Katroth Vasanth Rao* et al.
(IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH
Volume No.4, Issue No.5, August – September 2016, 4154-4158.

Unified Dual Energy Regulator For Mends Sags And Swells In Supply Side

KATROTH VASANTH RAO
M. Tech Student
Department of EEE
Aurora's Scientific and Technological Institute
Ghatkesar, Telangana 501301, India.

M.RAJASHEKER REDDY
Assistant Professor
Department of EEE
Aurora's Scientific and Technological Institute
Ghatkesar, Telangana 501301, India.

Abstract: **A DVR can make amends for current sag/swell and distortion within the supply side current so that the current across a sensitive/critical load terminal is perfectly controlled. A unified power-quality conditioner (UPQC) is capable of doing the functions of both DSTATCOM and DVR. This paper presents a better controller for that dual topology from the unified power quality conditioner (iUPQC) extending its applicability in power-quality compensation, plus microgrid applications. Quite simply, the iUPQC will act as a static synchronous compensator (STATCOM) in the grid side, while supplying even the conventional UPQC compensations in the load or microgrid side. Experimental answers are presented to verify the brand new functionality from the equipment. Applying this controller, past the conventional UPQC power quality features, including current sag/swell compensation. The iUPQC may also provide reactive power support to manage not just the burden-bus current but the current in the grid-side bus.**

Keywords: **iUPQC; Micro Grids; Power Quality; Static Synchronous Compensator (STATCOM); Unified Power Quality Conditioner (UPQC);**

I. INTRODUCTION

In comparison, power-electronics-driven loads generally require ideal sinusoidal supply current to be able to function correctly, whereas those are the most responsible ones for abnormal harmonic currents level within the distribution system. Within this scenario, devices that may mitigate these drawbacks happen to be developed through the years. A few of the solutions involve an adaptable compensator, referred to as unified power quality conditioner (UPQC) and also the static synchronous compensator (STATCOM). The twin topology from the UPQC, i.e., the iUPQC, was presented, in which the shunt active filter behaves being an ac-current source and also the series one being an ac-current source, both in the fundamental frequency [1]. The STATCOM has been utilized broadly in transmission systems to manage the current by way of dynamic reactive power compensation. Nowadays, the STATCOM is basically employed for current regulation, whereas the UPQC and also the IUPQC happen to be selected as solution for additional specific applications. In actual power converters, because the switching frequency increases, the ability rate capacity is reduced. Therefore, the iUPQC offers better solutions if in contrast to the UPQC in situation of high-power applications, because the iUPQC paying references are pure sinusoidal waveforms in the fundamental frequency. Furthermore, the UPQC has greater switching losses because of its greater switching frequency.

