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IMPROVEMENT OF POWER QUALITY BY USING MULTICONVERTER UNIFIED POWER QUALITY CONDITIONER

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ABSTRACT

To meet Power Quality (PQ) standard cutoff points, including some kind of compensation might be essential. Modern arrangements can be tracked down as dynamic correction or dynamic filtering. A shunt dynamic power filter is reasonable for the suppression of negative load impact on the supply organization, however in the event that there are supply voltage defects, a series dynamic power filter might be expected to give full pay. As of late, arrangements based on Adaptable AC Transmission Systems (Realities) have showed up. The use of Realities ideas in distribution systems has brought about another generation of repaying devices. A Brought together Power Quality Conditioner (UPQC) is the expansion of the Brought together Power-Stream Controller (UPFC) idea at the distribution level. It comprises of consolidated series and shunt converters for concurrent pay of voltage and current flaws in a supply feeder.

An Interline Power-Stream Controller (IPFC) comprises of two series Voltage-source Converters (VSC) whose dc capacitors are coupled. This permits dynamic power to course between the VSCs. With this configuration, two lines can be controlled at the same time to upgrade the organization use. An Interline Brought together Power-Quality Conditioner (IUPQC), which is the expansion of the IPFC idea at the distribution level. The IUPQC comprises of one series and one shunt converters. It is associated between two feeders to direct the bus voltage of one of the feeders, while controlling the voltage across a delicate load in the other feeder. In this configuration, the voltage guideline in one of the feeders is performed by the shunt-VSC. However, starting from the source impedance is exceptionally low, a high measure of current would be expected to boost the bus voltage in the event of a voltage hang/enlarge which isn't possible. It additionally has low powerful execution in light of the fact that the dc-connect capacitor voltage isn't controlled.

This project presents another brought together power-quality molding system (MC-UPQC), fit for synchronous remuneration for voltage and current in multi-bus/multi-feeder systems. By utilizing one shunt voltage-source converter (shunt VSC) and at least two series VSCs the configuration is made. The system can be applied to neighboring feeders to make up for supply-voltage and load current blemishes on the fundamental feeder and full remuneration of supply voltage flaws on the other feeders. The configuration will be planned as all converters are associated consecutive on the dc side and share a common dc-connect capacitor. Therefore, power can be moved from one feeder to adjoining feeders to make up for list/swell and interruption. The proposed geography can be utilized for synchronous remuneration of voltage and current blemishes in both feeders by sharing power pay capacities between two nearby feeders which are not associated. The system is likewise fit for making up for interruptions without the requirement for a battery stockpiling system and thusly without capacity limit restrictions. By the recreation the exhibition of MC-UPQC as well as the took on control algorithm will be represented.

INTRODUCTION:

With growing uses of nonlinear and electronically exchanged devices in dispersal systems and ventures, Power Quality (PQ) issues, similar to sounds, flash, and anomaly have become serious concerns. Similarly, lightning strikes on transmission lines, exchanging of capacitor banks, and different association issues can in like manner cause PQ issues, for instance, vagabonds, voltage hang/swell, and impedance. Then again, an addition of touchy weights including automated devices and complex cycle controllers requires a pure sinusoidal stock voltage for authentic weight action.

To fulfill PQ rule limits, including some sort of remuneration might be central. Present day plans can be found as unique revision or dynamic filtering. A shunt dynamic power channel is sensible for the camouflage of negative weight impact on the stock association, yet if there are supply voltage deserts, a series dynamic power channel might be supposed to give full compensation. Recently, plans considering Versatile AC Transmission Systems (Real factors) have showed up. The use of Real factors thoughts in scattering structures has brought about another period of compensating devices. It contains solidified series and shunt converters for synchronous remuneration of voltage and current blemishes in a store feeder.

Lately, multiconverter Real factors contraptions, for instance, an Interline Power-Stream Controller (IPFC) and the Summarized Bound together Power-Stream

Controller (GUPFC) are introduced. The place of these devices is to control the power stream of multiline or a sub network rather than control the power stream of a lone line by, for instance, an UPFC.

