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Coordinated Active Power Control between Shunt and Series Converters of UPQC for Distributed Generation Applications

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Abstract— **This paper presents a new concept of co-ordinated active power sharing between shunt and series converters of unified power quality conditioner (UPQC) for distributed generation applications. Normally, the UPQCs are used to mitigate both voltage and current power quality problems. However, these UPQCs are also used for delivering active power in addition to its power quality improvement by integrating distributed generation (DG) at the DC link of back to back connected converters. But, only the shunt converters are used to carry the whole active power from the DG sources and the series converters are used to handle only voltage related power quality problems. So, the shunt converter is loaded heavily and the series converter is kept idle in steady state cases. The more dependency on the shunt converter also reduces the reliability of the total system. This proposed control strategy is used to carry active power through both series converter and shunt converter even at the steady state conditions. The proposed method improves the utilization of the converters and also the reliability of the system. The effectiveness of the proposed control strategy is demonstrated by comparing with the conventional control algorithm, where only the shunt converter is used to carry active power. The proposed system is validated by performing hardware in loop (HIL) tests using OPAL-RT and dSPACE DS1103.**

Keywords—Distributed Generation; unified power quality control (UPQC); coordinated active power control.

I. INTRODUCTION

Conventional power systems are affected due to the depletion of fossil fuel energy resources and also increase in the environmental pollution. Consequently, a new trend of distributed power generation integration to the utility distribution network by using renewable sources is encouraged. Deregulated electricity market and open access to the distribution network are also another reasons for the new trend of distributed generation (DG). The microgrid can be viewed as an active distribution network consists of DG systems and different loads at distribution voltage level. The microgrid can also be treated as a single controlled unit that meets local energy for improving reliability and security [1-3]. The main advantages of the microgrid are uninterruptable power supply, increase in local reliability, reduction in feeder loss and local voltage regulation. A DC microgrid becomes more attractive due to its natural interface to renewable energy sources and energy storage systems [4]. However, a microgrid with DG exhibits like a weak grid and prevails the problem of power quality [5-6]. This DC microgrid is normally interconnected to the power system and local AC load through inverter [7]. However, the single inverter based DG can solve only current related power quality problems in addition to the active power transfer.

Unified power quality conditioner (UPQC) is widely used as an active power filter for improving both voltage and current power quality problems such as voltage sag, voltage swell, voltage harmonics, reactive power compensation, load unbalance and current harmonics etc [8-9]. Energy storage elements such as super capacitors are integrated with the DC link of UPQC to provide active and reactive power support for compensating deep voltage sags and swells for the extended time [10-11]. However, the UPQCs, in general, are used for improving the power quality and not for active power transfer. In UPQCs, the main objective is to reduce the active power injection through both the converters for minimizing the circulating active power. But in recent days, the DG resources are integrated at the DC link of UPQC [12-15]. In this UPQC with DG, the active power injection is also necessary in addition to its power quality improvement features. However, almost all the researchers are transferring the whole DG active power through the shunt converter and the series converter is used for the voltage power quality problems alone. So, the series converter is always in idle state and the shunt converter is hard-pressed in normal steady state conditions. This further reduces the reliability of the system by fully depending on the shunt converter. This problem can be addressed by transferring active power through the series converter even in steady state condition. In the literature only series converters are used in conjunction with PV system [16-17]. However, this series converter addresses only voltage power quality problems.

In regard to the aforementioned drawbacks of the reported control algorithms, this paper propose a new co-ordinated active power sharing control algorithm between shunt and series converters of UPQC. This will improve the utilization of both the converters even in the steady state condition. By using this proposed algorithm, even if the shunt converter fails, the system can feed active power through the series converter. So, this proposed control further improves the reliability of the system. The proposed control strategy is validated using real time hardware in loop (HIL). The plant consists of power converters, which are simulated in OPAL-RT and the control algorithm is implemented in the dSPACE DS1103 processor.

II. SYSTEM CONFIGURATION

Fig. 1 shows the system configuration of the UPQC integrated with the distributed generation (DG) at the DC link of back to back connected converters. This distributed energy resource may consists of different renewable sources e.g., solar, wind, biogas and fuel cell in conjunction with battery energy storage system (BESS). However, in the present case only BESS is considered for demonstration purpose. The main purpose of the UPQC is to transfer the power generated from the DG to the load and also to improve the voltage and current power quality problems. The considered circuit parameters of the UPQC and bidirectional buck-boost converter are presented in the Appendix.

