4.8 INTRODUCTION TO SPACE VECTOR MODULATION

❖ SVM is another direct digital PWM technique

❖ It has become a basic power processing technique in three-phase converters.

❖ SVM based converter can have a higher output voltage output.

❖ The output voltage is about 15% more in case of SVPWM .

❖ The current and torque harmonics produced are much less .

❖ The maximum peak fundamental magnitude of the SVPWM technique is about 90.6% of the inverter capacity

❖ SVPWM is accomplished by rotating a reference vector around the state diagram, which is composed of six basic nonzero vectors forming a hexagon. The reference is sampled at fixed interval and is formed using the voltage vectors of the particular sector in which reference lies along with zero vectors.

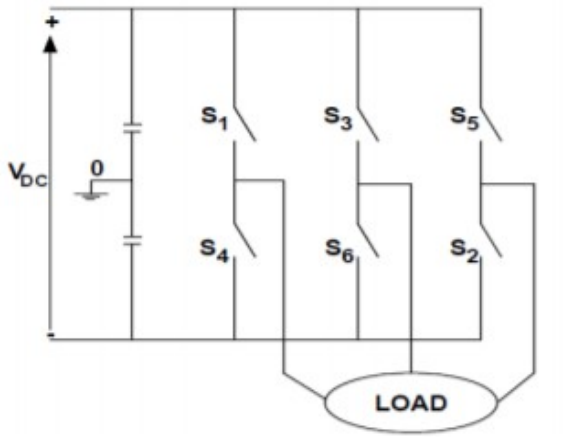

Figure 4.8.1 Basic diagram of two level three phase inverter

[Source: "Power Electronics" *by* P.S.Bimbra*,* Khanna Publishers *Page: 358]*

From fig.It has six switches (S1-S6) and each of these is represented with an IGBT switching device. A, B and C represents the output for the phase shifted sinusoidal signals. Depending on the switching combination the inverter will produce different outputs, creating the two-level signal (+Vdc and -Vdc).

The switches 1,3 and 5 are the upper switches and if these are 1 (separately or together) it turns the upper inverter leg ON and the terminal voltage (Va, Vb, Vc)is positive (+Vdc). If the upper switches are zero, then the terminal voltage iszero.

The lower switches are complementary to the upper switches, so the only possible combinations are the switching states: 000, 001, 010, 011, 100, 110, 110, and 111.

This means that there are 8 possible switching states, for which two of them are zero switching states and six of them are active switching states. These are represented by active (V1-V6) and zero (V0) vectors . The zero vectors are placed in the axis origin.

Next step is to calculate the dwell times or time for which we have to provide voltage vectors, so as to generate the Vref at that particular point of time. Vref can be found with two active and one zero vector. For sector 1 (0 to pi/3), Vref can be generated with V0, V1 and V2 as shown in fig.3. Vref in terms of the duration time can be considered as:

Vref *Ts= V1*T1+V2*T2+ V0*T0 ,Where Ts is the sampling time (3.3 *104sec) and T1, T2 andT0 are the time periods for which V1, V2 and V0 are applied for particular sample.

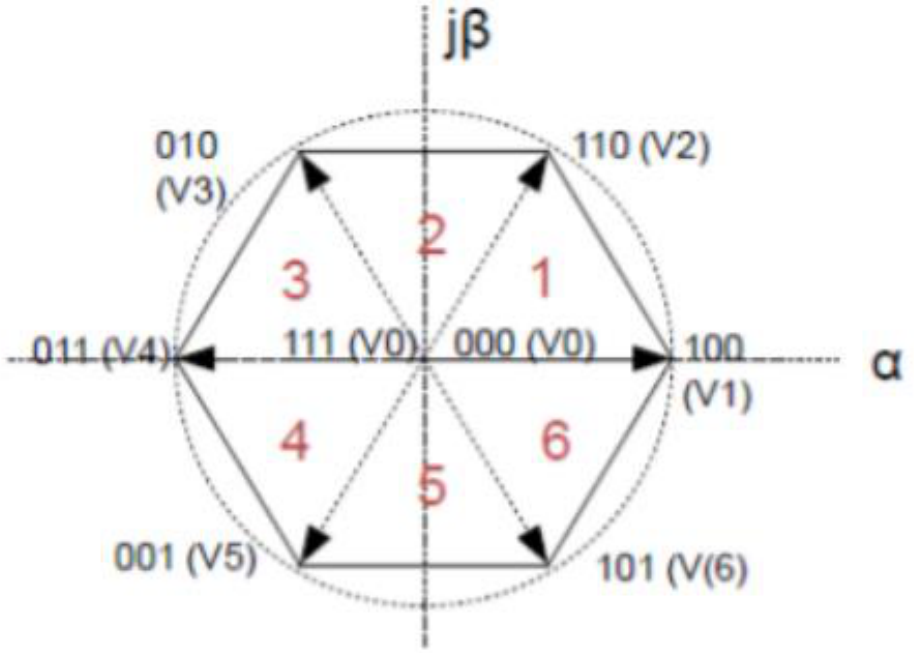

Figure 4.8.2 Space vector diagram of two level three phase inverter

[Source: "Power Electronics" *by* P.S.Bimbra*,* Khanna Publishers *Page: 359]*