To achieve SVPWM technique it is necessary to obtain the length and angle of reference voltage vector. From the angle of the reference voltage vector the exact location of the reference voltage vector is derived so as to determine in which sector the reference voltage vector is located.

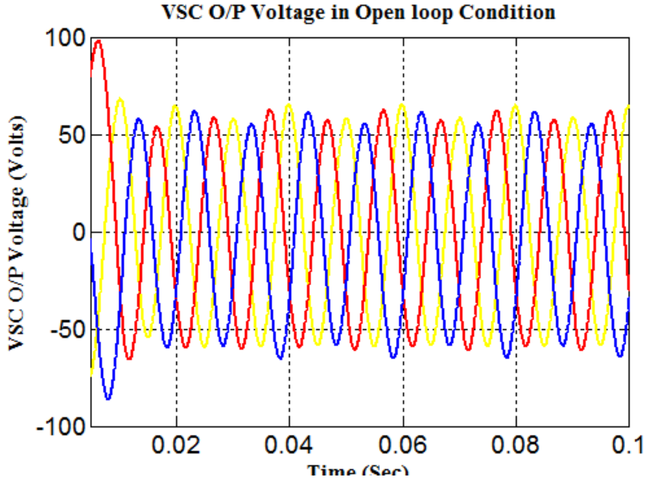

Figure 9: VSC Output in Open loop Condition

As shown in fig. 9. When the voltage source converter is switched by SVPWM technique it can work both in open loop condition and in closed loop condition. When the system is working in Open loop condition the entire system oscillates about the point of equilibrium from the reference value after time t=t0. To avoid such oscillations the system is made to work in closed loop system.

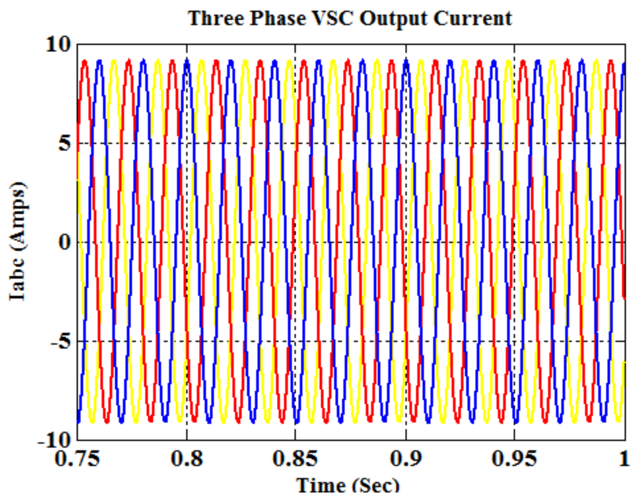

Figure 10: VSC Output in Open loop Condition

The Fig. 10. gives the simulation output of per phase and three phase current at the output of the VSC. When the System is made to work in Closed loop condition the oscillations at the output of the converter circuit is eliminated and the performance of the circuit is increased.

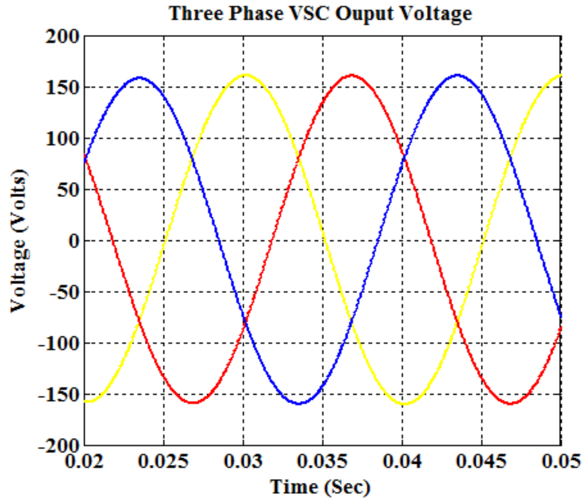

Figure 11: SVPWM - VSC Output Voltage

The Fig. 11. shows the output voltage of the voltage source converter. In this there is no distortion at the output and hence the efficiency of the system is increased. When this converter output voltage is connected in-between the load and source of the transmission or distribution system, the power factor is improved and hence the Voltage Source converter is made to work as STATCOM for Reactive Power Compensation.