III. CONTROL STRATEGIES

This section presents the proposed control algorithms for series converter, shunt converter, and battery energy storage system (BESS). The main objective of this UPQC is to transfer active power from the DG and also to improve the voltage and current power quality problems.

A. *Series Converter control algorithm*

The main purpose of the series converter is to improve the voltage power quality and also to transfer active power. The voltage power quality problems are eliminated by injecting the voltage in series through series transformer. The active power is transferred through the series transformer by phase shifting the load voltage from the grid voltage. So, the reference load voltage is generated in such a way to inject active power and also to improve the voltage power quality at the load terminals. The phasor diagram for the basic understanding of series converter voltage injection scheme is shown in Fig. 2. The control schematic for the series converter is presented in Fig. 3. The maximum active power that can be transferred through the series converter depends upon the kVA rating of the converter. The calculation of the maximum active power injection through the series converter is presented in the following section. As shown in Fig. 2, the load voltage (v_l) is shifted by power angle (δ) in such a way that the required amount of active power is transferred through the series converter. Estimation of this power angle (δ) is achieved by using a proportional integral (PI) controller. The phase angle (β) gives the exact position of the grid voltage from the absolute phasor reference, which is obtained from the phase locked loop (PLL). The angle of the reference load voltage (Φ) is obtained by adding power angle (δ) and the grid voltage angle (β). The magnitude of the load voltage $|V_l|$ is normally selected as a rated peak phase voltage. So, the reference load voltages (v_{labc}^*) are calculated from the reference load voltage magnitude $|V_l|$ and the phase angle (Φ). The PWM pulses are generated for the series converter by comparing the reference load voltages (v_{labc}^*) with the sensed load voltages (v_{labc}).

B. *Shunt Converter Control Algorithm*

A shunt active filter is used to transfer the active power from the DG in addition to the basic responsibilities such as load current harmonics compensation and load reactive power compensation. So, the shunt converter current consists of load current harmonics, the reactive component of load current and active power component of shunt converter current. However, indirect current control method is adapted for controlling the shunt converter. So, the grid currents are taken as reference, which should be free from harmonics. The complete control scheme for the shunt converter is presented in Fig. 4.

By applying KCL at the load terminal, the grid currents are the summation of load currents and shunt converter currents. So, the active component of the grid current consists of the active component of the fundamental load current and also the active component of the shunt converter currents. The active component of fundamental load current is calculated from the sensed load currents. Sensed load currents are converted in to synchronous reference frame using the grid voltage angle (β). The direct and quadrature axis components of the load currents ($\overset{\approx}{i}_{ld}$ and $\overset{\approx}{i}_{lq}$) comprises the fundamental ($\bar{i}_{ld}$) and harmonic component ($\tilde{i}_{ld}$) of the load current. The fundamental component of the load current ($\bar{i}_{ld}$) is extracted using low pass filter.

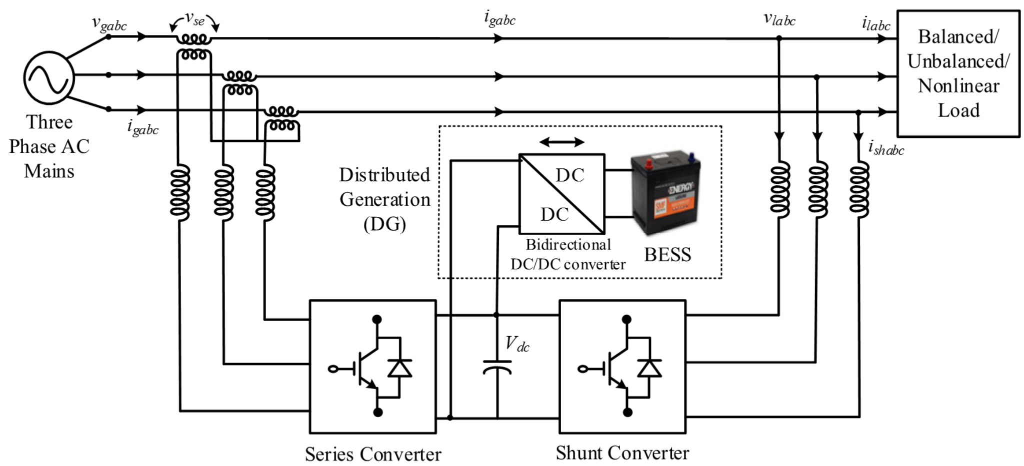

Fig. 1. Schematic of three phase UPQC with distributed generation.

