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Harmonic reduction and power quality improvenment by using UPQC

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ABSTRACT

An UPQC is a static series compensator that injects voltage and current in series to the distribution system, regulating the load side voltage. It is connected between the supply and the sensitive load to compensate the line voltage and current harmonics, reduction of transients into compensation of voltage sags & swell. The pulse width modulation (PWM) controls of the UPQC deal with a well- known frequency spectrum, since it is controlled using voltage and current sinusoidal references, different from the conventional UPQC that is controlled using non sinusoidal references analysis, and experimental results of the developed prototype are presented.

INTRODUCTION

This dissertation attempts to various control strategies providing a reliable solution to the faulted system with the help of UPQC (Unified power quality controller).In normal condition it operates in standby mode.

During the distribution, the nominal voltage is compared with the Voltage variation in order to calculate the voltage to be injected by the UPQC to & quality of power quality. Maintain the supply voltage within limits.

The capable of providing the reactive power compensation but the real power is provided by the energy utilization system.

In the Linear & Non-linear loads, series conditioner device is capable of generating or absorbing real and reactive power with the help of its essential components, namely power circuit & control circuit. Mainly control techniques are available to controlled output voltage, to be injected into the system.

It absorb the various disturbances by injecting appropriate voltage, current into the system thereby relieving the main source from meeting the reactive power demand of the load. It focuses on reliability

Series & shunt transformer

It provides electrical isolation & voltage boost to the system. In a 3-phase system, either 3 single phase units of isolating transformer or 3-phase isolating transformer can be employed for the purpose of voltage injection. While selecting the injection transformer, the determination of expected maximum output voltage is prime significance, both economically & technically. Prior to the level of the distribution system being compensated by UPQC & largest sag to be compensated by VSI at the minimum Dc-link voltage decides the turn ratio of the series injection transformer.

The effects of higher order harmonics on the transformer are related to the positioning of filtering system, i.e. inverter filtering side system & line side filtering.

Proposed system uses 3 single phase units of isolating transformer with unity turns ratio. The LC type filters are provided on the inverter side to deliver the filtered & controlled VSI voltage to the transformer.

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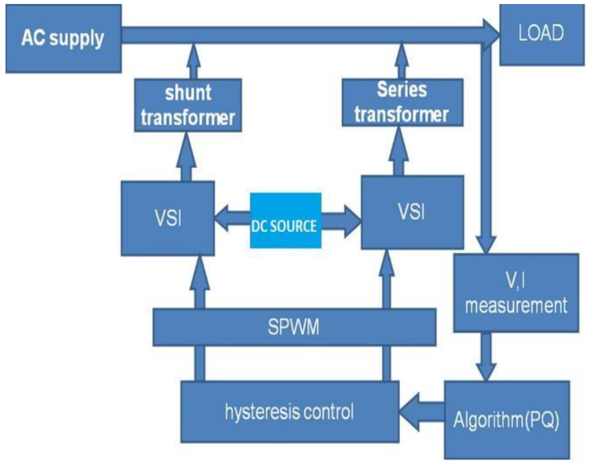
BLOCK DIAGRAM



CONTROL SYSTEM

Several techniques & control philosophy of the UPQC have been implemented for power quality improvement in the distribution system. The UPQC is equipped with a control system to mitigate voltage sags/swells. The control of the UPQC is very important as it involves the detection of voltage sags and swells (start, end & depth of voltage sag). The control strategy can depend on the type of load connected.

Its main purpose is to maintain constant voltage magnitude at the point where the sensitive load is connected under system disturbances. Two basic control strategies of UPQC can be stated as

1. Pre-sag compensation method.
2. Reactive power compensation

PROPOSED SYSTEM

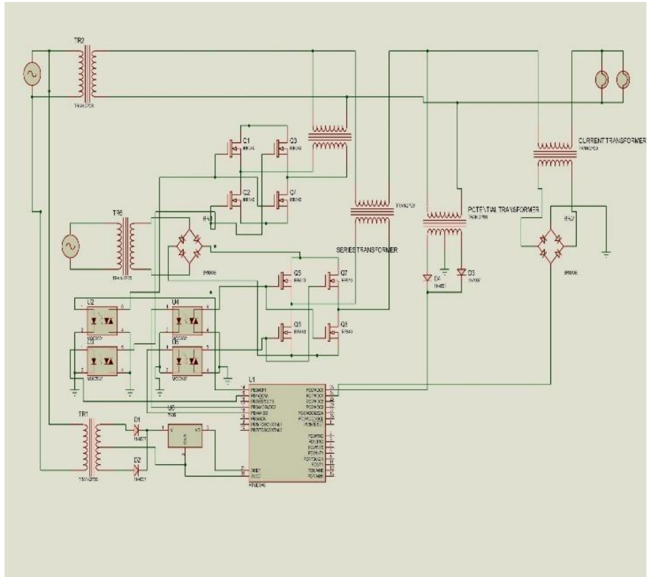
Voltage sags are one of the most severe power quality problems & UPQC is an effective solution to mitigate it. The purpose of control scheme is to control the system output by generating an appropriate control signal prior to the unbalanced condition prevailing in the system.