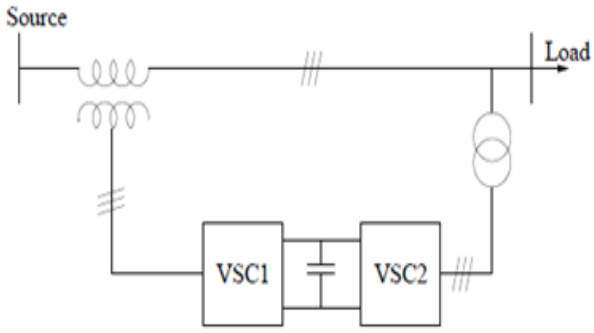
It widens the possibility of voltage and power-stream control past what is practical with the known two-converter UPFC. The most un-troublesome GUPFC contains three converters one related the fundamental GUPFC have some control over full scale five power structure sums, for instance, a vehicle voltage and free unique and responsive power floods of two lines. The possibility of GUPFC can be reached out for extra lines if major. The device might be presented in a couple of central substations to supervise power floods of multiline or a gathering of lines and give voltage support as well. By using GUPFC contraptions, the exchange limit of transmission lines can be extended on a very basic level.

Also, by using the multiline-the chiefs limit of the GUPFC, dynamic power stream on lines can't be extended, yet furthermore be diminished concerning working and market exchange essentials. All around, the GUPFC can be used to extend the exchange limit and simplicity blockages in a versatile way. This thought can be reached on a mission to design multiconverter game plans for PQ improvement in neighboring feeders. For example, the Interline Brought together Power-Quality Conditioner (IUPQC), which is the extension of the IPFC thought at the movement level, has been proposed in the IUPQC contains one series and one shunt converter. It is related between two feeders to control the vehicle voltage of one of the feeders, while coordinating the voltage across a sensitive weight in the other feeder. In this plan, the voltage rule in one of the feeders is performed by the shunt-VSC. Nonetheless, beginning from It also has low powerful execution in light of the way that the dc-associate capacitor voltage isn't coordinated.

In this endeavor, another plan of an UPQC assembled the Multiconverter Bound Power-Quality Conditioner (MC-UPQC) is presented. The structure is stretched out by adding a series-VSC in a coterminous feeder. The proposed geography can be used for concurrent compensation of voltage and current blemishes in the two feeders by splitting power remuneration limits between two neighboring feeders which are not related. The structure is in like manner prepared for compensating for obstructions without the necessity for a battery storing system and consequently without limit limits.

POWER QUALITY CONDITIONER

The course of action of both DSTATCOM and DVR have a few control over the power idea of the source current and the heap transport voltage. Additionally, accepting that the DVR and STATCOM are related on the DC side, the DC transport voltage can be coordinated by the shunt related DSTATCOM while the DVR supplies the normal energy to the heap in case of the transient aggravations in source voltage. The setup of such a contraption (named as Brought together Power Quality Conditioner (UPQC)) is shown in Fig. This is an adaptable contraption like an UPFC. Regardless, the control objectives of an UPQC are extremely not equivalent to that of an UPFC.



UPQC scheme

CONTROL OBJECTIVES OF UPQC

The shunt related converter has the going with control targets:

1. To balance the source streams by injecting negative and zero plan parts anticipated by the heap.

2. The make up for the music in the heap current by imbuing the essential consonant streams.

3. To control the power factor by implanting the important open current (at fundamental repeat).

4. To coordinate the DC transport voltage.

The series related converter has the going with control targets:

1. To change the voltages at the heap transport by implanting negative and zero grouping voltages to compensate for those present in the source.

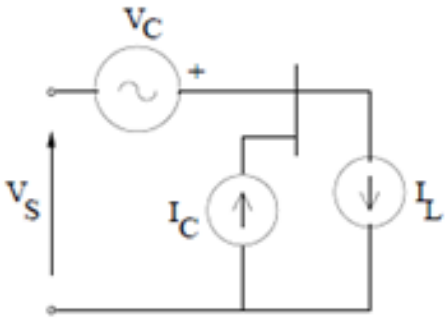
2. To bind the heap transport from music present in the source voltages, by mixing the symphonious voltages

3. To control the size of the heap transport voltage by injecting the vital dynamic and open parts (at head repeat) dependent upon the power factor on the source side

4. To control the power factor at the data port of the UPQC (where the source is related. Note that the power

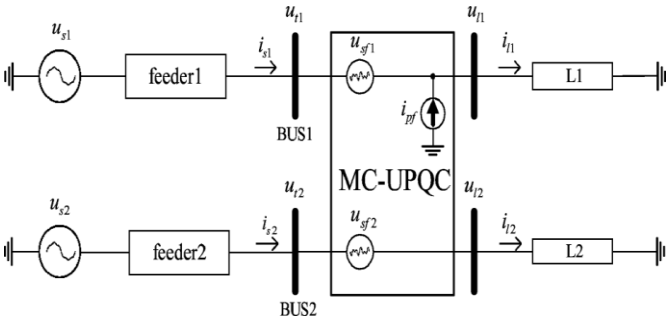
factor at the outcome port of the UPQC (related with the heap) is compelled by the shunt converter.