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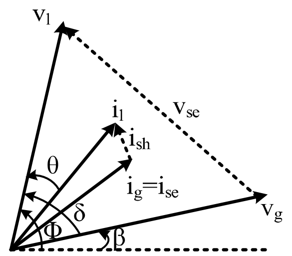

Fig. 2. Phasor diagram for the series converter voltage injection scheme.

A series converter transfers some portion of the DG active power to the grid and the remaining power needs to be transferred through the shunt converter. The active power component of the shunt converter current is obtained by processing the DC link voltage error (v_{dce}) between the reference and estimated DC link voltage (V_{dc}* and V_{dc}) through the PI controller as,

$$i_{shd}(k)=i_{shd}(k-1)+k_{psh}\{v_{dce}(k)-v_{dce}(k-1)\}+k_{ish}v_{dce}(k) \quad (1)$$

where k_{psh} and k_{ish} are proportional and integral gains of the DC link voltage controller. V_{dce}(k) and V_{dce} (k-1) are DC link voltage errors at the kth and (k-1)th instants. I_{shd} (k) and i_{shd} (k-1) are active power component of the GSC current at kth and (k-1)th instants.

The active component of the reference grid current (i_{gd}) is obtained by adding the active component of the fundamental load current ($\overline{I_{ld}}$) and the active power component of the shunt converter currents (I_{shd}). The reactive component of the reference grid current (i_{gq}) is selected as zero.

The active component of the reference grid current (i_{gd}^*) and reactive component of the reference grid current (i_{gq}^*) are converted into the reference grid currents as,

$$i_{ga}^* = i_{gd}^* \sin\beta + i_{gq}^* \cos\beta \quad (2)$$

$$i_{gb}^* = i_{gd}^* \sin(\beta - 2\pi/3) + i_{gq}^* \cos(\beta - 2\pi/3) \quad (3)$$

$$i_{gc}^* = i_{gd}^* \sin(\beta + 2\pi/3) + i_{gq}^* \cos(\beta + 2\pi/3) \quad (4)$$

The reference grid currents (i_{ga}^*, i_{gb}^* and i_{gc}^*) are compared with the actual sensed grid currents (i_{ga}, i_{gb} and i_{gc}) and pulses are generated for the shunt converter using the hysteresis current controller. The hysteresis controller is a feedback current control used to track the reference current signals within a hysteresis band (i_{hb}). At every sampling instant, the actual currents (i_{gabc}) are compared with the reference current (i_{gabc}^*) as,

$$\Delta i_{gabc} = i_{gabc}^* - i_{gabc} \quad (5)$$

when $\Delta i_{gabc} > i_{hb}$, lower switch is turned on (6)

when $\Delta i_{gabc} < - i_{hb}$, upper switch is turned on (7)

By using these equations, gating pulses for the shunt converter are generated.

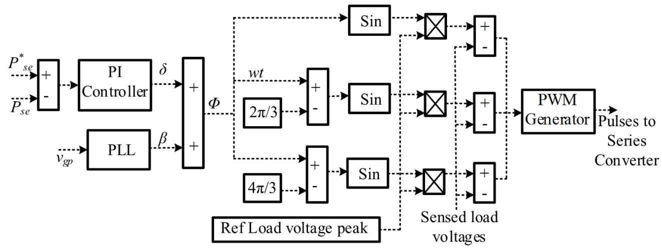

Fig. 3. Control algorithm for the series converter.

