiency and better Harmonic spectrum [2-3].

The Multilevel inverter have some disadvantage also over two level inverter such as, Increasing the voltage level, the number of switches and their respective gate driver circuit increased so overall complexity of circuit increased, which increased size and cost of the circuit. So makes the balance between the desired output and cost.

The Multilevel inverter Classified on the basis of DC- voltage Magnitude are two types as Symmetrical Multilevel inverter and Asymmetrical Multilevel inverter. A symmetrical

multilevel inverter have a DC-Link voltage with same magnitude and an asymmetrical multilevel inverter have a DC-Link voltage with different magnitudes. An asymmetrical multilevel inverter are classified as binary, quasi linear and ternary hybrid inverters. As compared with symmetrical configuration, an asymmetrical configuration can obtain more voltage levels in output with same number of components used in design a particular level multilevel inverter [4]. The conventional multilevel inverter can be classified as two groups, one multilevel with common dc source such as flying capacitor (FC-MLI) and diode clamped (DCMLI) and second multilevel with isolated dc source like cascade H- Bridge (CHBMLI). These structure of multilevel inverter are uses depends upon applications.

In this paper, a new asymmetrical multilevel inverter topology is proposed with a simple configuration of cascade H- Bridge multilevel inverter (CHBMLI) with reduced number of switches and insulated gate driver circuit.

In [5] a new topology of cascade H- bridge multilevel inverter has been presented. In [5], to obtain the different output voltage level, an additive and subtractive combination of voltage sources uses with one cell of cascade H-bridge multilevel inverter. This new topology with a special arrangement of voltage component that requires fewer components compared to existing conventional topology.

This paper presented a new topology for cascade multilevel inverters that produces a large number of steps with a low number of power converter switches and with different magnitudes of voltage source. In section 3, operating modes details of the proposed topology, in section 4, control and modulation techniques presented for proposed topology and Simulink results are shown in section 5.

II. PROPOSED TOPOLOGY

Fig. 1 shows the proposed topology for a 21-LEVEL Asymmetrical Multilevel inverter, which consists of the full-bridge converter with arrangement of different magnitude voltage sources and IGBT switches. In Fig.1, For 21 Level inverter 12 IGBT switches required. In this topology arrangement of different magnitude voltage sources along with full bridge converter gives the 21 level output voltage. The switches S5, S6 to S12 are used to provide the path to obtain

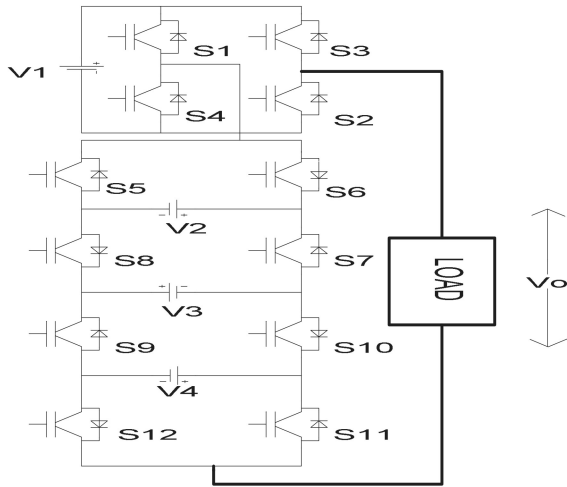


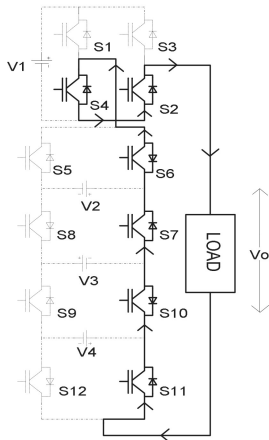
Fig.1: Proposed Topology 21- Level Asymmetric MLI

Different output voltage level. The voltage sources V_1 , V_2 , V_3 , and V_4 are of V , $2V$, $3V$, and $4V$ respectively. In section 3, the operating modes shows, for describes the different level output voltage. As to obtain $+1 V$ Level, V_1 and switches $S_3, S_4, S_6, S_7, S_{10}, S_{11}$ ON and Rest are OFF. Similarly $+2 V, +3V$ and up to $-10V$ Level obtain different switches ON and OFF, This is shown in TABLE 1. In [5], the voltage sources V_2, V_3 and V_4 are used for additive and subtractive the output voltage level .In table 1 shows the switching scheme of proposed Asymmetrical MLI.

