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Grid Voltage Regulation By Using Pv Based Dual Topology Of The Unified Power Quality Conditioner(Iupqc)

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ABSTRACT:

This paper introduces an improved controller for Interline Unified vigour great Conditioner (iUPQC), extending from its conventional performance of load voltage law now to grid voltage legislation also. The multiplied iUPQC can act as a Static Synchronous Compensator (STATCOM) on the grid side and as ordinary iUPQC at load part. The multiplied iUPQC approach has a Photovoltaic (PV) array alternatively of the dc link capacitor. The whole system was simulated in MATLAB/SIMULINK. The simulation results are proved to confirm the brand new performance of the gear.

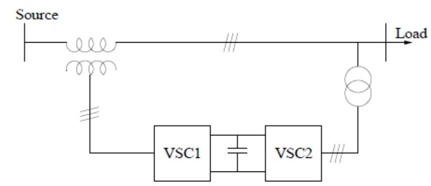
KEY WORDS:iUPQC, power quality STATCOM, THD, UPQC.

INTRODUCTION:

In in these days's power approach scenario, many problems can occur because of the terrible pleasant of the furnished vigour. The drastic increase within the usage of the energy digital devices has precipitated this exceptional power great disorders. On the other hand these energy digital masses as a rule requires an best sinusoidal deliver for his or her smooth functioning. Many devices that can mitigate this power great issues has been invented over years. Essentially the most up to date tendencies in reducing the vigour great problems are the utilization of the multitasking instruments that may compensate a number of energy high-quality problems simultaneously. Such most efficient device is the Unified power first-class Conditioner (UPQC), which used to be first presented by using Hirofumi Akagi in 1995 [1].UPQCs are categorized into one of a kind categories. Interline UPQC (iUPQC) or dual UPQC is without doubt one of the major one among them [2].Mostly, the shunt converter of the UPQC behaves as controlled present supply that compensates the load current likewise the series active filter behaves as controlled voltage source to compensate the voltage imperfections. In the dual configuration of UPQC, known as Interline Unified energy fine Conditioner(iUPQC)the shunt energetic filter acts as a sinusoidal voltage supply and sequence converter as sinusoidal current source. There are a few benefits for the iUPQC over the traditional UPQC, i.E. The utilizing the fundamental confident sequence accessories of the current andvoltage references for the sequence and shunt compensators, where as in conventional UPQC the nonsinusoidal compensating voltages and currents are used [3]. At reward, Static Synchronous Compensators (STATCOM) are generally used for voltage regulation [4].UPQCs and iUPQCs are employed for more exact purposes.A widespread variety of applicability of iUPQC can be reached in smart grids and grid-tied microgrids if another performance of STATCOM will also be combined into traditional iUPQC. This outcome in reduced fee of total process.APhotovoltaic (PV) array can be modelled as an alternative for the dc hyperlink of iUPQC process.

UNIFIED POWER QUALITY CONDITIONER

The provision of both DSTATCOM and DVR can control the power quality of the source current and the load bus voltage. In addition, if the DVR and STATCOM are connected on the DC side, the DC bus voltage can be regulated by the shunt connected DSTATCOM while the DVR supplies the required energy to the load in case of the transient disturbances in source voltage. The configuration of such a device (termed as Unified Power Quality Conditioner (UPQC)) is shown in Fig. 14.15. This is a versatile device similar to a UPFC. However, the control objectives of a UPQC are quite different from that of a UPFC.



CONTROL OBJECTIVES OF UPQC

The shunt connected converter has the following control objectives

1. To balance the source currents by injecting negative and zero sequence components required by the load
2. The compensate for the harmonics in the load current by injecting the required harmonic currents
3. To control the power factor by injecting the required reactive current (at fundamental frequency)
4. To regulate the DC bus voltage.

The series connected converter has the following control objectives

1. To balance the voltages at the load bus by injecting negative and zero sequence voltages to compensate for those present in the source.

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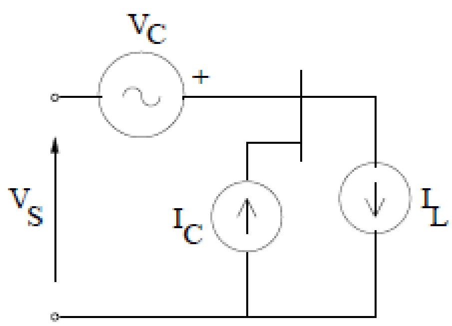
2. To isolate the load bus from harmonics present in the source voltages, by injecting the harmonic voltages

3. To regulate the magnitude of the load bus voltage by injecting the required active and reactive components (at fundamental frequency) depending on the power factor on the source side

4. To control the power factor at the input port of the UPQC (where the source is connected. Note that the power factor at the output port of the UPQC (connected to the load) is controlled by the shunt converter.