C. Battery Energy Storage System Control Algorithm

In this present case, the whole DG is represented as BESS. In general, BESS gets the reference power command from the centralized energy management system. The power command depends upon the electricity price and state of charge (SOC) of the battery. The centralised energy management system is out of scope of this paper. The BESS may be given commands for charging or discharging. So, this BESS system is connected with bidirectional DC/DC converter. The DC link voltage or output voltage of this DC/DC converter is regulated by using the shunt converter. From the power reference command, the reference current for BESS is calculated by using the sensed value of the DC link voltage. The power control for this bidirectional DC/DC converter is given in Fig. 5. The sensed battery current is compared with the reference battery current and the error is passed through the PI controller for obtaining the duty ratio to the DC/DC converter. This duty ratio is given to the PWM controller for obtaining pulses to control the bidirectional DC/DC converter.

D. Calculation of maximum limit for active power transfer through series converter

This section presents the calculation of the maximum amount of active power that can be transferred through the series converter without overloading. The phasor relation between different voltages are presented in the Fig. 6. The grid voltage is considered as kV_S, where, k ranges from 0.7 to 1.3 depends upon the voltage sag or swell respectively. If the voltage at the grid changes k times, then the grid current changes by 1/k times. So, the series converter or grid current I_{se} = I_s/k. The active, reactive and apparent series converter powers are calculated as,

Series converter active power, $P_{se} = V_{se} I_{se} \cos\gamma$ (8)

Series converter reactive power $Q_{se} = V_{se} I_{se} \sin\gamma$ (9)

Series converter kVA rating $S_{se} = \sqrt{P_{se}^2 + Q_{se}^2}$ (10)

The series converter voltage is calculated from the simple trigonometric relations as,

Series converter voltage, $V_{se} = \sqrt{(kV_S - V_L\cos\delta)^2 + (V_L\sin\delta)^2}$ (11)

Phase angle γ is calculated from the phasor diagram as,

$$\gamma = 180^0 - \tan^{-1}\left(\frac{V_L\sin(\delta)}{kV_S - V_L\cos(\delta)}\right) \quad if\ V_L\cos(\delta) \le kV_S \quad (12)$$

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$$\gamma = \tan^{-1}\left(\frac{V_L \sin(\delta)}{V_L \cos(\delta) - kV_S}\right) \quad if\ V_L \cos(\delta) > kV_S \qquad (13)$$

By substituting the value of γ, V_{se} and I_{se} in the (8) and (9)

$$P_{se} = \sqrt{(kV_S - V_L \cos\delta)^2 + (V_L \sin\delta)^2} * \frac{I_s}{k}\cos\left(180^0 - \tan^{-1}\left(\frac{V_L \sin(\delta)}{kV_S - V_L \cos(\delta)}\right)\right) \qquad (14)$$

$$Q_{se} = \sqrt{(kV_S - V_L \cos\delta)^2 + (V_L \sin\delta)^2} * \frac{I_s}{k}\sin\left(180^0 - \tan^{-1}\left(\frac{V_L \sin(\delta)}{kV_S - V_L \cos(\delta)}\right)\right) \qquad (15)$$

All the calculations are done in p.u. So, the V_s and I_s are considered as 1. The values of active power (P_{se}), reactive power (Q_{se}) and apparent power (S_{se}) are calculated by varying δ from 0 to 90^0 at different k values. From the above calculated powers, the variation in kVA rating (S_{se}) of the converter with the active power (P_{se}) is plotted for 1 p.u, 0.7 p.u and 1.3 p.u voltages as shown in Fig. 7. The value of maximum injected active power can be calculated by considering maximum sag voltage and converter kVA rating by using Fig. 7.

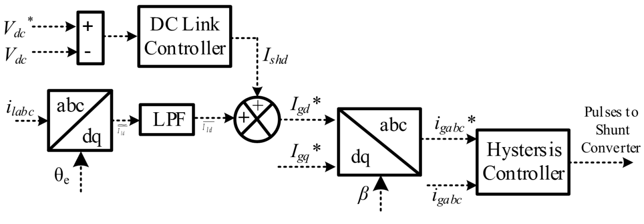

Fig. 4. Control algorithm for shunt converter.