II. IUPQC MODEL

Current-source ripper tools based custom power products are more and more getting used in custom power applications for increasing the power quality (PQ) of power distribution systems. Devices for example distribution static Compensator (DSTATCOM) and dynamic current restorer (DVR) happen to be discussed extensively. A DSTATCOM can make amends for distortion and unbalance inside a load so that a well-balanced sinusoidal current flows with the feeder. It may also regulate the current of the distribution bus. The UPQC includes two current-source converters (VSCs) which are linked to a typical electricity capacitor. Among the VSCs is connected in series having a distribution feeder, as the other is connected in shunt with similar feeder. It's also easy to connect two VSCs to 2 different Feeders inside a distribution system [2]. Let's think that the VSC-1is connected in shunt to Feeder-1 as the VSC-2 is connected in series with Feeder-2. Each one of the two VSCs is recognized by three H-bridge inverters. Inverters are provided from the common single electricity capacitor and every inverter includes a transformer connected at its output. The secondary (distribution) sides from the shunt-connected transformers are connected in star using the neutral point being attached to the load neutral. The secondary winding from the series-connected transformers are directly connected in series using the bus B-2 and cargo L-2. The ac filter capacitors Cf and Ck will also be connected in every phase to avoid the flow from the harmonic currents generated because of switching. The six inverters from the IUPQC are controlled individually. The schematic structure of the VSC in IUPQC. Within this structure, each switch represents an electrical semiconductor tool and an anti-parallel diode. All of the inverters are provided from the common single electricity capacitor Cdc and every inverter includes a transformer connected at its output. The six inverters from the IUPQC are controlled individually. The switching action is acquired using output feedback control. Generally Pulse-Width Modulated Current Source Inverter can be used [3]. The fundamental purpose of the VSI would be to convert the Electricity current provided through the energy hard drive into an AC current. Within the DVR power circuit step-up current injection transformer can be used. Thus a VSI having a low current rating is enough. Manipulating the position from the ripper tools output current with regards to the Air conditioning system current controls the actual power exchange between your ripper tools and also the Air conditioning system. Within the H bridge inverter, four switches are utilized. If this employed for multilevel arrangement specifically for high current application, it's generally known as chain circuits. The Inverter contains four switches S1-S4, each comprising a semi-conductor tool and an anti-parallel diode. Power semiconductor device could be a power MOSFET for low power applications. The Inverter is provided with an Electricity source having a current of Vdc. Modulation in power electronics is really a procedure for a switched representation of the wave form. The switched representation is much more efficient form. Ideally the switched signal is designed for high power with efficiency 100%. The PWM control signal is placed HIGH when modulating signal includes a greater statistical value compared to carrier signal and it is set LOW once the carrier signal includes a greater statistical value. Typically the most popular type of PWM synthesis may be the Sinusoidal PWM (SPWM).Within an SPWM the modulating signal is sinusoidal and carrier signal is really a triangular wave. The regularity from the modulating signal is selected is the fundamental frequency from the output waveform to become synthesized.

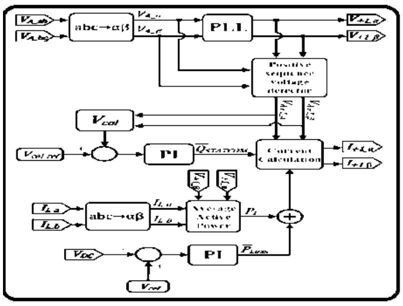


Fig.1.Framework of iUPQC

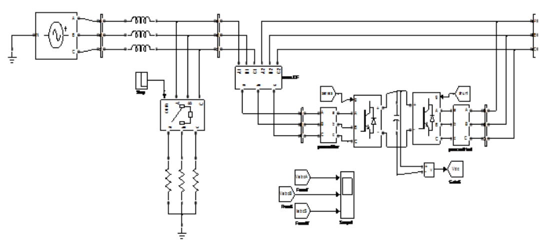
III. PROPOSED ALGORITHAM

This paper proposes a better controller, which expands the iUPQC functionalities. This improved form of iUPQC controller includes all functionalities of individual's previous ones, such as the current regulation in the load-side bus, and today supplying also current regulation in the grid-side bus, just like a STATCOM towards the grid [4]. Simulation answers are presented to validate the brand new controller design. To be able to clarify the applicability from the improved iUPQC controller, Bus A is really a critical bus from the power system that supplies sensitive loads and can serve as reason for coupling of the microgrid. Bus B is really a bus from the microgrid, where nonlinear loads are connected, which requires premium-quality power. The voltages at buses A and B should be controlled, to be able to correctly give you the sensitive loads and also the nonlinear loads. The results brought on by the harmonic currents attracted through the nonlinear loads ought to be mitigated; staying away from harmonic current propagation to bus A. Using a STATCOM to be sure the current regulation at bus A isn't enough since the harmonic currents attracted through the nonlinear loads aren't mitigated. However, a UPQC or perhaps an iUPQC between bus A and bus B can compensate the harmonic currents from the nonlinear loads and compensate the current at bus B, when it comes to current harmonics, unbalance, and sag/swell. Nonetheless, this really is still insufficient to be sure the current regulation at bus A. Hence, to attain all of the preferred goals, a STATCOM at bus A along with a UPQC (or perhaps an iUPQC) between buses A and B ought to be employed. However, the expense of the solution could be unreasonably high [5]. A beautiful solution could be using a modified IUPQC controller to supply also reactive power support to bus A, additionally to any or all individual's functionalities of the equipment. Observe that the modified iUPQC can serve as an intertie between buses A and B. Furthermore, the microgrid attached to the bus B might be a complex system comprising distributed generation, energy management system, along with other control systems involving microgrid, in addition to smart grid concepts. the iUPQC hardware and also the measured units of the three-phase three-wire system which are utilized in the controller. The controller inputs would be the voltages at buses A and B, the present required by bus B (iL), and also the current vDC from the common electricity link. The outputs would be the shunt-current reference and also the series-current mention of pulse width modulation (PWM) controllers. The current and current PWM controllers is often as simple as individuals employed, or perhaps be improved further to higher cope with current and current imbalance and harmonics. First, the simplified Clark transformation is used towards the measured variables. The shunt ripper tools impose the current at bus B. Thus, it's important to synthesize sinusoidal voltages with nominal amplitude and frequency [6]. Consequently, the signals delivered