It generates the signals to enable the VSI (voltage source inverter) by providing proper firing sequence to the circuit.

In this work, different control strategies for Unified power quality controller are investigated with emphasis on voltage sag compensation. Three promising control methods to compensate voltage sags are tested & compared with hardware of UPQC on 11kV system.

The comparison of the performance of three control strategies is made on basis of voltage waveforms & its frequency spectrum analysis

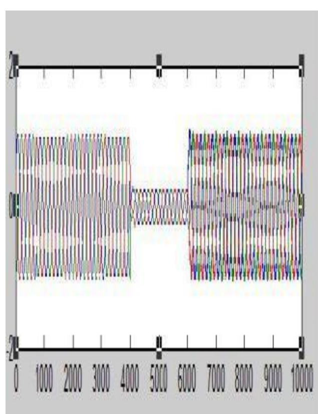
CIRCUIT DIAGRAM



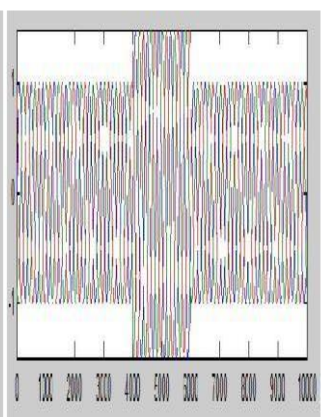
Filter

The Filter is used to remove the pulsated AC. A filter circuit uses capacitor and inductor. The function of the capacitor is to block the DC voltage and bypass the AC voltage. The function of the inductor is to block the AC voltage and bypass the DC voltage.

- I/O and Packages
  23 Programmable I/O Lines
  28-lead PDIP, 32-lead TQFP, and 32-pad QFN/MLF
- Operating Voltages
  5.5V (ATmega8L)
  4.5 - 5.5V (ATmega8)
- Power Consumption at 4 Mhz, 3V, 25°C Active: 3.6 mA
  Idle Mode: 1.0 mA
  – Power-down Mode: 0.5 µA



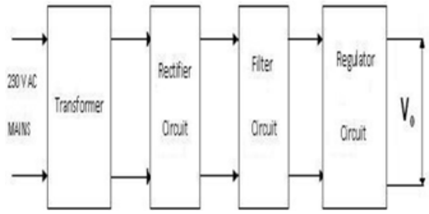
A. sag



B. swell

Power rectifier

Fundamental classes of voltage regulators are linear regulators and switching regulators. Two basic types of linear regulator are the series regulator and the shunt regulator.



Power supply circuit

The stacking factor gives an approximate number to how much of the core is effective when calculating flux. The series regulator is connected in series with the load and the shunt regulator is connected in parallel with the load taken into account.

Flux and Flux Density are related by area. The apparent area of the core is the measured area, where the lamination is included in the measurement. The effective area of the core is the area that actually affects the flux density calculation. The effective area can be found using the following relationship.

The Program memory is In-System Reprogrammable Flash memory. The fast- access Register File contains 32 x 8-bit general purpose working registers with a single clock cycle access time. This allows single-cycle Arithmetic Logic Unit (ALU) operation.

In a typical ALU operation, two operands are output from the Register File, the operation is executed, and the result is stored back in the Register File in one clock cycle.

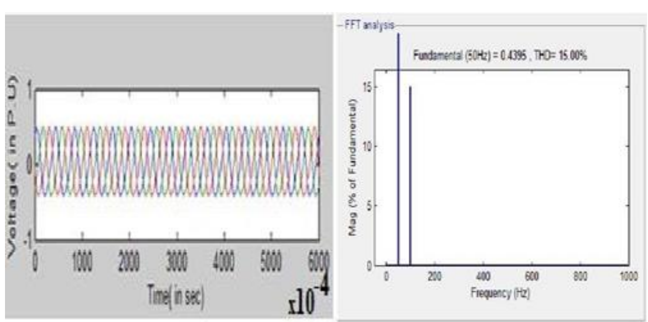
Six of the 32 registers can be used as three 16-bit indirect address register pointers for Data Space addressing enabling efficient address calculations. One of the these address pointers can also be used as an address pointer for look up tables in Flash Program memory. These added function registers are the 16-bit X, Y and Z-register.

CONSCLUSION

The various control strategies are employed & tested for 11kV distribution system. The HCC controller based UPQC, fuzzy controller based UPQC and HCC- fuzzy controller based UPQCs are connected step by step in the compensated feeder to compare their performances. The effectiveness of different control techniques based UPQCs for static linear & static non- linear loads have been investigated

RESULT

Load voltage waveforms & frequency spectrum of hybrid control scheme for static non-linear loaded HCC circuits that the harmonics are effectively reduced to a less value as compared to 23.70% with HCC controller & 17.49% with Fuzzy controller Hardware results indicate that the non-linear control techniques provide better compensation to the system as compared to the linear HCC technique based UPQC connected to the feeder during static non-linear loads.



Balanced condition output

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