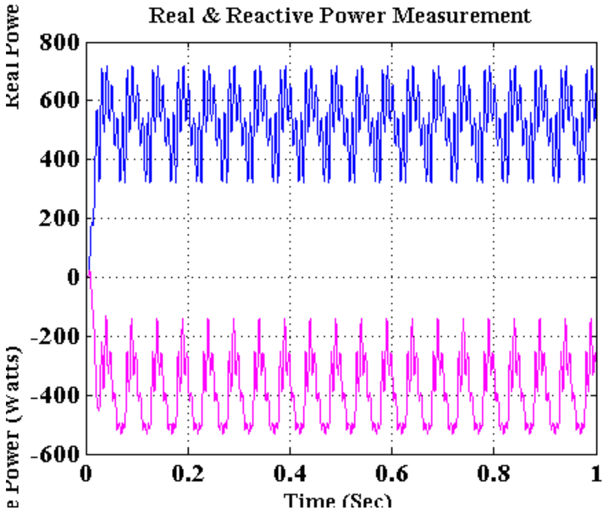

Figure 12: Real & Reactive Power On Converter Side

The Fig. 12. shows the Simulation result of Real and Reactive Power measurement on Converter side. On observing the result the reactive power is completely negative and hence it is compensated and only the real power has been transferred to the load side. As the reactive power is compensated the Power factor of the Voltage source converter is 0.91.

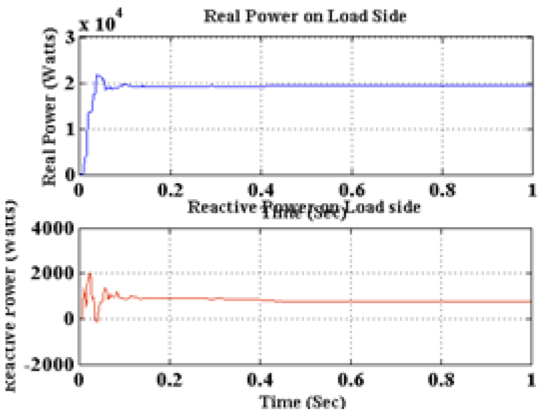

Figure 13: Real & Reactive Power On Load Side

The Fig. 13& 14 shows the Simulation result of Real and Reactive Power and V & I measurement on load side. On observing the result the real power on Load side is around 22KW whereas the reactive power is 2KW which is comparatively very less and it can be neglected and hence the Power factor on the load side is achieved approximately as Unity.

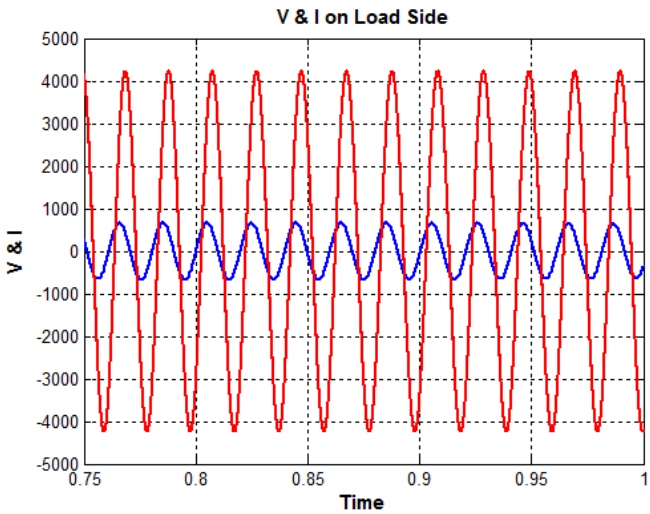

Figure 14: V & I on Load Side

7. Conclusion

The Pulse width Modulation is obtained either by analog technique or by digital techniques. The generation of pulses by SVPWM technique is a digital technique. The advantage of digital control technique over analog technique is that it is possible to achieve Stability, Precision (noise immunity) and Flexibility. With digital control the stability of the system is achieved as there is no drift, offset or aging effects. Digital technique is more flexible as it can be customized by changing the software. With the use of digital technique the DC bus utilization factor can be achieved fully.

Space Vector PWM technique in three phase Voltage Source Converter makes it possible to adapt the converter switching behavior to different loads like half load, full load, linear load, non-linear load, static load, pulsating load, etc. In combination with the Z-Source technique and grounding three phase transformer in the output this provides the following advantages:

i) Very low values can be reached for the output voltage THD (<2% for linear loads., <3% for non linear loads)
ii) Robust dynamic response (<3% deviation at 100% load step, recovery time to <1%: <20ms)
iii)In SVPWM technique the DC bus utilization factor can be increased by 15% more than the conventional PWM technique.
iv)With the use of SVPWM switching the peak switch current at the time of switching is reduced and hence looses in the switch is reduced. Therefore stress on the converter switches is less and hence the audible noise can also be influenced and therefore it can be minimized.
v) Space Vector Pulse width Modulation in Voltage source Converter provides excellent output performance, optimized efficiency, and high reliability compared to conventional Pulse Width Modulation.

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