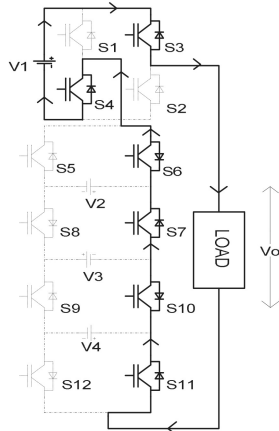
TABLE 1: SWITCHING SCHEME OF PROPOSED 21- LEVEL ASYMMETRICAL MLI

OUTPUT VOLTAGE	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
+10 V	OFF	OFF	ON	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
+9 V	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
+8 V	OFF	OFF	ON	ON	ON	OFF	OFF	ON	OFF	ON	OFF	ON
+7 V	OFF	ON	OFF	ON	ON	OFF	OFF	ON	OFF	ON	OFF	ON
+6 V	OFF	OFF	ON	ON	OFF	ON	OFF	ON	OFF	ON	ON	OFF
+5 V	OFF	OFF	ON	ON	OFF	ON	ON	OFF	OFF	ON	OFF	ON
+4 V	OFF	ON	OFF	ON	OFF	ON	ON	OFF	OFF	ON	OFF	ON
+3 V	OFF	OFF	ON	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON
+2 V	OFF	ON	OFF	ON	OFF	ON	OFF	ON	ON	OFF	OFF	ON
+1 V	OFF	OFF	ON	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF
0 V	OFF	ON	OFF	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF
-1 V	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
-2 V	OFF	ON	OFF	ON	ON	OFF	ON	OFF	OFF	ON	ON	OFF
-3 V	ON	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	ON	ON	OFF
-4 V	ON	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	ON
-5 V	ON	ON	OFF	OFF	ON	OFF	OFF	ON	ON	OFF	ON	OFF
-6 V	ON	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF	OFF	ON
-7 V	OFF	ON	OFF	ON	OFF	ON	ON	OFF	ON	OFF	ON	OFF
-8 V	ON	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	ON	OFF
-9 V	OFF	ON	OFF	ON	ON	OFF	ON	OFF	ON	OFF	ON	OFF
-10 V	ON	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF