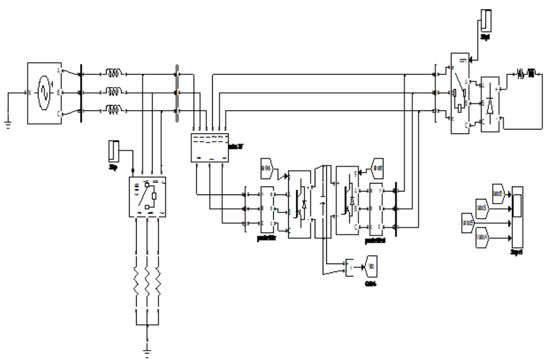
(IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH
Volume No.4, Issue No.5, August – September 2016, 4154-4158.

to the PWM controller would be the phase-locked loop (PLL) outputs with amplitude comparable to 1 p.u. There are lots of possible PLL algorithms that could be utilized within this situation. Within the original iUPQC approach, the shunt-ripper tools current reference could be either the PLL outputs or even the fundamental positive-sequence component Veterans administration one of the grid current. Using Veterans administration one in the controller is helpful to reduce the circulating power with the series and shunt converters, under normal operation, as the amplitude from the grid current is at a suitable selection of magnitude. For combined series-shunt power conditioners, like the UPQC and also the iUPQC, just the current sag/swell disturbance and also the power factor (PF) compensation from the load create a circulating average power with the power conditioners. Furthermore, the compensation from the load PF boosts the current provided through the shunt ripper tools. The ability flow within the series ripper tools signifies that the high power is needed in situation of sag current disturbance rich in active power load consumption.

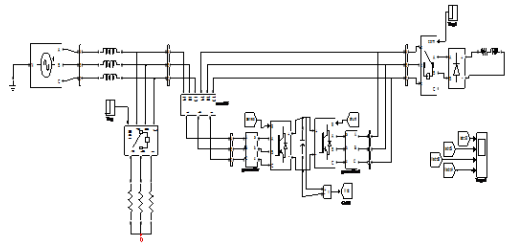
IV. SIMULATION RESULTS



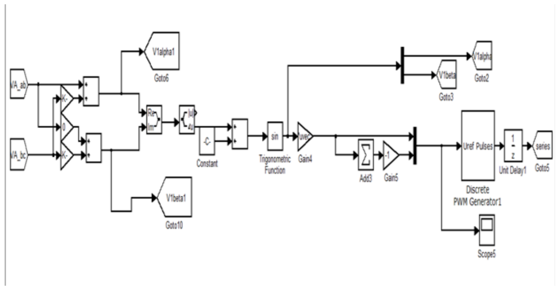
Developed Simulink Model With No Load



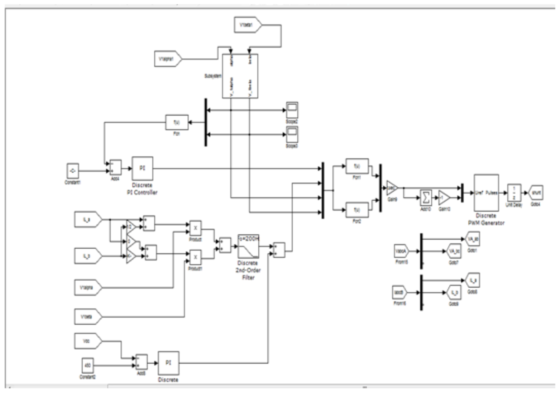
Develoed Simulink Model With Three Phase Load



