DC LEVEL STABILIZATION IN NEUTRAL POINT CLAMPED MULTILEVEL INVERTERS

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***Abstract*: The present work deals deep review of study and analysis of 3 phase construction of multipulse and inverters using different topologies and configurations. The most purpose of this is to review the modulation techniques and compare them with one anotheranalysing their benefitsand drawbacks. Their applications areanalysedwith their functioning like the cascaded electrical converter work as a function of a rectifier or charger for the batteries of an electrical vehicle whereas the vehicle was connected to an ac supply system.**

***Keywords*: multipulse converters, modulation techniques, Total harmonic distortion, multi-level.**

1. Introduction: Numerous industrial applications have begun to need higher power equipment in recent years. Some medium voltage motor drives and utility applications need medium voltage and power unit power level. For a medium voltage grid, it'shardto attachjust one power semiconductor switch directly. As a result, a construction power convertor structure has been introduced as an alternate in high power and medium voltage things. A constructionconvertor not solely achieves high power ratings, howeverconjointlypermitsthe employment of renewable energy sources.

1.1Multi pulse converters: These are the most fundamental solution for harmonic problem in a three-phase converter system. With the advancements in technology advances these converters and other power electronic devices with integrated magnetic features such as high quality of input power and improved performance would be required by many industrial, commercial applications, power supplies. The effect of increasing the number of pulses of AC to DC converters directly alters its performance parameters like ripple percentage, form factor and the total harmonic distortion.

Why use Multi-Pulse Technique

The term multi-pulse is not unique, in principle it refers to presence of pulse in multiple count per cycle. However, in the power electronics industry, it related to the converters which is operating in a 3 phase system and provides greater than 6 pulse of DC output per cycle.

In multi-pulse method multiple converters are connected in such a way so that the harmonics generated by one converter are negated the harmonics produced by other converters. Thus certain harmonics related to number of converters are eliminating by the power source. In a multipulse converters assumed that the DC link uses a filter such that any ripple caused by the DC load does not significantly influence the shape of DC current. Results of multi-pulse systems give two major accomplishments namely:-

1. It reduces the current harmonics of the AC input line.
2. It reduces the voltage ripple of DC output.

Reduction of AC input line current harmonics is very important as regards the impact the converters on the power system. Multi-pulse strategies are characterized by the apply of multiple converters with a universal load.

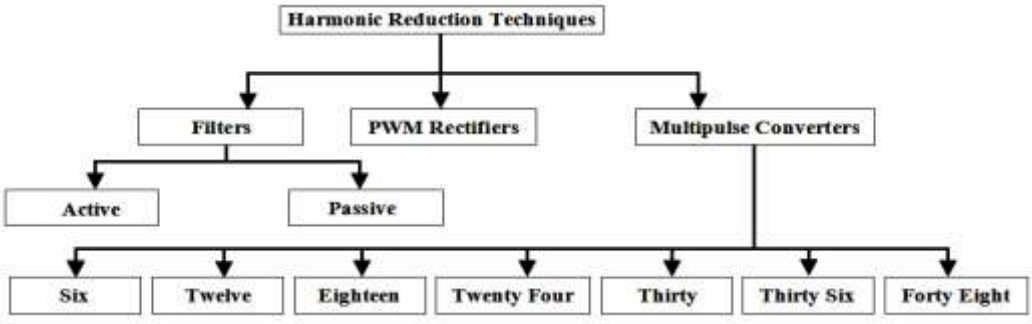

Fig. 1 Various Harmonic Reduction Techniques

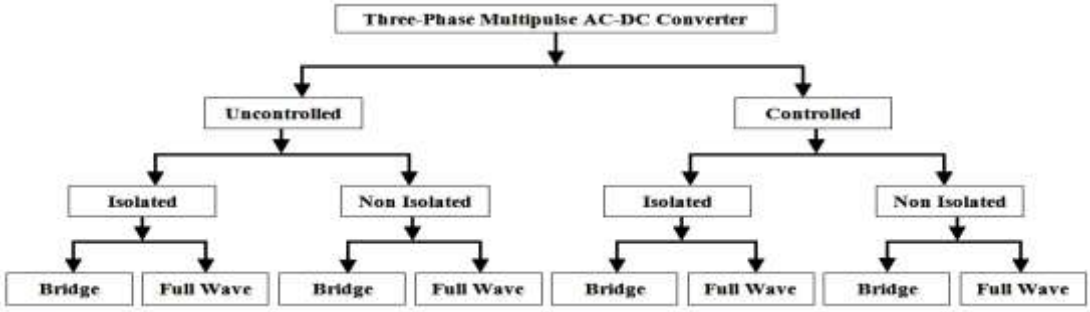

Fig. 2 Multi-Pulse Converter Configuration

Phase shifting transformers are a necessaryingredient and supply the mechanism for cancellation of harmonic current pairs, e.g. the 5^{th} and 7^{th} harmonics or the 11^{th} and 13^{th} so on. Thus for harmonic current reduce by the multipulseconverters is connected with phase shifting transformers. Fig.1. & 2 given below shows the various harmonics reduction techniques

1.3 Multipulse Converter Advantages Compared to Other harmonic compensation techniques

1. The performance parameters such as total harmonic distortion (THD) of AC mains current and ripple factor of output DC voltage improve simultaneously.
2. The improvement is independent of supply frequency variation, unlike passive filters.
3. Economic, maintenance free and efficient.
4. Minimal or no control required as Diodes and/or thyristors are mainly used.
5. Higher pulse number means fewer input harmonics (better p.f.), and steady state output.
6. High Efficiency.