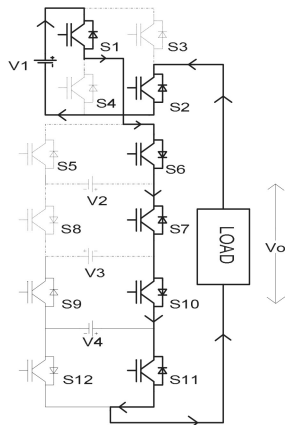
III. OPERATING MODES



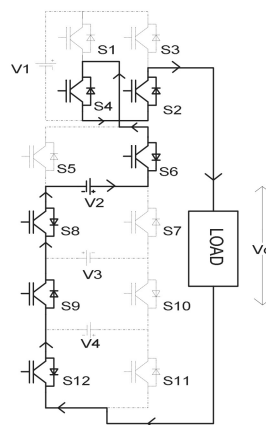
Level 0
Fig. a



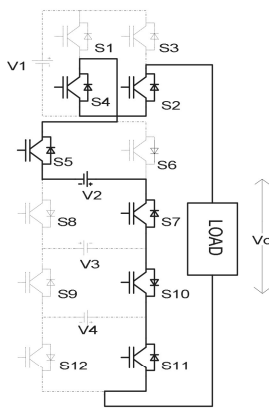
Level +1
Fig. b



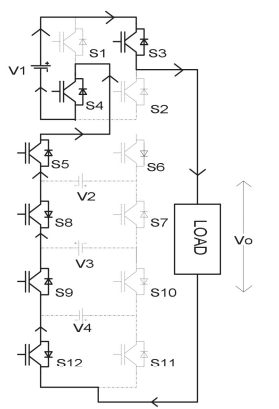
Level -1
Fig. c



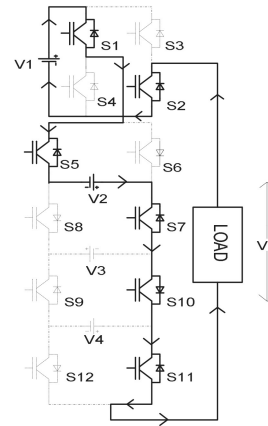
Level +2
Fig. d



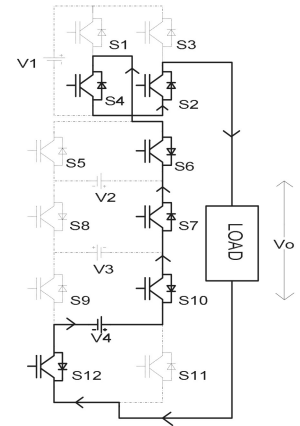
Level -2
Fig. e



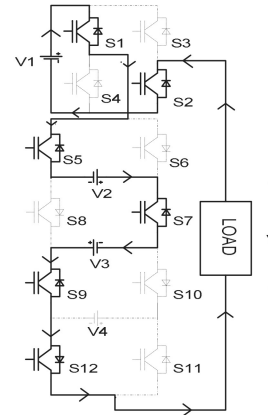
Level +3
Fig. f



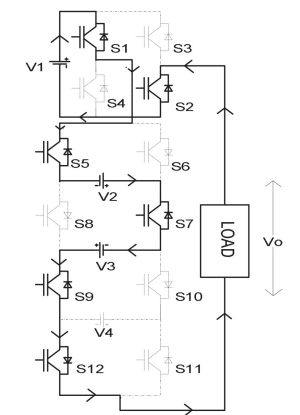
Level -3
Fig. g



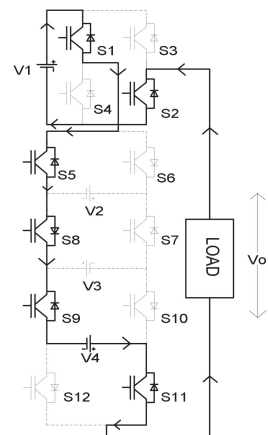
Level +4
Fig. h



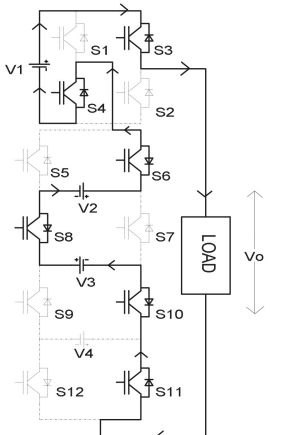
Level -4
Fig. i



Level +5
Fig. j



Level -5
Fig. k



Level +6
Fig. l

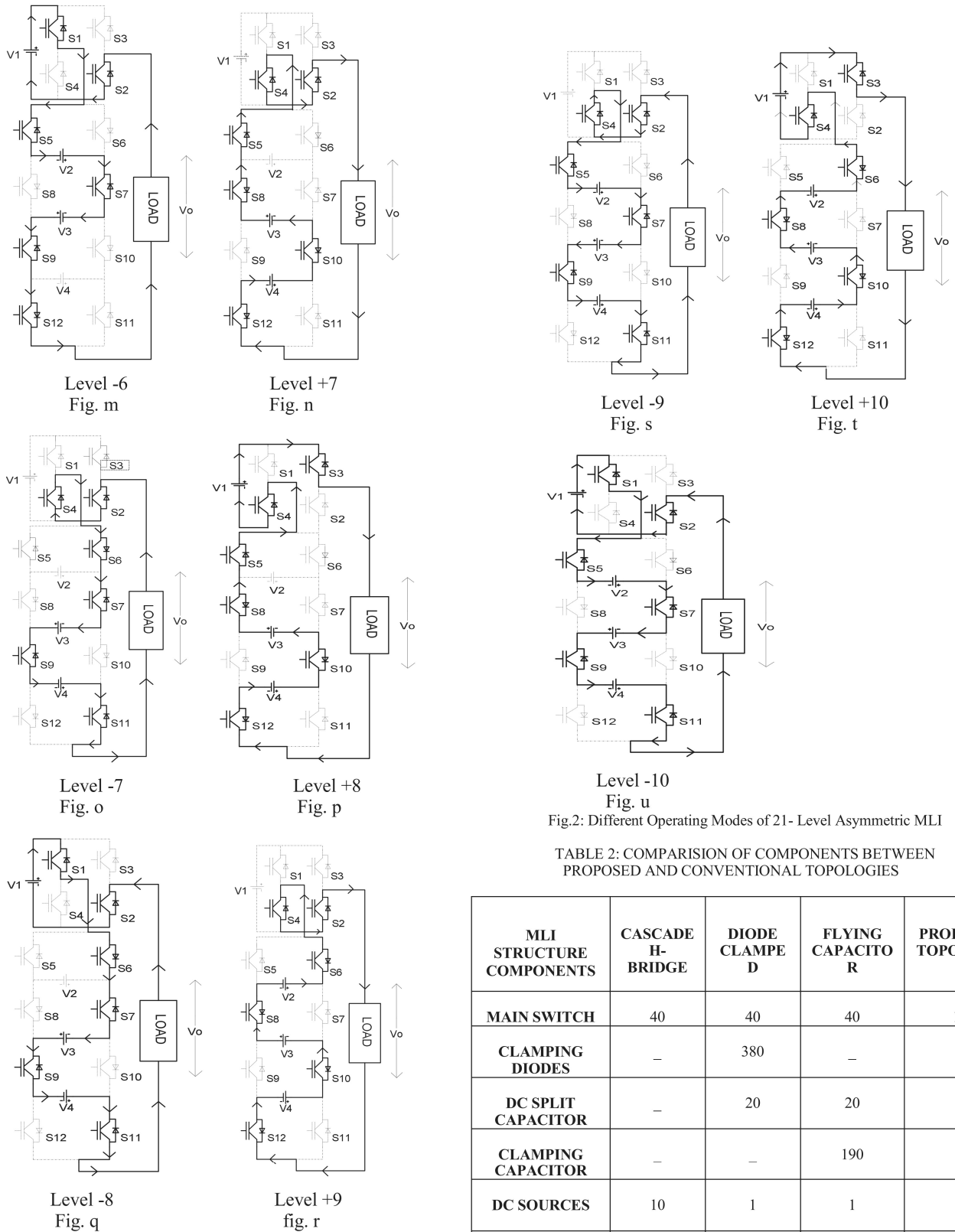


Fig.2: Different Operating Modes of 21- Level Asymmetric MLI

TABLE 2: COMPARISON OF COMPONENTS BETWEEN PROPOSED AND CONVENTIONAL TOPOLOGIES

MLI STRUCTURE COMPONENTS	CASCADE H-BRIDGE	DIODE CLAMPED	FLYING CAPACITOR	PROPOSED TOPOLOGY
MAIN SWITCH	40	40	40	12
CLAMPING DIODES	-	380	-	-
DC SPLIT CAPACITOR	-	20	20	-
CLAMPING CAPACITOR	-	-	190	-
DC SOURCES	10	1	1	4
TOTAL	50	441	251	16

IV. CONTROL AND MODULATION TECHNIQUES