Develoed Simulink Model With Two Phase Load



Developed Simulink Model For Series Converter Gating Pulse



Developed Simulink Model For Shunt Converter Gating Pulse

In order to verify all the power quality issues described in this paper, the iUPQC was connected to a grid with a voltage sag system, as depicted in Fig. 6. The voltage sag system was composed by an inductor (*LS*), a resistor (*RrmSag*), and a breaker (*S*Sag). To cause a voltage sag at bus A, *S*Sag is closed. At first, the source voltage regulation was tested with no load connected to bus B. In this case, the iUPQC behaves as a STATCOM, and the breaker *S*Sag is closed to cause the voltage sag. To verify the grid-voltage regulation (see Fig. 7), the control of the *Q*STATCOM variable is enabled to compose (4) at instant $t = 0$ s. In this experimental case, $LS = 10$ mH, and RSag = 7.5 Ω. Before the *Q*STATCOM variable is enabled, only the dc link and the voltage at bus B are regulated, and there is a voltage sag at bus A, as shown in Fig. 7. After $t =$ 0s, the iUPQC starts to draw reactive current from bus A, increasing the voltage until its reference value. As shown in Fig. 7, the load voltage at bus B is maintained regulated during all the time, and the grid-voltage regulation of bus A has a fast response.

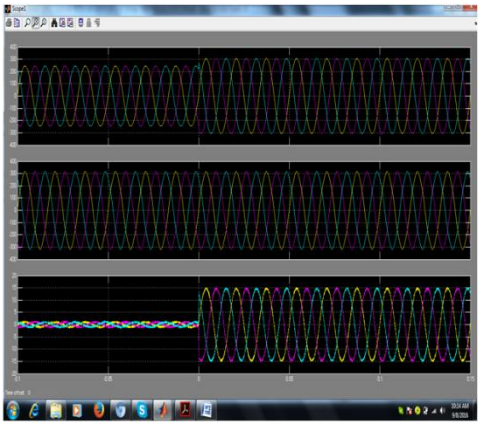


Fig. iUPQC response at no load condition: (a) grid voltages VA, (b) load voltages VB, and (c) grid currents.

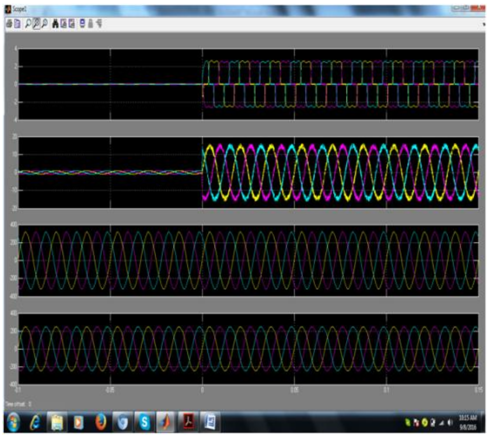


Fig. iUPQC transitory response during the connection of a threephase diode rectifier: (a) load currents, (b) grid currents, (c) load voltages and (d) grid voltages.

