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Literature Survey on Topologies & various Control Techniques of Multilevel Converter

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Abstract: In this study, the most common structure converter topologies and management schemes are reviewed. Structure converter topologies (MLIs) square measure increasingly being used in medium and high power applications as a result of their many advantages like low power dissipation on power switches, low harmonic contents and low magnetic attraction interference (EMI) outputs. The chosen amendment technique to manage the converter can have an honest role on harmonic elimination whereas generating the most effective output voltage. Intensive studies are performed on carrier-based, sinusoidal, space vector and letter of the alphabet delta PWM ways that in open loop management of inverters. The selection of topology and management techniques would possibly vary according to power demands of the converter.

Keywords: Multilevel inverters; classical topologies; PWM.

I. INTRODUCTION

The foremost common initial application of construction converters has been in traction, each in locomotives and track-side static converters [1]. More modern applications are for power grid converters for power unit compensation and stability sweetening [2], Active Filtering [3], High-Voltage motor drive [4], High-voltage DC transmission [5], and last for medium voltage Induction motor variable speed drives [6]. The previous approaches transmitted the good thing about well-known circuit structures and management strategies. However, the newer semiconductors area unit costlier, and by going higher in power, different power-quality needs ought to be consummated, introducing the necessity of power filters. The new approach uses the well-known and cheaper semiconductors; however, the additional advanced circuit structures came at the side of many challenges for implementation and management. Nonetheless, these challenges turned apace into new opportunities, since the additional advanced circuit structures enabled additional management degrees of freedom that might be wont to improve.

II. CLASSIFICATION OF MULTILEVEL INVERTER

- 1) Diode clamped multilevel inverter (Neutral Point Clamped Inverter).
- 2) Flying Capacitor Multilevel Inverter (Capacitor Clamped Inverter).
- 3) Cascaded H-bridge Multilevel Inverter.

A. Diode Clamped Multilevel Inverter [10-12]

Fig.1 Shows a Three level diode clamped electrical converter during which the 2 series connected capacitors C1 and C2 divide the dc voltage into three output voltage levels V_{an} : $V_{dc}/2$, 0 and $-V_{dc}/2$ by the change combination as shown in Table 1. The change state one implies the switch is ON whereas state zero implies that it's OFF. The two diodes D1 and D2 clamp the voltage across the switch to once each S1 and S2 square measure turned ON, the voltage across point „a“ and „zero“ is $V_{a0} = V_{dc}$. S1“ blocks the voltage across C1 and S2“ blocks the voltage across C2, D1“ balances the voltage sharing between S1“ and S2“. The voltage V_{an} is ac whereas voltage V_{a0} is dc. If the output is found between point „a“ and „zero“, then it's a dc-dc converter that has three output voltage levels: V_{dc} , $V_{dc}/2$ and zero.

Table-1 State Combination of Diode Clamped Converter

Voltage (V_{an})	S1	S2	S1'	S2'
$V_{dc}/2$	1	1	0	0
0	0	1	1	0
$-V_{dc}/2$	0	0	1	1

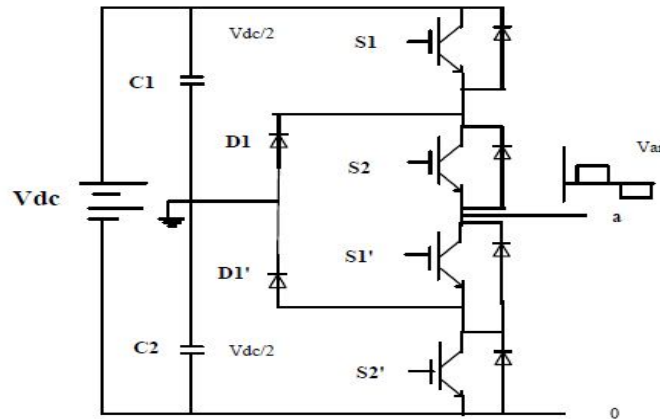


Figure-1 Three Level Diode Clamped Converter

B. Capacitor Clamped Multilevel Inverter [13-15]

Fig.2 shows a 3 level electrical device clamped electrical converter. Here rather than diodes, electrical devices square measure wantto clamp the device voltage to at least one capacitor voltage level. The voltage across „a“ and „zero“ Van has 3 voltage levels Van: $V_{dc}/2$, 0, $-V_{dc}/2$ by the change combination as shown in Table 2.The change state „1“ denotes that switch is ON and state „0“ denotes that switch is OFF. There square measure 2 attainable mixtures to get the voltage level.

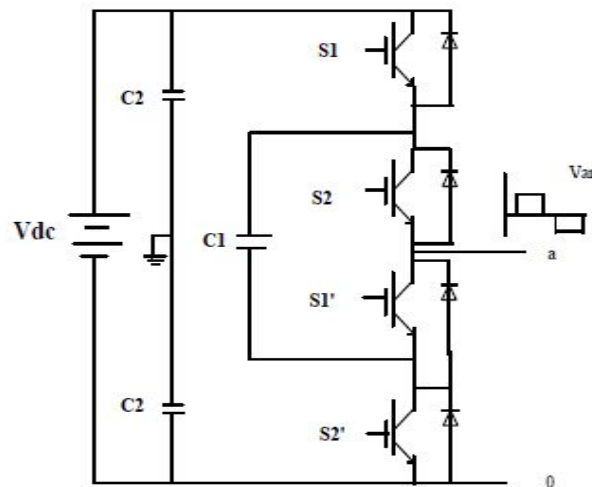


Figure-2 Capacitor Clamped Converter

Table-2 State Combination of Capacitor Clamped Converter

Voltage (Van)	S1	S2	S1'	S2'
$V_{dc}/2$	1	1	0	0
0	0	0	1	1
$-V_{dc}/2$	1	0	1	0
	0	1	0	1

C. Cascaded H-Bridge Multilevel Inverter [16-18]

Fig. 3 shows a section leg of a five-level cascaded electrical converter. It consists of 2 H-Bridge electrical converter units with 2 isolated and equal DC sources. once switches S11, S21 and switches S12, S22 conduct, the output voltage of the H Bridges H1 and H2 is $V_{H1} + V_{H2} = E$ and also the resultant electrical converter section voltage is $V_{AN}=V_{H1}+V_{H2}=2E$.