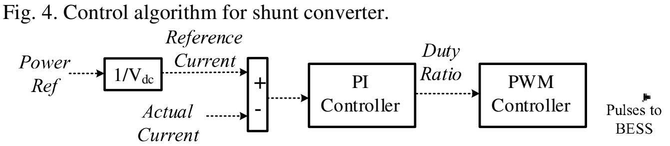

Fig. 5. Control algorithm for the bidirectional DC-DC converter of the BESS.

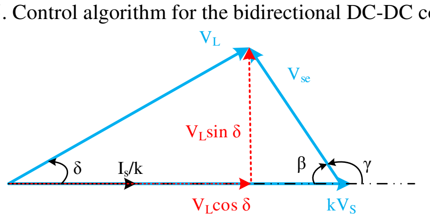

Fig. 6. Phasor diagram representing different voltage vectors.

IV. Results and Discussion

The co-ordinated active power sharing between both series and shunt converters of the UPQC are experimentally validated by using the hardware-in-the-loop (HIL) results. This proposed coordinated control strategy is compared with the UPQC-P control strategy. This UPQC-P is considered as a conventional topology for the comparison. In UPQC-P, the voltage sag and swell are compensated by using active power. The performance of the proposed and conventional control algorithms are compared for different conditions such as voltage sag, voltage swell, change in series converter power reference and change in DG power. Figs. (8-13) show the dynamic performance comparison between the proposed and the conventional control algorithms.

Here in the results, only 'a' phase is recorded out of three phases, which are denoted by adding 'a' in the subscript of the notations. Results in the test are recorded in terms of grid voltage (v_{ga}), load voltage (v_{la}), series converter voltage (v_{sea}), DC link voltage (V_{dc}), active power from the grid (P_g), series converter active power (P_{se}), shunt converter active power (P_{sh}) and DG active power (P_{dg}).

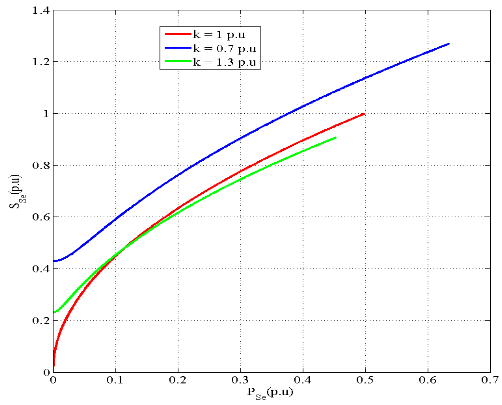

Fig. 7. Variation of the series converter apparent power (Sse) with the variation in the active power (Pse) injection for different grid voltages.

A. *Dynamic performance under voltage sag condition:*

Fig. 8 shows the performance of the series converter with the conventional control strategy. As shown in Fig. 8(a), the series converter starts injecting voltage when a sag occurs and the load voltage is kept undisturbed. Fig. 8(b) shows different powers under voltage sag condition. The active power through the series converter is observed as zero before the sag condition and the series converter starts injecting active power during voltage sag. As the series converter starts injecting active power, the active power through the shunt converter (P_{sh}) is reduced. Fig. 9 shows the performance of the series converter with the proposed coordinated control algorithm. The active power through the series converter follows the reference power irrespective of the voltage condition. The load voltage is regulated to the desired value even under voltage sag condition.

B. *Dynamic performance under voltage swell condition:*

Figs. 10-11 show the performance of the UPQC with DG under 1.3 p.u voltage swell condition. Fig. 10 shows the performance with the conventional control strategy. The load voltage is regulated to the reference value even under voltage swell condition by injecting voltage through the series converter as shown in Fig. 10 (a). At the voltage swell condition, the series converter power becomes negative and the circulating active power starts flowing through the series and shunt converter. So, the variation in the shunt converter power is also observed. Fig. 11 shows the performance of the proposed control strategy under voltage swell condition. The series converter voltage is varied for compensating the voltage swell.

