Abstract

The power factor of a converter is made up of two components: displacement and distortion. The effects of two are combined into total power factor. The displacement factor is the ratio of the active power of the fundamental wave in watts, to the apparent power of the fundamental wave, in volt-amperes. This is the power factor as seen by the utility metering by watt-hour and VAR-hour meters. The distortion component is that part associated with the harmonic voltages and currents present. As lower power factor causes wastage of power in transmission and distribution, de-rating of electrical apparatus, poor voltage regulation etc., it is necessary for the energy consumer to maintain good power factor. Virtually all of today's high-performance electronic equipment uses a static power rectifier, which conducts current for part of a cycle through multiple paths in order to convert alternating current to direct current. It pulls current in sharp, irregular or "nonlinear" pulses. Thus, power converters are the major source of harmonics, which in turn lowers the power factor on supply side. Other electrical equipments, which are connected to the same line, suffer from bad power quality.

To improve the power factor on supply side it is necessary to eliminate harmonics on supply side. Filters can be used to reduce the harmonics, but it will not eliminate harmonics completely due to constraint on filter size. Elimination of lower order harmonics will require big and bulky filter. Active power factor correction method is used to improve power factor.
Space Vector PWM technique is used for the active front-end power factor correction. The power circuit comprises of three IGBT devices. Active switching of IGBTs maintains unity power factor on supply side. Low pass filter is used to eliminate switching frequency harmonics. While the lower order harmonics will be eliminated by Space Vector PWM principle. Control circuit will be implemented using 80C196MC micro-controller. This micro-controller has dedicated PWM generator and three-phase complementary waveform generator. Alternately, SVPWM can also be generated using 89C51 microcontroller, but with reduced PWM frequency. IGBT drivers are used to provide isolation between power circuit and control circuit as well as for amplification of PWM signal.

The aim is design and fabrication of three-phase controlled rectifier to achieve the following performance;

- Variable output voltage with regulation
- Reduction in harmonics on supply side, i.e. sinusoidal input current
- Reduction of switching losses due to less number of switching devices
- Reduction of voltage ripples on DC side