Operation of UPQC



The operation of a UPQC can be explained from the analysis of the idealized equivalent circuit shown in Fig. 14.16. Here, the series converter is represented by a voltage source VC and the shunt converter is represented by a current source IC. Note that all the currents and voltages are 3 dimensional vectors with phase coordinates. Unlike in the case of a UPFC (discussed in chapter 8), the voltages and currents may contain negative and zero sequence components in addition to harmonics. Neglecting losses in the converters, we get the relation

$$\langle V_L, I_C\rangle + \langle V_C, I_S\rangle = 0$$

whereX,Ydenote the inner product of two vectors, defined by

$$\langle X, Y\rangle = \frac{1}{T}\int_0^T X^t(\tau)Y(\tau)d\tau.$$

Let the load current IL and the source voltage VS be decomposed into twoComponents given by

$$I_L = I_L^{1p} + I_L^r$$
$$V_S = V_S^{1p} + V_S^r$$

Where I1p L contains only positive sequence, fundamental frequency components. Similar comments apply to V 1pS .IrL and V rS contain rest of the load current and the source voltage including harmonics. I1pL is not unique and depends on the power factor at the load bus. However, the following relation applies for I1p L .

$$P_L = \langle V_L, I_L\rangle = \langle V_L, I_L^{1p}\rangle$$

This implies that hIrL ;VLi = 0. Thus, the fundamental frequency, positive sequence component in IrL does not contribute to the active power in theload.To meet the control objectives, the desired load voltages and source currents must contain only positive sequence, fundamental frequency components and

$$P_L = |V_L^* \; I_S^*| \cos\phi_l = |V_S^{1p} I_S^*| \cos\phi_s$$

where V ¤ L and I¤S are the reference quantities for the load bus voltage and the source current respectively. Ál is the power factor angle at the load bus while Ás is the power factor angle at the source bus (input port of UPQC). Note that V ¤ L(t) and I¤S (t) are sinusoidal and balanced. If the reference current (I¤C) of the shunt converter and the reference voltage (V ¤ C) of the series converter are chosen as

$$I_C^* = I_L^*, \quad V_C^* = -V_S^r + V_C^{1p}$$

with the constraint

$$\langle V_C^{1p}, I_S^* \rangle = 0$$

we have,

$$I_S^* = I_L^{1p}, \quad V_L^* = V_S^{1p} + V_C^{1p}$$

Note that the constraint (14.30) implies that V 1p C is the reactive voltage in quadrature with the desired source current, I¤S . It is easy to derive that $\langle V_C^*, I_S^* \rangle = 0 = \langle I_C^*, V_L^* \rangle$ The above equation shows that for the operating conditions assumed, a UPQC can be viewed as ainaction of a DVR and a STATCOM with no active power °ow through the DC link. However, if the magnitude of V ¤ Lis to be controlled, it may not be feasible to achieve this by injecting onlyreactive voltage. The situation gets complicated if V 1pS is not constant, butchanges due to system disturbances or fault. To ensure the regulation ofthe load bus voltage it may be necessary to inject variable active voltage (inphase with the source current). If we express

$$V_C = V_C^* + \Delta V_C, I_C = I_C^* + \Delta I_C$$

$$I_S = I_S^* - \Delta I_C, V_L = V_S^{1p} + V_C^{1p} + \Delta V_C$$

$$\langle I_S, \Delta V_C \rangle + \langle V_L, \Delta I_C \rangle = 0$$

In deriving the above, we assume that

$$\langle I_S, V_C^* \rangle = 0 = \langle V_L, I_C^* \rangle$$

This implies that both ¢VC and ¢IC are perturbations involving positivesequence, fundamental requency quantities (say, resulting from symmetricvoltage sags).the power balance on the DC side of theshunt and series converter. The perturbation in VC is initiated to ensurethat

$$|V_C^* + \Delta V_C + V_S| = |V_L| = \text{constant}.$$

Thus, the objective of the voltage regulation at the load bus may requireexchange of power between the shunt and series converters.