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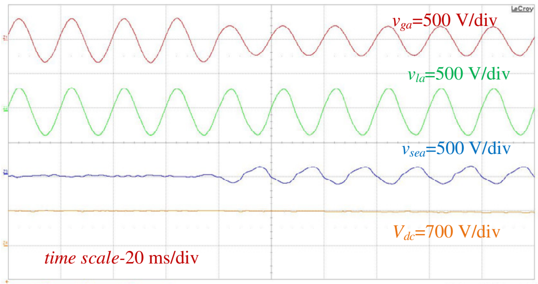
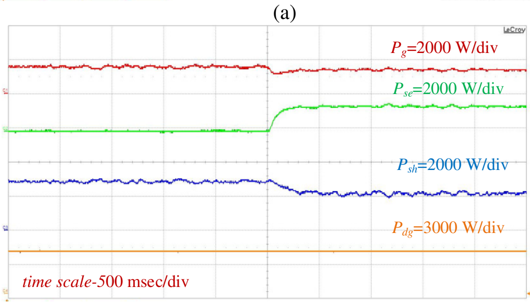


(a)



(b)

Fig. 8 Performance of the UPQC with conventional control algorithm under voltage sag condition (a) v_{ga}, v_{la}, v_{sea} and V_{dc}, (b) P_g, P_{se}, P_{sh} and P_{dg}.

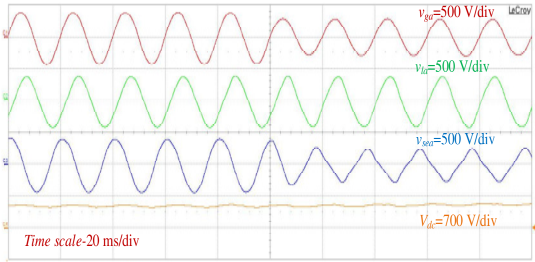
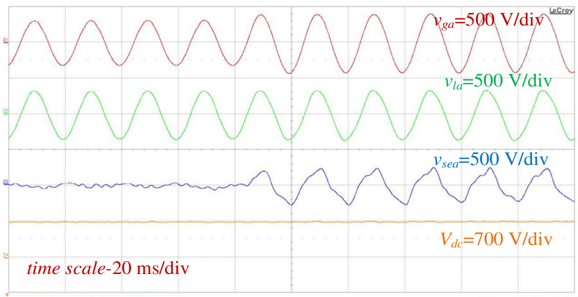
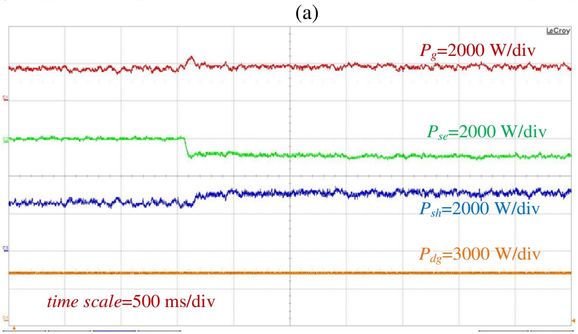


Fig. 9 The variation in v_{ga}, v_{la}, v_{sea} and V_{dc} under voltage sag condition using the proposed coordinated control.



(a)



(b)

Fig. 10 Performance of the UPQC with conventional control algorithm under voltage swell condition (a) v_{ga}, v_{la}, v_{sea} and V_{dc}, (b) P_g, P_{se}, P_{sh} and P_{dg}.

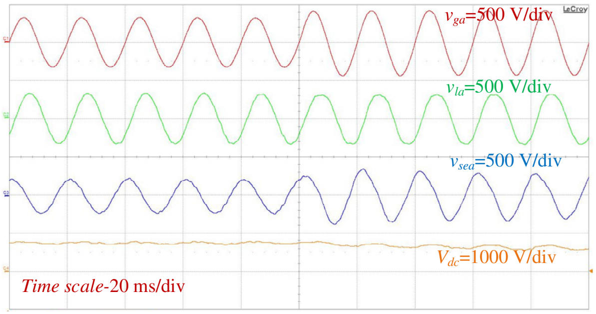


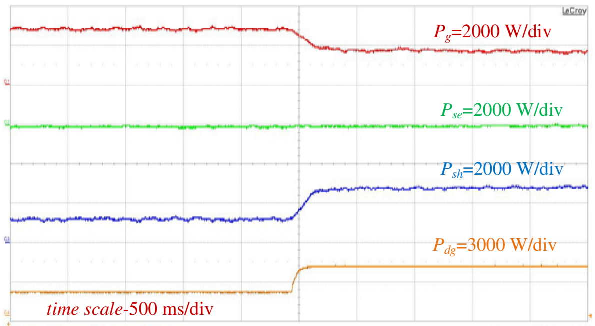
Fig. 11 The variation in v_{ga}, v_{la}, v_{sea} and V_{dc} under voltage swell condition using the proposed coordinated control.