Modulation play an important role in the inverter to obtain desired output. Modulation can be over modulation and under modulation depends on modulation index. Modulation index is the ratio of reference signal to carrier signal.

In this paper multicarrier pulse width modulation (MC-PWM) technique used. As MC-PWM techniques classified as level shifted and phase shifted [6]. The level shifted multicarrier pulse width modulation techniques are as [10-11].

- a) Phase Disposition (PDPWM)
- b) Phase Opposition Disposition (PODPWM)
- c) Alternate Phase Opposition Disposition (APODPWM)
- d) Phase Opposition Disposition with variable Frequency (PODVPWM)

a) *Phase Disposition pulse width modulation (PDPWM):*

In Phase disposition pulse width modulation technique all carrier above and below the zero reference are in same phase.

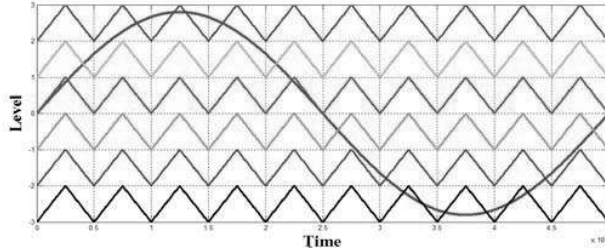


Fig.3: Carrier arrangement in PDPWM techniques

b) *Phase Opposition Disposition Pulse Width Modulation (PODPWM):*

In phase opposition Disposition pulse width modulation techniques all carrier above zero reference are in same phase and below the zero reference also in same phase but 180° out of phase with above the zero reference[7].