OPERATION OF UPQC



Equivalent circuit of UPQC

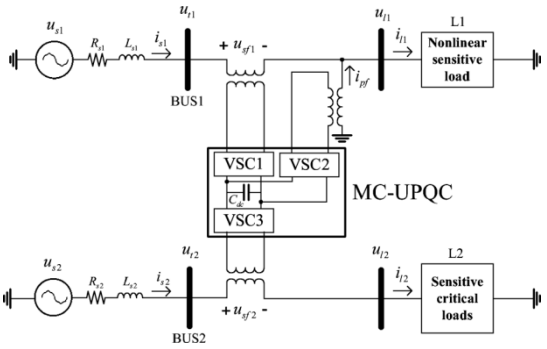
MODELLING OF PROPOSED MC-UPQC SYSTEM



Single-line diagram of a distribution system with an MC-UPQC.

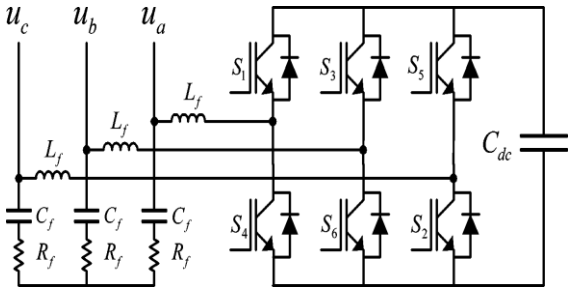
As shown in figure.5.1, two feeders related with two unmistakable substations supply the heaps L1 and L2. The MC-UPQC is related with two vehicles BUS1 and BUS2 with voltages of ut1 and ut2, independently. The shunt part of the MC-UPQC is similarly connected with load L1 with a current of il1. Supply voltages are implied by us1 and us2 while load voltages are ul1 and ul2 Finally, feeder streams are shown by is1 and is2 load streams are il1 and il2 Transport voltages ut1 and ut2 are distorted and might be presented to hang/develop. The heap L1 is a nonlinear/touchy weight which needs a pure sinusoidal voltage for real movement while its current is non-sinusoidal and contains sounds. The heap L2 is a fragile/essential weight which needs a basically sinusoidal voltage and should be totally shielded against mutilation, hang/swell, and obstruction. These sorts of weights essentially integrate creation undertakings and fundamental expert centers, as clinical centers, air terminals, or broadcasting centers where voltage impedance can achieve outrageous judicious incidents or human harms.

MC-UPQC Plan



Typical MC-UPQC used in a distribution system.

In the proposed configuration, VSC_1 is connected in series with BUS_1 and VSC_2 is connected in parallel with load L_1 at the end of $Feeder_1$. VSC_3 is connected in series with BUS_2 at the $Feeder_2$ end.



The reward reactor (Lf)and high-pass yield channel (Rf , Cf) related with thwart the movement of exchanging music into the power supply. As shown in Fig 5.2, all converters are given from a common dc-interface capacitor and related with the movement system through a transformer.

Discretionary (scattering) sides of the series-related transformers are straightforwardly connected in series with BUS1 and BUS2, and the helper (spread) side of the shunt-related transformer is related in agreed with load L1.

The marks of the MC-UPQC showed in Fig 5.2 are:

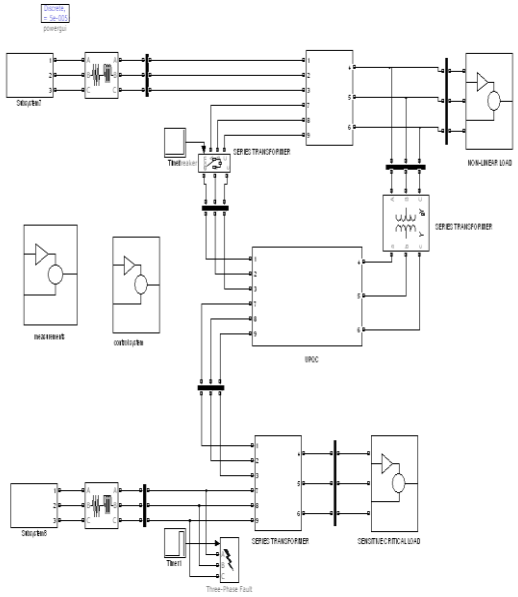
1) To direct the heap voltage (ul1) against hang/swell and aggravations in the structure to defend the nonlinear/sensitive weight L1,

2) To direct the heap voltage ul2 against hang/swell, impedance, and aggravations in the system to shield the fragile/fundamental weight L2,

3) To compensate for the responsive and consonant pieces of nonlinear weight current (il1).