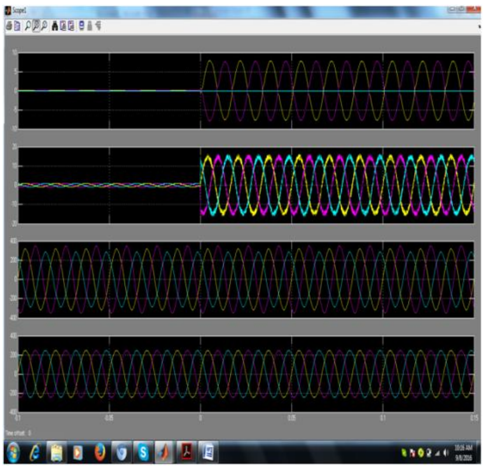


Fig. iUPQC transitory response during the connection of a twophase diode rectifier: (a) load currents, (b) source currents, (c) load voltages, and (c) source voltages.

V. CONCLUSION

Within the improved iUPQC controller, the currents synthesized through the series ripper tools are based on the typical active power the burden and also the active capacity to supply the electricity-link current regulation, along with a typical reactive capacity to regulate the grid-bus current. In this way, additionally to any or all the ability-quality compensation options that come with a standard UPQC or perhaps an iUPQC, this improved controller also mimics a STATCOM towards the grid bus. This new feature improves the applicability from the iUPQC and offers new solutions later on scenarios involving smart grids and micro grids, including distributed generation and storage systems to higher cope with the natural variability of renewable sources for example solar and wind power. Furthermore, the raised iUPQC controller may justify the expense and promotes the iUPQC applicability in power quality problems with critical systems, where it's important not just an iUPQC or perhaps a STATCOM, but both, concurrently. Despite adding yet another power-quality compensation feature, the grid-current regulation cuts down on the inner-loop circulating power within the iUPQC, which may allow lower power rating for that series ripper tools? The Simulation results verified the raised iUPQC goals. The grid-current regulation was achieved without any load, in addition to when offering a 3-phase nonlinear load. These results have shown an appropriate performance of current regulation at each side from the iUPQC, whilst paying harmonic current and current imbalances.

VI. REFERENCES

[1] A. Mokhtatpour and H. A. Shayanfar, “Power quality compensation as well as power flow control using of unified power quality conditioner,” in Proc. APPEEC, 2011, pp. 1–4.

[2] A. P. Jayam, N. K. Ardeshna, and B. H. Chowdhury, “Application of STATCOM for improved reliability of power grid containing a wind turbine,” in Proc. IEEE Power Energy Soc. Gen. Meet.—Convers. Del. Elect. Energy 21st Century, 2008, pp. 1–7.

[3] B. W. Franca, L. G. B. Rolim, and M. Aredes, “Frequency switching analysis of an iUPQC with hardware-in-the-loop development tool,” in Proc. 14th EPE Conf. Appl., 2011, pp. 1–6.

[4] J. M. Guerrero, P. C. Loh, T.-L. Lee, and M. Chandorkar, “Advanced control architectures for intelligent microgrids—Part II: Power quality, energy storage, and AC/DC microgrids,” IEEE Trans. Ind.

Electron., vol. 60, no. 4, pp. 1263–1270, Apr. 2013.

[5] D. N. Zmood and D. G. Holmes, "Stationary frame current regulation of PWM inverters with zero steady-state error," IEEE Trans. Power Electron., vol. 18, no. 3, pp. 814–822, May 2003.

[6] J. A. Moor Neto, L. Lovisolo, B. W. França, and M. Aredes, "Robust positive-sequence detector algorithm," in Proc. 35th IEEE IECON, Nov. 2009, pp. 788–793.

AUTHOR's PROFILE

Katroth Vasanth Rao is pursuing his M.Tech in the stream of Power system control and automation (PSCA) from Aurora's Scientific and Technological Institute Ghatkesar. He completed his B.Tech in the stream of Electrical and Electronics Engineering from Narsimha reddy engineering college in 2014. His areas of interest are Power System ,control system and electrical machines .

M.Rajasheker Reddy is working as Asst. Professor and project coordinator in the department of EEE, Aurora's Scientific and Technological Institute, Ghatkesar. He has the teaching experience of over five years. He has also guided more than 20 M.Tech andB.Tech Projects. His areas of interest are Power Electronics, control systems and power systems.

