INVESTIGATIONS ON THIRD HARMONIC INJECTION MODULATION SCHEME FOR MULTILEVEL INVERTERS

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Abstract

The multilevel voltage supply inverter is lately utilized in many industrial functions such as ac energy supplies, static VAR compensators, pressure systems, etc. One of the large blessings of multilevel configuration is the harmonic discount in the output waveform besides growing switching frequency or reducing the inverter energy output. The output voltage waveform of a multilevel inverter is composed of the wide variety of stages of voltages, generally received from capacitor voltage sources. The proposed switching method is investigated through MATLAB simulation.

1. INTRODUCTION

In current years, enterprise has begun to demand greater energy equipment, which now reaches the megawatt level. Controlled AC drives in the megawatt vary are generally linked to the medium-voltage network. Today, it is difficult to join a single electricity semiconductor swap immediately to medium voltage grids. For these reasons, a new household of multilevel inverters has emerged as the answer for working with greater voltage levels. Depending on voltage tiers of the output voltage, the inverters can be categorised as two-level inverters and multilevel inverters. The inverters with voltage stage three or extra are referred as multilevel inverters. Multilevel inverters have emerge as captivating specially due to the fact of the extended strength ratings, multiplied harmonic performance and decreased EMI emission that can be carried out with the more than one DC tiers that are on hand for synthesis of the output voltage.

Limited fossil gas reserves and ever growing populace are posing a difficult problem of catering the growing demand of electrical energy. At the equal time, environmental problems such as international warming are additionally a purpose of serious challenge to humanity. In response to these problems, most nations have adopted insurance policies which commonly cowl two directives:

- Efficient utilization of modern strength resources.
- Finding out approaches for wonderful utilization of renewable power resources.
- The conversion of energy from one shape to every other is a predominant phase of the utilization process. Hence, an environment friendly and wonderful conversion method is wanted to limit the waste of strength and enhance the energy quality.

BACKGROUND OF THE RESEARCH

Multilevel inverters have been underneath lookup and improvement for greater than three many years and have discovered profitable industrial applications. However, this is nevertheless a technological know-how underneath development, and many new contributions and new business topologies have been pronounced in the final few years. The intention of this dissertation is to crew and assessment current contributions, in order to set up the contemporary nation of the artwork and traits of the technological know-how to furnish readers with a complete and insightful assessment of the place multilevel converter technological know-how stands and is heading. This chapter first gives a short overview of well-established multilevel inverters strongly oriented to their contemporary nation in industrial functions and then centres the dialogue on the new multilevel inverters that have made their way into the industry. Multilevel inverters have been attracting increasing pastime currently the essential motives are; improved electricity ratings, extended harmonic performance, and decreased electromagnetic interference (EMI) emission that can be archived with more than one DC stages that are synthesis of the output voltage waveform. In precise multilevel
inverters have considerable demand in functions such as medium voltage industrial drives, electric powered vehicles, and grid related photovoltaic systems.

Up-to-date, there are many techniques, which are utilized to inverter topologies. In multilevel technology, there are countless popular modulation topologies as follows:

- Sinusoidal or “Sub harmonic” Natural Pulse Width Modulation (SPWM)
- Selective Harmonic Eliminated Pulse Width Modulation (SHE PWM) Programmed-Waveform Pulse Width Modulation (PWPWM)
- Optimized Harmonic Stepped-Waveform Technique

II. Control Scheme
The control scheme for the multilevel can be described from the waveform tested underneath in Fig.1 and Fig.2. The wave structure tested below suggests the carrier and reference present day for a 9 stage diode clamped multilevel inverter. As it can be confirmed from the decide that a 1/3 harmonic waveform has been superimposed on a quintessential reference wave. The resultant reference waveform is a flat topped wave having a modulation index tons much less than 1.

Fig. 1 carrier and reference waveform

Fig. 2 subsystem for the proposed modulation scheme
III Results and Discussion

Fig. 3 carrier and reference wave form for modulation index 1 and k=0.25

Fig. 4 Voltage waveform for Ma=0.9, k=0.25

Fig. 5 Voltage waveform for Ma=0.8, k=0.25
Fig. 6 Voltage waveform for Ma=1.0, k=0.25

Fig. 7 Carrier and reference waveform for modulation index 1 and k=0.5

Fig. 8 Voltage waveform for Ma=0.9, k=0.5
The simulation consequences for the proposed scheme has been validated for one of a variety modulation index Ma, and for special value of harmonic injection everyday k. for occasion k=0.5 plausible the ratio of the injected harmonic signal to reference is 0.5. It can be in fact decided from Fig.3 and Fig. 7 that the model in the fee of good enough penalties in a sharp dip in the pinnacle rate of modulation signal. Furthermore a decrement in rms charge of quintessential aspect is located at reduced modulation index , on the contrary a moderate model in THD is observed. On the special hand from Fig. 5 and Fig.9 , for ma=0.8 and k=0.25, rms quintessential fee is 341.1volts and THD is 28.64%, even as for the equal Ma and k=0.5, rms fee increses to 349.1 at the same time as THD is 57.96%. Thus it can be concluded that lengthen in harmonic injection magnitude good enough penalties in most utilisation of DC bus then again at the equal time moreover deteriotes the spectral propperties of the wave shape as demonstrated in table.1

<table>
<thead>
<tr>
<th>Modulation index</th>
<th>K=0.5</th>
<th>K=0.25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ma=0.8</td>
<td>THD 57.96</td>
<td>RMS 349.1</td>
</tr>
<tr>
<td>Ma=0.9</td>
<td>THD 50.10</td>
<td>RMS 381.9</td>
</tr>
</tbody>
</table>

IV Conclusions

After analyzing a range of Journals/Articles, Conference Papers and IEEE Transactions, it has been concluded that many researchers have tried to decrease harmonics in diode clamped multilevel inverter and some of the researchers have mentioned about the applications, overall performance of their experimentation consequences in their work. A ideal charge of ok and modulation index can additionally quit end result in an extended perfomance in phrases of THD and DC bus utilisation.

References


