Homework 9

Page 184. Chinese textbook

Question 7.3

What is the difference between unipolar PWM and bipolar PWM? How many voltage levels are there in the output phase voltage (the voltage between the output terminal and the mid-point of the dc voltage) and line-to-line voltage in a three-phase bridge PWM inverter?

Question 7.4

What's the basic principle of Selected Harmonic Elimination PWM? Assume there are total 10 switching instants controllable during half cycle of the signal, how many orders of harmonic can be eliminated?

Answer 7.3

The triangular wave carrier has only a single polarity in the positive half cycle or negative half cycle of the signal wave, and the PWM waveform obtained only changes in the unipolar range in the half cycle, which is called unipolar PWM control mode.

The triangular wave carrier is no longer unipolar, but has positive and negative parts, and there also exist positive and negative part in the PWM wave.

In a three-phase bridge PWM inverter, there are three kinds of output phase voltages:

$$\frac{1}{2}U_d \qquad -\frac{1}{2}U_d$$

In a three-phase bridge PWM inverter, there are three kinds of output line voltages:

$$U_d \qquad 0 \qquad -U_d$$

Answer 7.4

First, try to make the waveform symmetrical. Meanwhile, in order to eliminate even harmonics, the positive and negative half periods of the waveform should be symmetrical. Besides, in order to eliminate the cosine term in harmonics, the waveform is symmetrical with the axis, $\omega t = \frac{\pi}{2}$ before and after the positive a quarter to this period. Therefore, there are 5 time point of switch that can be controlled by ourselves. Thus one of five points is used to control the magnitude of fundamental wave as well as the other eliminating four kinds of harmonics for 4 different frequency.