To accomplish these targets, series VSCs (i.e., VSC1 and VSC3) fill in as voltage controllers while the shunt VSC (i.e., VSC2) functions as a continuous controller.

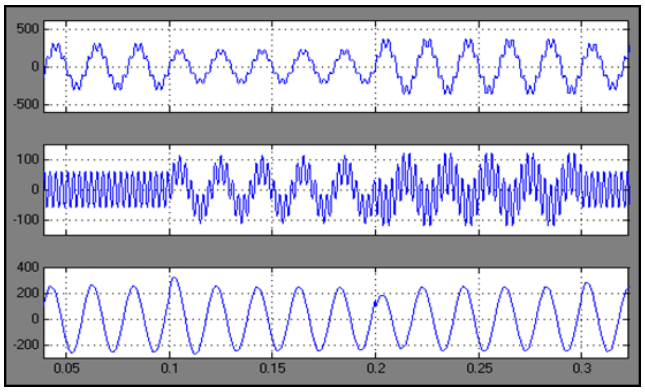
MATLAB DESIGN OF MC-UPQC STUDY AND RESULTS



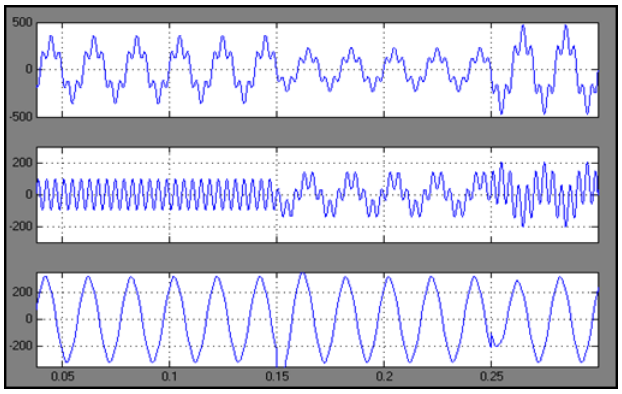
Distortion and Sag/Swell on the Bus Voltage

Permit us to consider that the power structure in contains two three-stage three-wire 380(v) (rms, L), 50-Hz utilities. The BUS1 voltage contains the seventh-demand symphonious with a worth of 22%, and the BUS2 voltage contains the fifth solicitation consonant with a worth of 35%. The BUS1 voltage contains 25% hang among s and 20% swell betweens. The BUS2 voltage contains 35% rundown betweens and 30% swell betweens. The nonlinear/sensitive weight L1 is a three-stage rectifier load which supplies a RC heap of 10 and 30 F. Finally, the fundamental weight L2 contains a sensible RL heap of 10 and 100 mH.

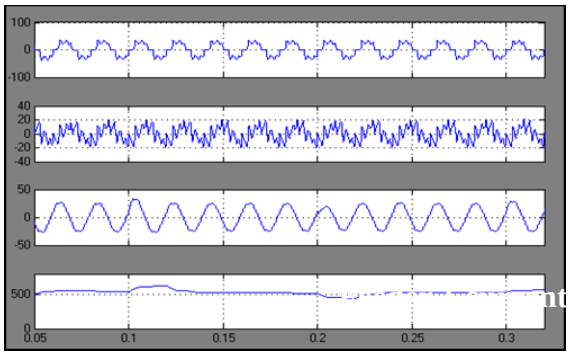
The MC-UPQC is turned on at 0.02 s. The BUS1 voltage, the relating pay voltage mixed by VSC1, finally load L1 voltage are shown in Fig. 6.2 In all figures, simply the stage waveform is shown for ease.



Likewise, the BUS2 voltage, the relating pay voltage infused by VSC3, lastly, the heap L2 voltage are displayed in Fig. 6.3. As displayed in these figures, contorted voltages of BUS1 and BUS2 are sufficiently made up for across the heaps L1 and L2 with awesome powerful reaction.



