

Harmonics and mitigation techniques - Simplified

Harmonics are pollutants in electrical network. Normally current harmonics are the cause for generation of voltage harmonics. Source impedance is the reason. Harmonics are measured in terms of THD (Total harmonic distortion) in percentage.

Current harmonics in any network are generated due to non-linear loads. Loads which do not draw sinusoidal current from sinusoidal voltage are called non-linear loads. Typical non-linear loads in present day industries are;

- Variable frequency drives
- DC motor drives
- Rectifiers
- Inverters and converters

All electrical machines are designed to give best performance with pure sine wave voltage input.

Presence of harmonics results in poor efficiency and high unexplained failure rates in various equipment.

To take care of this problem, electricity distributing companies have started imposing regulations with respect to injecting harmonics into the grid by consumers. There are a few standards like IEEE-519 for generation of harmonics.

It is impossible to avoid non-linear loads like VFD, DC motor drives in present day industries. But it is also necessary to improve power quality.

For harmonics mitigation, the following options are now available.

1. Use of compensated electrical equipment which generate current harmonics within limits.
2. Instead of plain capacitors, use detuned capacitors for power factor improvement.

3. Use passive filters to filter out harmonic currents. They consist of inductor combined with relatively small capacitor bank. Effective design achieves reduction of harmonic currents generated by VFDs and other 3 phase 6 pulse rectifier loads down to 5%.

4. Use specifically designed Active filters

5. Use of combination of active and passive filters is preferred in some cases, on account of commercial and technical considerations