C. Performance under change in DG power

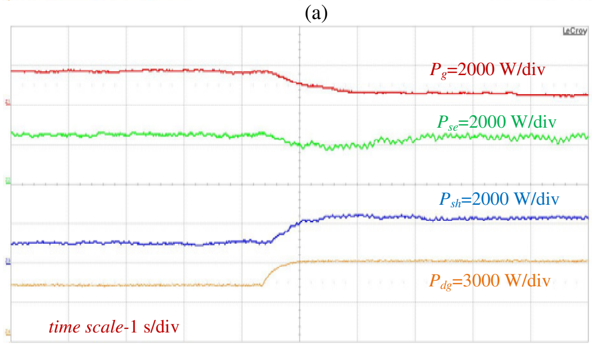
The performance of the UPQC with both the conventional and proposed control algorithms is presented under variation in DG power in Fig. 12. In both the control algorithms, the variation in the DG power is reflected in the shunt converter power and there is no variation in series converter power. In the conventional control algorithm, the active power through the series converter is observed as zero as shown in Fig. 12(a). Whereas, the series converter is injecting an active power in the proposed control strategy as shown in Fig. 12(b).

D. Performance under change in series converter power:

By using the conventional control algorithm, the variation in the series converter power depends upon the voltage sag or swell. However, the series converter power reference can be varied using the proposed control algorithm, which depends upon the DG power. Fig. 13 shows the performance of the UPQC with the change in the series converter power. As the series converter power is increased, the shunt converter power is decreased.



(a)



(b)

Fig. 12 Dynamic performance of the UPQC under change in DG power (a) v_{ga}, v_{la}, v_{sea} and V_{dc}, (b) P_g, P_{se}, P_{sh} and P_{dg}.

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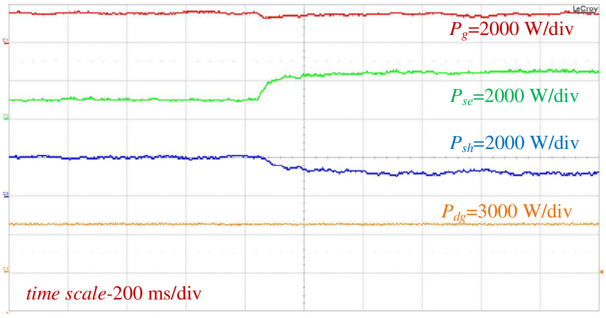

Fig. 13 The variation in the P_g, P_{se}, P_{sh} and P_{dg} under change in series converter power using the proposed coordinated control.

V. CONCLUSION

A new coordinated active power control strategy has been proposed to share the active power between the shunt and series converters of the UPQC for distributed generation applications. This proposed control strategy has been compared with the conventional control strategy of the UPQC by using hardware-in-the-loop experimental results. By using HIL results, the capability of sending the active power through the series converter has been demonstrated. This control algorithm reduces the burden on the shunt converter and also improves the reliability of the system.

APPENDICES

A. Three-phase ac supply: 400 V (rms), f = 50 Hz.
B. DC bus: dc bus capacitor = 3700 µF/800 V, reference dc bus voltage = 700 V.
C. UPQC: shunt inverter interfacing inductance = 3 mH, shunt inverter ripple filter resistance= 5 Ω, capacitance = 10 µF, series inverter coupling inductance = 3 mH, series inverter ripple filter resistance= 5 Ω, capacitance = 10 µF, series voltage injection transformer turn ratio = 1:3.
D. Bidirectional buck-boost converter: inductor = 10 mH, input capacitor = 40 µF, output capacitor = 400 µF.

REFERENCES

[1] S. Chowdhury, S. P. Chowdhury and P. Crossley, *Microgrids and Active Distribution Networks*, London, United Kingdom, The Institution of Engineering and Technology, 2009.