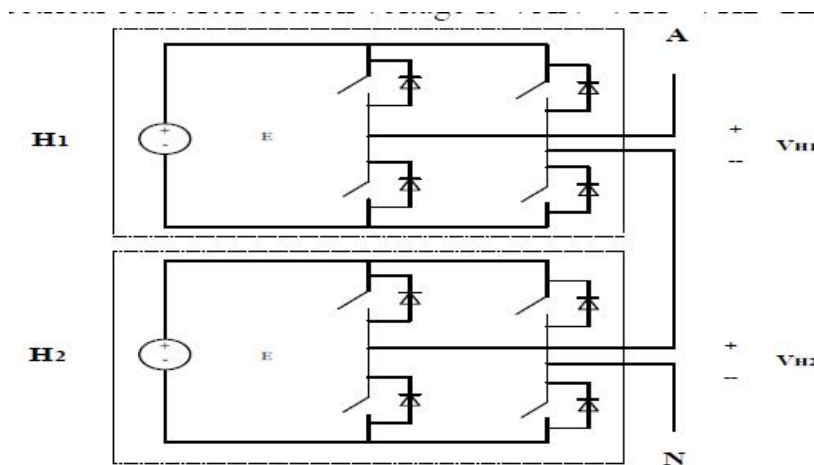


Figure-3 Cascade H Bridge Converter

III. MODULATION TECHNIQUES OF MULTILEVEL INVERTER

Switching frequency, modulation techniques are broadly divided into 2 parts as fundamental switching frequency and high switching frequency pulse width modulation (PWM).

- 1) *In Phase Disposition (IPD)*: In this modulation technique, all the carriers are in phase and reference wave is a 3-phase sinusoidal wave.
- 2) *Phase Opposition Disposition (POD)*: In this type of modulation technique, the carriers above the sinusoidal reference zero points are in phase, but shifted by 180° out of phase with those below the zero reference point.
- 3) *Alternative Phase Opposition Disposition (APOD)*: In this type of modulation technique, each carrier is phase shifted by 180° from its adjacent carrier.

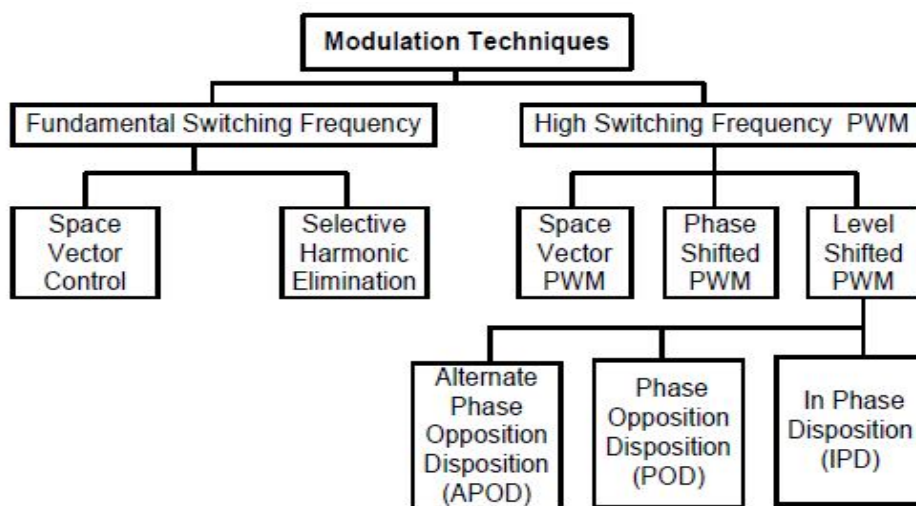


Figure-4 Classification of Modulation Techniques

Table-3 Comparison of Component Required

Converter Type	Diode Clamped	Flying Capacitor	Cascaded H-Bridge
Main Switching Devices	$(m-1)*2$	$(m-1)*2$	$(m-1)*2$
Main Diodes	$(m-1)*2$	$(m-1)*2$	$(m-1)*2$
Clamping Diodes	$(m-1)*(m-2)$	0	0
DC Bus Capacitors	$(m-1)$	$(m-1)$	$(m-1)/2$
Balancing Capacitors	0	$(m-1)*(m-2)/2$	0

IV. CONCLUSION

Based on the survey of conventional converter topologies given within the previous sections, several new hybrid topologies will be designed through the mixtures of three main MLI topologies described. Besides the mix of topologies, the trade-offs in MLI structures will be dealt with discrimination AH-MLIs that's shaped discrimination completely different DC supply levels in electrical converter cells. Yet, standard PWM methods that generate switching frequency at fundamental don't seem to be acceptable for MLIs, thanks to switching devices of the upper voltage modules would get to operate at high frequencies solely throughout some inverting instants.

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