ABSTRACT

Electric powers generated by the utilities are distributed to the consumers in the form of ac voltage at 50Hz frequency. The utilities have a control on the design and operation of the equipment used for transmission and distribution of power and can, therefore, keep the voltage and frequency delivered to their customers within close limits. The power electronic converters act as loads are nonlinear and inject distorted currents in the network and consequently generate harmonic voltage waveforms. With the proliferation of nonlinear loads such as diode/thyristor rectifiers, non sinusoidal currents degrade power quality in power transmission and distribution systems. Typically, the scope of the electric power system is to generate electrical energy and to deliver this energy to the end-user equipment at an acceptable voltage. As nonlinear loads draw harmonic and reactive power components of current from ac mains, the quality of power deteriorates. The Shunt Active Power Filter is used in power systems for the compensation of harmonic currents generated by nonlinear loads.

A reference current estimation method for control of Shunt active power filter using a digital filter based synchronous reference frame theory is presented. To extort the fundamental component of source current, the synchronous reference frame theory is suitable because of its easy mathematical calculation compared to the instantaneous reactive power theory and other control algorithms. The compensation process is based on sensing line currents only, which include sensing of harmonics or reactive power components of the load. Various simulation results are presented under steady state and Transient conditions and the performance of PI controller. During sudden changing load the capacitor gets stressed, due to this problem overall
system Total Harmonic Distortion has increased. For this Fuzzy gain scheduling controller is used to control the DC link voltage and it is compared with PI controller during transient and steady state conditions. During sudden changing load the overall THD has minimized as compared to PI controller based shunt active power filter.

For industrial applications the load will be continuously varying, so continuous parameter tracking is most essential for controlling the THD for various conditions. Artificial intelligent controller based on mammalian limbic system and an emotional process is presented in DC Link voltage control for three phase shunt active power filter. A novel approach of the intelligent techniques, for control and decision making processes, was introduced that is based on the emotion processing mechanism in the brain, and is essentially an active selection, which is based on emotional cues and sensory inputs. In this work, a model of shunt active power filter system for improving power quality by using the artificial intelligent control system is presented, which controls the DC link voltage spike through the transient period precisely and maintains speedy settling time during sudden changing of load. In this proposed method Brain Emotional Learning Based Intelligent Controller (BELBIC) is used, the response of the DC link voltage is compared with PI and Fuzzy Gain Scheduling controller.

This generation of artificial intelligent controllers that has high auto learning speed with simple arrangement shows outstanding error free environment for industrialized applications. Simulation results obtained with MATLAB and testing results on an experimental SAPF are presented to authenticate the proposed method. The Synchronous reference frame based SAPF system to meet IEEE Standard 519 recommended harmonic standards for various rated nonlinear loads under balanced supply conditions is analysed.