1.4 Multilevel Inverter

The power within the battery is in DC mode and also the motor that drives the wheels typically uses AC power, so there ought to be a conversion from DC to AC by an influenceconvertor. Inverters willdo that conversion. The only topology which will be used for this conversion is that the two-level electrical converter that consists of 4 switches. Every switch wantsAN anti-parallel diode, therefore there ought to be conjointly four opposing parallel diodes. There also aredifferent topologies for inverters.

1.1.1. Working of Multi Level Inverter

A structureelectrical convertermay be a power electronic system that synthesizes a curving voltage output from many DC sources. These DC sources are often fuel cells, star cells, extremist capacitors, etc. the mostplan of structure inverters is to owna more robustcurving voltage and current within the output by mistreatment switches serial. Since several switches area unitplaceserial the change angles area unitnecessarywithin thestructure inverters as a result of all of the switches ought to be switched in such the simplest way that the output voltage and current have low harmonic distortion.

1.4 Multilevel Inverters

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1.4.1 Multilevel Inverter Topologies

From the electrical energy conversion purpose of readwe tend to distinguish four basic convertortypes[1]. Rectifiers convert AN input AC voltage and current to an output DC voltage and current, choppers convert AN input DC voltage and current to an output DC voltage and current of various values, inverters convert AN input DC voltage and current to an output AC voltage, current, frequency and count of phases, AC converters convert AN input voltage, current, count of phases and frequency to an AC energy with completely different parameters. The frequency converters that convert AN input frequency to AN output frequency whichat the same time maintain the count of phases produce a subgroup of AC converters and that theyarea unitthere most wide-spread converters within the field of electrical drives.

The basic topologies of converters for electrical drives is classified as in Fig. 1., Even so, it'ssensibleto stay in mind that every power converterconsists of power electronic devices that area unit connected into a selectedelectricalthemewhicharea unitmanagement by a selected control strategy.

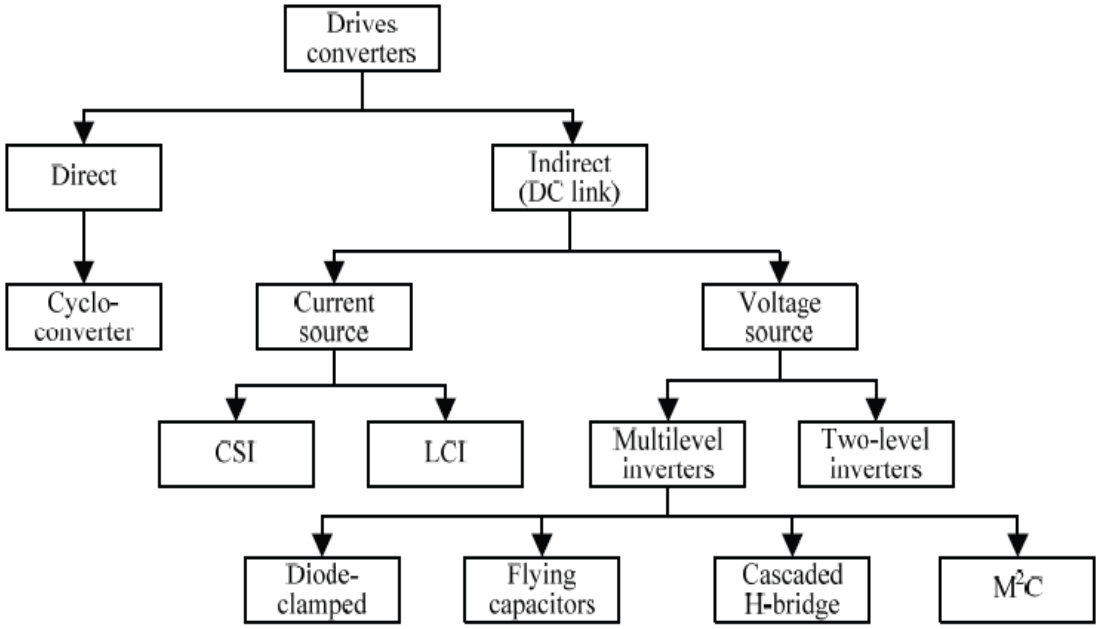

Fig. 1 Classification of drives converter topologies

1.4.1.1 Diode-clamped Topology

Five years oncethe outline and realization of the primary cascaded H-bridge megacycle per second, Baker (1980) planneda brand new topology – a neutral-point-clamped constructionelectrical converter, particularly a three-level and a five-level affiliation. However, only one year later Nabae, Takahashi and Akagi (1981) printeda pieceregarding the implementation of pulse-width modulation for this topology and that they introduced their initial results of the three-level performance. This topology was the primary one that created it doableto supplyassociate output voltage from only DC supply.