[2] Suleiman M. Sharkh, Mohammad A. Abu-Sara, Georgios I. Orfanoudakis and Babar Hussain, *Power Electronic Converters for Microgrids*, New York, USA, Wiley-IEEE Press, 2014.

[3] M. I. Marei, E. F. El-Saadany and M. M. A. Salama, “Flexible distributed generation: (FDG),” in *proc. IEEE Power Engineering Society Summer Meeting,* vol. 1, 25 July 2002, pp. 49-53.

[4] T. Dragicevic, J. C. Vasquez, J. M. Guerrero and D. Skrlec, “Advanced LVDC Electrical Power Architectures and Micrograms: A step toward a new generation of power distribution networks,” *IEEE Electrification Mag.*, vol. 2, no. 1, pp. 54-65, March 2014.

[5] J. F. G. Cobben, W. L. Kling and J. M. A. Myrzik, “Power quality aspects of a future micro grid,” in *Proc. Int. Conf. on Future Power Syst.*, 2005, 18 Nov. 2005, pp. 1-5.

[6] T. Keil, J. Jager, A. Shustov and T. Degner, “Changing network conditions due to distributed generation - systematic review and analysis of their impacts on protection, control and communication systems,” in *Proc. 19th Int. Conf. on Electricity Dist.,* Vienna, Austria, May 2007.

[7] N. R. Tummuru, M. K. Mishra and S. Srinivas, “Multifunctional VSC controlled microgrid using instantaneous symmetrical components theory,” *IEEE Trans. Sustainable Energy*, vol. 5, no. 1, pp. 313-322, Jan. 2014.

[8] V. Khadkikar and A. Chandra, “A New control philosophy for a unified power quality conditioner (UPQC) to coordinate load-reactive power demand between shunt and series inverters,” *IEEE Trans. Power Delivery*, vol. 23, no. 4, pp. 2522-2534, Oct. 2008.

[9] Bhim Singh, K. Al-Haddad and A. Chandra, “A review of active filters for power quality improvement,” *IEEE Trans. Ind. Electron.,* vol. 46, no. 5, pp. 960-971, Oct 1999.

[10] B. M. Han and B. Bae, “Unified power quality conditioner with super-capacitor for energy storage,” *Eur. Trans. Elect. Power*, vol. 18, pp. 327–343, Apr. 2007.

[11] D. Somayajula, M. L. Crow, “An Ultracapacitor Integrated Power Conditioner for Intermittency Smoothing and Improving Power Quality of Distribution Grid,” *IEEE Trans. Sustainable Energy*, vol. 5, no. 4, pp. 1145-1155, Oct. 2014.

[12] B. Han, B. Bae, H. Kim and S. Baek, “Combined operation of unified power-quality conditioner with distributed generation,” *IEEE Trans. Power Del.*, vol. 21, no. 1, pp. 330-338, Jan. 2006.

[13] M Hosseinpour, Y Mohamadrezapour, S Torabzade, “Combined operation of unified power quality conditioner and photovoltaic array,” *Journal of Applied Sciences*, vol. 9, pp. 680-688, 2009.

[14] S. K. Khadem, M. Basu and M. F. Conlon, “Intelligent islanding and seamless reconnection technique for microgrid with UPQC,” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 3, no. 2, pp. 483-492, June 2015.

[15] S. K. Khadem, M. Basu, and M. F. Conlon, “UPQC for power quality improvement in DG integrated smart grid network—A review,” *Int. J. Emerg. Electr. Power Syst.*, vol. 13, no. 1, p.1-3, 2012.

[16] N. Saadat, S. S. Choi and D. M. Vilathgamuwa, “A series-connected photovoltaic distributed generator capable of enhancing power quality,” *IEEE Trans. Energy Convers.*, vol. 28, no. 4, pp. 1026-1035, Dec. 2013.

[17] S. Dasgupta, S. K. Sahoo, S. K. Panda and G. Amaratunga, “Single-phase inverter-control techniques for interfacing renewable energy sources with microgrid—part II: series-connected inverter topology to mitigate voltage-related problems along with active power flow control,” *IEEE Trans. Power Elect.*, vol. 26, no. 3, pp. 732-746, March 2011.

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