

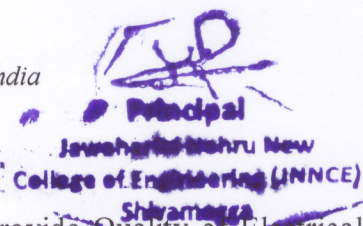
Enhancement of Power Quality using Single Phase Generalised Unified Power Quality Conditioner in Distribution System

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Abstract

The main function of Custom Power Devices (CPDs) is to provide Quality of Electrical Power as per the customer's requirements in the distribution system. For this purpose CPDs are connected in the medium or low voltage level distribution systems with high speed power electronic converters/static controllers. In this paper a CPD called GUPQC consisting of three voltage inverters connected to common DC-link energy storage capacitor is used in the three bus distribution system to address power quality issues. GUPQC simulation model in single phase system is simulated in MATLAB. The p-q theory control strategy is used to obtain required compensating signal in order to compensate harmonics of load current at bus-1 and UVT control strategy is used to generate compensating signal in order to mitigate the voltage variations during voltage sag / swell at the source bus.

Keywords: Custom Power Devices (CPDs), Active Power Filter (APF), GUPQC, Voltage Sag, Voltage Swell, Electrical Power Quality (EPQ) and Distribution System (DS).

I. Introduction

The aim of the electrical utilities is to deliver continuous sinusoidal voltage with a fixed magnitude and frequency to their consumers along with regulated sinusoidal currents at the AC mains. Today's AC distribution systems face serious Electrical Power Quality (EPQ) issues such as high reactive power requirements, unbalanced loads, harmonic-rich load currents and very high neutral currents [1]. EPQ enhancement in DSs is therefore crucial to counteract the inevitability of excessive use of nonlinear loads in electrical devices which are prone to EPQ issues. The consistency and price of EPQ for the new economy in the smart grid distribution system (DS) has now become a priority as electrical utilities shift towards smart grid [2-3]. The main function of CPDs is to provide EPQ as per the customer's requirements in the distribution system. For this purpose CPDs are connected in the medium or low voltage level distribution systems with high speed, power electronic converters or static controllers [4-5]. In 2011, a recent GUPQC configuration was proposed, which is a combination of two series and one shunt VSCs connected to three independent distribution feeders/buses. It mitigates two feeders/buses voltage imperfections and other feeder/bus current imperfections. GUPQC improves the EPQ of a multi-bus/multi-feeder