iUPQC

In an iUPQC the series APF acts as a controlled sinusoidal current supply and the shunt APF acts as a controlled sinusoidal voltage source as shown in Fig.2.The shunt energetic filter offers negligible impedance to the harmonic current, even as the series energetic filter offers an infinite worth. Thus the harmonic present injected through the nonlinear load flows by way of the shunt active filter [6]. The boundaries of traditional UPQC can be overcome by the iUPQC, i.e. In conventional UPQC, whenever the controller has to calculate the compensating voltage and current, for this reason the requirement of processing as well as synthesizing more than one frequency indicators will make the controller design more intricate and has larger switching losses in the converters. The fundamental change between the UPQC and iUPQC is the changes in the shunt and series supply type

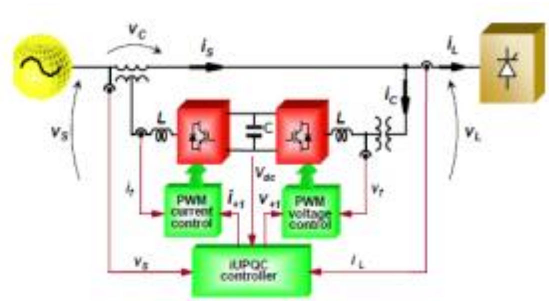
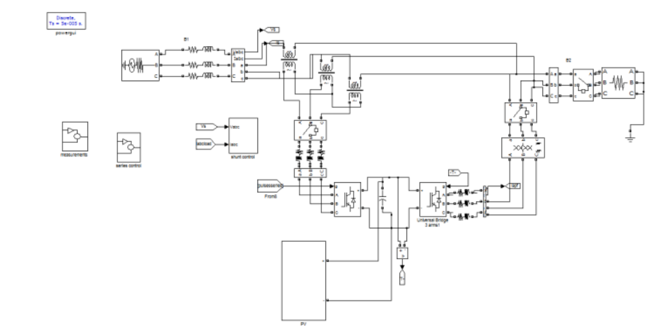
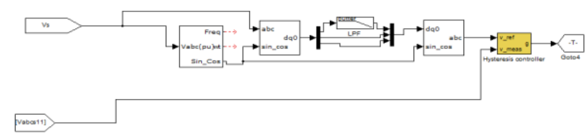


Fig.2. Structure of iUPQC

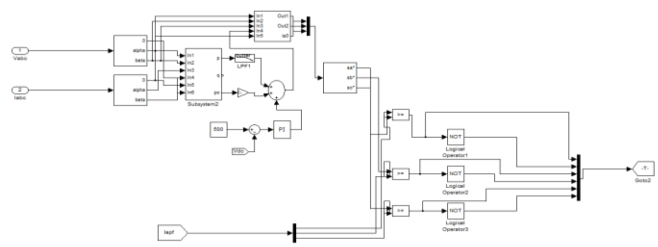
SIMULATION FILE



Control system



Results:



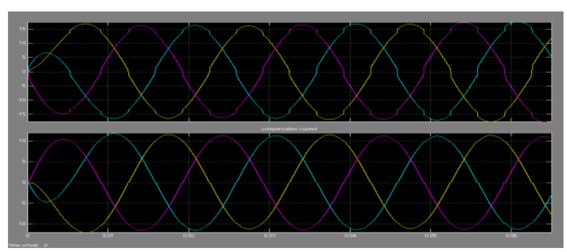


Fig: Load Current

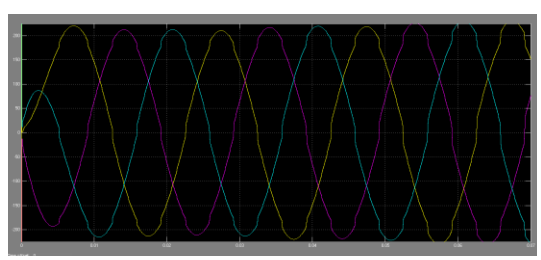


Fig: VAbc

CONCLUSION

when you consider that the usage of vigour electronic devices is growing daily, it is extremely rough to keep the power high-quality on the appropriate limit. The UPQC and iUPQC is regarded as one of the most most state-of-the-art solutions to maintain vigor exceptional.It'll be extra important if one more performance of STATCOM for grid voltage regulation can be included in the iUPQC. This paper investigated the expanded controller performance of iUPQC to prove extra grid voltage regulation as STATCOM. A PV array is additionally modelled instead for the DC hyperlink capacitor. The simulation effects proves that the elevated iUPQC controller regulates the voltage both at load as good as at the source part. The THD analysis demonstrates that THD valuesof the extended iUPQC system diminished to anegligibly small price. The increased iUPQCcontroller was efficaciously realized by way ofsimulation. This will also be understood more competently by way of practical implementation also.

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