The nonlinear burden current, its comparing pay current infused by VSC2, repaid Feeder1 current, and, at long last, the dc-connect capacitor voltage are displayed in Fig. 6.4. The twisted nonlinear burden current is repaid quite well, and the all out consonant bending (THD) of the feeder current is diminished from 28.5% to under 5%. Likewise, the dc voltage guideline circle has worked appropriately under all aggravations, like hang/enlarge in the two feeders.

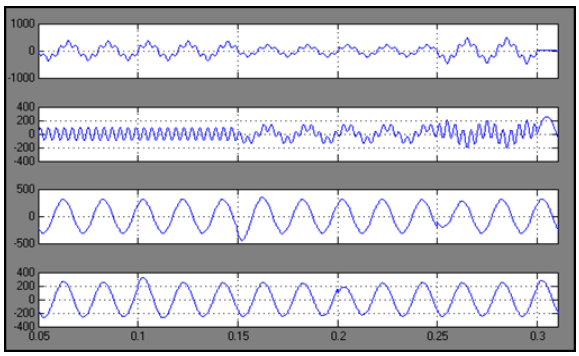


Upstream Fault on Feeder2

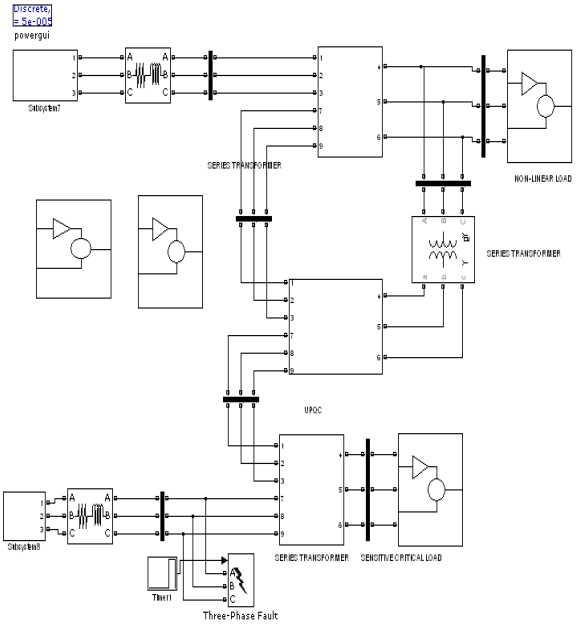
Right when a shortcoming happens in Feeder2 (in a L-G, L-G, and L-G faults), the voltage across the touchy/fundamental weight L2 is locked in with hang/swell or impedance. This voltage imperfection can be compensated for by VSC2.

For this present circumstance, the power expected by load L2 is given through VSC2 and VSC3. This recommends that the power semiconductor switches of VSC2 and VSC3 should be assessed to such a degree that hard and fast power move is possible. This might fabricate the cost of the device, however the benefit that might be obtained can offset the expense.

In the proposed game plan, the touchy/fundamental weight on Feeder2 is totally defended against bending, hang/swell, and obstruction. Besides, the controlled voltage across the touchy weight on Feeder1 can supply a couple of clients who are similarly protected against distortion, hang/extend, and transient obstruction. In this manner, the cost of the MC-UPQC should be changed against the cost of impedance, considering reliability records, for instance, the client ordinary obstruction length list (CAIDI) and client typical impedance repeat document (CAIFI). It is ordinary that the MC-UPQC cost can be recuperated in a couple of years by charging higher duties for the shielded lines.

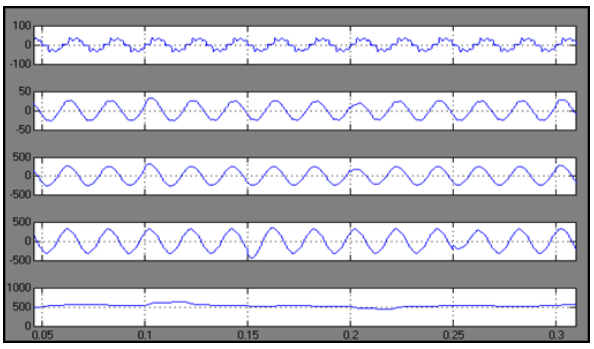


The introduction of the MC-UPQC under an issue condition on Feeder2 is attempted by applying a three-stage shortcoming to ground on Feeder2 between s. Reenactment results are shown in Fig.6.5.



