EE524: POWER QUALITY ASSESSMENT & REMEDIAL MEASURES (3-0-0: 3)

Power Quality- An Overview

Power quality definition, PQ characterization: Transients, Short duration and long duration voltage variations, Voltage imbalance, waveform distortion, voltage fluctuations, power frequency variation-power acceptability curves: CBEMA, ITIC -- sources of Electric Power Quality problem in power system: poor load power factor , Non- linear and unbalanced loads, DC offset in loads , Notching in load voltage, Disturbance in supply voltage- power acceptability curves-IEEE guides, EMC standards and recommended practices.

Voltage Variations

Voltage sags- Magnitude & Duration – types- Sources of sags-Estimation of Voltage sag performance: Transmission and Utility distribution system, Effect of Sag on AC Motor Drives, Single- Phase Domestic and Office Loads, Monitoring and mitigation of Voltage sag. Origin of Long and Short interruption-influence on various equipments-Basic reliability indices related interruption-monitoring and mitigation of interruption.

Power Quality Analysis

Measurements of Voltage, Current, Power, Energy, Power Factor- Time Domain methods and Frequency Domain methods: Laplace's Fourier and Hartley transform-The Walsh Transform- Wavelet Transform. Harmonics and Distortion, Voltage versus Current Distortion, Harmonics versus Transients, Harmonics Indexes, Harmonics Sources from Commercial Loads, Harmonics Sources from Industrial Loads.

Power Quality Monitoring

Introduction, transducers, CT, PT, power quality instrumentation, Harmonic monitoring, event recording, flicker monitoring, assessment of voltage and current unbalance, Symmetrical components of phasor quantities , Instantaneous symmetrical components, Instantaneous real and reactive powers, analysis of distortion: On-line extraction of fundamental sequence components from measured samples.

Power Quality Enhancement

Utility –**Customer** interface-Harmonics filters: passive , Active and hybrid filters- Customer power device: Network configuration Devices, Load compensation using DSTATCOM ,Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P-Q theory , Synchronous detection method- Customer power park- Status of application of customer power devices.

Text Books and References

1. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publishers.
2. M. H. Bollen, "Understanding Power Quality Problems", Wiley-IEEE Press.
3. J. Arrillaga, "Power System Quality Assessment", John Wiley.
4. J. Arrillaga, B. C. Smith, N. R. Watson & A. R. Wood, "Power System Harmonic Analysis", John Wiley.
5. S. Santoso, H. W. Beaty, R. C. Dugan, M. F. McGranaghan, "Electrical Power System Quality", McGraw Hills.
6. M. H.J. Bollen, "Understanding Power Quality Problems- Voltage sag & Interruptions", IEEE Press.
7. A. Ghosh, " Power Quality Enhancement using Costum Power Devices", Kluwer Academic publishers.