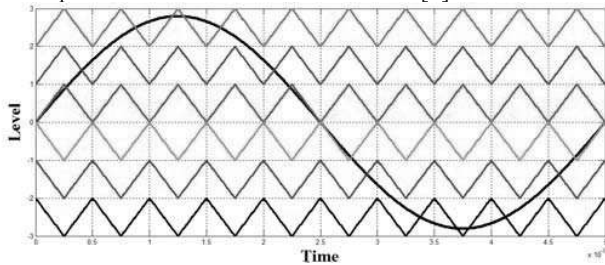


Fig.4: Carrier arrangement in PODPWM techniques

c) *Alternate Phase Opposition Disposition Pulse Width Modulation (APODPWM):*

In alternate phase opposition Disposition pulse width modulation scheme every carrier is out of phase with its neighbor carrier by 180° [8].

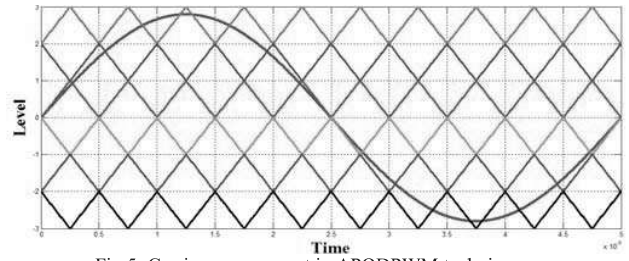


Fig.5: Carrier arrangement in APODPWM techniques

d) *Phase Opposition Disposition with Variable Frequency (PODVPWM):*

In phase opposition Disposition variable frequency pulse width modulation techniques all carrier above zero reference are in same phase having different frequency and below the zero reference also in same phase with different frequency but 180° out of phase with above the zero reference [9].

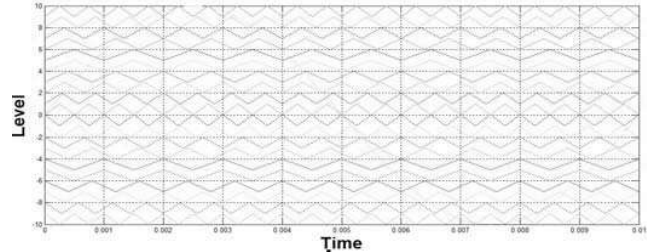


Fig.6: Carrier arrangement in PODVPWM techniques

V. SIMULATION RESULT

To examine the performance of the proposed topology MATLAB/SIMULINK R2010 software used. In the simulation, the switches have been assumed ideal. In this paper high switching frequency method is used, switching frequency of carrier 2000 Hz. Table 3 gives the information about the Total Harmonic Distortion (THD) in 21- Level Asymmetrical Multilevel inverter with different PWM scheme and modulation index. Here some of the results are shown as.

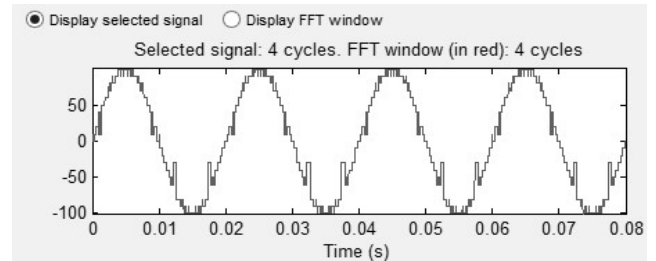


Fig.7: FFT Analysis of 21- Level Asymmetric MLI output voltage

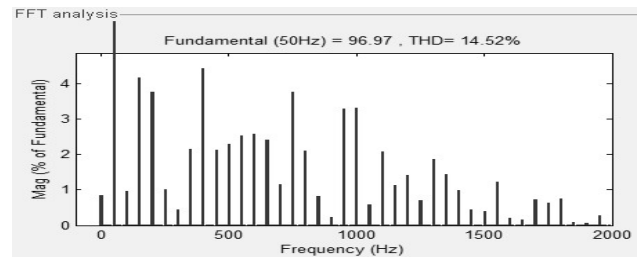


Fig.8: FFT Of 21 -Level asymmetrical MLI with PD Modulation scheme