LOAD CHANGE

To assess the framework conduct during a heap change, the nonlinear burden L1 is multiplied by diminishing its protection from half at 0.5 s. The other burden, notwithstanding, is kept unaltered. The framework reaction is displayed in Fig. 6.6. It tends to be seen that as burden L1 changes, the heap voltages and stay undisturbed, the dc transport voltage is managed, and the nonlinear burden current is redressed.



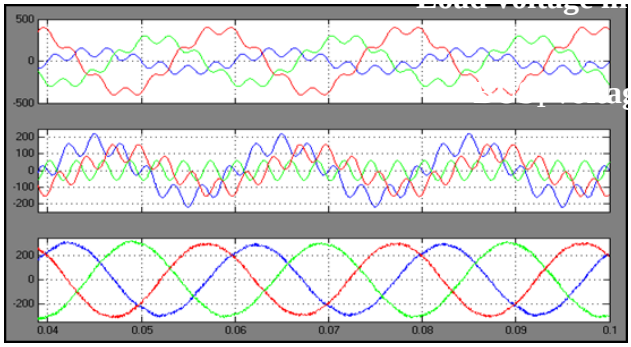
UNBALANCE VOLTAGE

The control systems for shunt and series VSCs, which are introduced in Portion II, rely upon the - technique. They are prepared for compensating for the inconsistent source voltage and lopsided weight current. To survey the control structure limit with respect to unbalanced voltage remuneration, another reenactment is performed. In this new propagation, the BUS2 voltage and the consonant pieces of BUS1 voltage resemble those given in Fragment IV. Nonetheless, the fundamental piece of the BUS1 voltage is a lopsided three-stage voltage with an unbalance component of 40%. This unbalance voltage is given by

$$Ut1,\ fundamental = \begin{bmatrix} 0.31\cos(\omega t + 46^0) \\ 0.31\cos(\omega t + 106^0) \\ 0.155\cos(\omega t + 210^0) \end{bmatrix}$$

The multiplication results for the three-stage BUS1 voltage, series pay voltage, and weight voltage in feeder 1 are shown in Fig. 6.8. The reenactment results show that the consonant parts and unbalance of under disproportionate source voltage for by injecting the proper series voltage. Here, the heap voltage is a three-stage sinusoidal offset voltage with controlled adequacy.

Simulation diagram of MC-UPQC for showing results in unbalanced condition.



BUS_1 voltage, series compensating voltage and load voltage in $Feeder_1$ under unbalanced source voltage.

CONCLUSION

In this assignment, another setup for synchronous compensation of voltage and current in bordering feeders has been proposed. The new plan is named multi-converter bound together power-quality conditioner (MC-UPQC). Appeared differently in relation to a common UPQC, the proposed geography is ready to do totally shielding fundamental and fragile weights against mutilations, hangs/swell, and break in two-feeder structures.

Benefits:

1) Power move between two bordering feeders for list/swell and obstruction pay;

2) Pay for obstructions without the necessity for a battery storing structure and, thusly, without limit obstacle;

3) Splitting power pay limits between two bordering feeders which are not related.

REFERENCES

[1] D. D. Sabin and A. Sundaram, "Quality enhances reliability," IEEE Spectr., vol. 33, no. 2, pp. 34–41, Feb. 1996.

[2] M. Rastogi, R. Naik, and N. Mohan, "A comparative evaluation of harmonic reduction techniques in three-phase utility interface of power electronic loads," IEEE Trans. Ind. Appl., vol. 30, no. 5, pp. 1149–1155, Sep./Oct. 1994.

[3] F. Z. Peng, "Application issues of active power filters," IEEE Ind. Appl. Mag., vol. 4, no. 5, pp. 21–30, Sep../Oct. 1998.

[4] H. Akagi, "New trends in active filters for power conditioning," IEEE Trans. Ind. Appl., vol. 32, no. 6, pp. 1312–1322, Nov./Dec. 1996.

[5] L. Gyugyi, C. D. Schauder, S. L. Williams, T. R. Rietman, D. R. Torjerson, and A. Edris, "The unified power flow controller: A new approach to power transmission control," IEEE Trans. Power Del., vol. 10, no. 2, pp. 1085–1097, Apr. 1995.

[6] H. Fujita and H. Akagi, "The unified power quality conditioner: The integration of series and shunt active filters," IEEE Trans. Power Electron., vol. 13, no. 2, pp. 315–322, Mar. 1998.

[7] A. Ghosh and G. Ledwich, "A unified power quality conditioner (UPQC) for simultaneous voltage and current compensation," Elect. Power Syst. Res., pp. 55–63, 2001.

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