1.4.1.2 Flying Capacitor Topology

Generally, within the theory of structure inverters, the complexness of the ability circuit in additionbecause themanagementwill increasechop-chop with eachalternative addition level. Therefore, the principle operate of the flying electrical deviceelectrical converter (FCI) are explained on a three-level electrical converterinitial. The relationships and natural connections between inverters with completely differentvariety of levels and also thecomplexness growth are apparent if three-, four- and five-level inverters are introduced.

1.4.1.3 Cascaded H-bridge Topology

The first multi coupling based semiconductors was delineated and made by Baker and Bannister (1975). It had been a cascaded topology thatcould be a serial association of one-phase converters. Today, these converters square measurecalled cascaded H-bridge converters. A basic theme of a three-phase five-level cascaded H-bridge constructionelectrical converter is shown in Fig.2,Every leg consistsof 1part full bridges connected in chain.

1.5 Harmonics

Harmonics square measurecurved voltages or currents having frequencies that square measurewhole number multiple of the frequencies at thatprovide system are styleto control. Harmonics square measuremade by linear instrumentation, likearc furnaces, variable speed drives and massesthat use power physical science. Voltages or currents having frequency elements that aren'twhole number multiple of frequencies at thatthe provision system is to control.

1.5.1 How harmonics Produced

The harmonic results thanks to the operation of power electronic converters. The harmonic voltage and current ought to be restricted to the suitable level at the purpose of association to the network. To make sure the harmonic voltage at intervals limit, everysupply of harmonic current willpermitsolely a restricted contribution, as per the IEC-61400-36 guideline. The fastshiftprovidesan outsized reduction in lower order harmonic current compared to the road commutated convertor, however the output current can have high frequency current and might be simply filter-out.

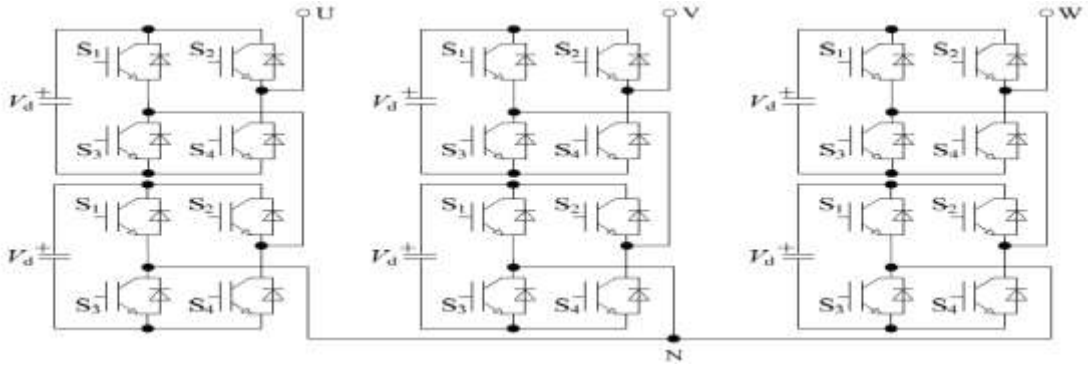

Fig.2 Basic scheme of a three-phase five-level cascaded H-bridge multilevel inverter

1.5.2 Effect of Harmonics

Harmonic distortion will have prejudicial effects on electrical instrumentation. Unwanted distortion will increase the present in power systems which end in higher temperatures in neutral conductors and distribution transformers. Higher frequency harmonics cause extra core loss in motors which ends in excessive heating of the motor core. These higher order harmonics also can interfere with communication transmission lines since they oscillate at an equivalent frequencies because the transmit frequency.3 If left uncurbed, increased temperatures and interference will greatly shorten the lifetime ofequipment and cause harm to power systems.

2 Methods for reduction of harmonics in multilevel

- Pulse width modulation techniques
- Sinusoidal Pulse Width Modulation Techniques

3 Conclusions

The current trend of modulation control for multilevel converters is to output high quality power with high efficiency. For this reason, popular traditional PWM, sinusoidal PWM (SPWM) methods and space vector PWM (SVPWM) methods are not the best methods for multilevel converter control due to their high switching frequency. The resultant method can solve low order harmonic equations, but cannot solve high order harmonic equations. In this thesis, switching angles for each H-Bridge converter are equal. If the switching angle numbers for each H-Bridge converter are not equal, it may be possible to find more solutions for a wider modulation index range.

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