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A Circulated Static Arrangement Compensator Framework for Acknowledging Dynamic Force Stream Control on Existing Electrical Cables

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ABSTRACT

As indicated by development of power interest and the expanded number of non-direct loads in force matrices, giving a great electrical force ought to be considered. In this paper, voltage hang and swell of the force quality issues are contemplated and dispersed force stream controller (DPFC) is utilized to alleviate the voltage deviation and enhance power quality. The DPFC is another FACTS gadget, which its structure is like bound together power stream controller (UPFC). Regardless of UPFC, in DPFC the basic dc-connection between the shunt and arrangement converters is disposed of and three-stage arrangement converter is isolated to a few single-stage arrangement dispersed converters through the line. The contextual analysis contains a DPFC sited in a solitary machine limitless transport power framework including two parallel transmission lines, which recreated in MATLAB/Simulink environment. The displayed reenactment results approve the DPFC capacity to enhance the force quality.

I. INTRODUCTION

In the last decade, the electrical power quality issue has been the main concern of the power companies Power quality is defined as the index which both the delivery and consumption of electric power affect on the performance of electrical apparatus From a customer point of view, a power quality problem can be defined as any problem is manifested on voltage, current, or frequency deviation that results in power failure.

The power electronics progressive, especially in flexible alternating-current transmission system (FACTS) and custom power devices, affects power quality improvement. Generally, custom power devices, e.g., dynamic voltage restorer (DVR), are used in medium-to-low voltage levels to improve customer power quality. Most serious threats for sensitive equipment in electrical grids are voltage sags (voltage dip) and swells (over voltage). These disturbances occur due to some events, e.g., short circuit in the grid, inrush currents involved with the starting of large machines, or switching operations in the grid.

The FACTS devices, such as unified power flow controller (UPFC) and synchronous static compensator (STAT-COM), are used to alleviate the disturbance and improve the power system quality and reliability. In this paper, a distributed power flow controller, introduced in as a new FACTS device, is used to mitigate voltage and current waveform deviation and improve power quality in a matter of seconds. The DPFC structure is derived from the UPFC structure that is included one shunt converter and several small independent series converters, as shown in Fig. 1. The DPFC has same capability as UPFC to balance the line parameters, i.e., line impedance, transmission angle, and bus voltage magnitude.

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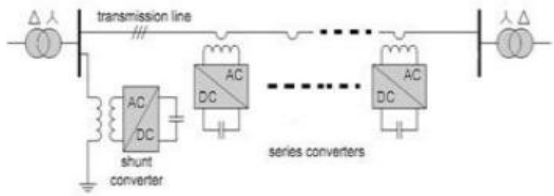

Fig.1. The DPFC Structure

II. DPFC PRINCIPLE

In examination with UPFC, the primary point of interest offered by DPFC is wiping out the enormous DC-connection and instates utilizing third consonant current to dynamic force trade. In the accompanying subsections, the DPFC fundamental ideas are clarified.

A. Eliminate DC Link and Power Exchange

Inside of the DPFC, the transmission line is utilized as an association between the DC terminal of shunt converter and the AC terminal of arrangement converters, rather than direct association utilizing DC-join for force trade between converters. The technique for force trade in DPFC depends on force hypothesis of non-sinusoidal segments. In view of Fourier arrangement, a non-sinusoidal voltage or current can be introduced as the whole of sinusoidal parts at diverse frequencies. The result of voltage and current segments gives the dynamic force. Since the essential of a few terms with distinctive frequencies are zero, so the dynamic force mathematical statement is as take after:

$$p = \sum_{i=1}^{\infty} V_i I_i \cos \phi_i \qquad (1)$$

Where Vi and Ii are the voltage and current at the ith consonant, separately, and φi is the point between the voltage and current at the same recurrence. Comparison (1) communicates the dynamic forces at diverse recurrence segments are free. In view of this, a shunt converter in DPFC can assimilate the dynamic force in one recurrence and produces yield power in another recurrence. Accept a DPFC is put in a transmission line of a two-transport framework, as appeared in Fig.1. While the force supply creates the dynamic power, the shunt converter has the capacity to ingest power in central recurrence of current. In the mean time, the third symphonious segment is caught in Y-Δ transformer. Yield terminal of the shunt converter infuses the third consonant current into the nonpartisan of Δ-Y transformer (Fig. 3). Thusly, the symphonious current moves through the transmission line.

This consonant current controls the DC voltage of arrangement capacitors. Fig. 2 delineates how the dynamic force is traded between the shunt and arrangement converters in the DPFC. The third-symphonious is chosen to trade the dynamic force in the DPFC and a high-pass channel is required to make a shut circle for the consonant current. The third-consonant current is caught in Δ-twisting of transformer. Thus, no compelling reason to utilize the high-pass channel at the less than desirable end of the framework At the end of the day, by utilizing the third-consonant, the high-pass channel can be supplanted with a link associated between Δ-twisting of transformer and ground. This link courses the consonant current to ground.

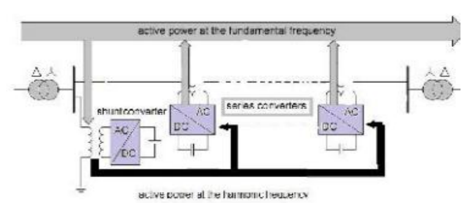

Fig. 2.Active power exchange between DPFC converters

A. The DPFC Advantages

The DPFC in comparison with UPFC has some advantages, as follows:

- **High Control Capability**

The DPFC similar to UPFC can control all parameters of transmission network, such as line impedance, transmission angle, and bus voltage magnitude.

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- **High Reliability**

The series converters redundancy increases the DPFC reliability during converters operation. It means, if one of series converters fails, the others can continue to work.

- **Low Cost**

The single-phase series converters rating are lower than one three-phase converter. Furthermore, the series converters do not need any high voltage isolation in transmission line connecting; single-turn transformers can be used to hang the series converters.

III. DPFC CONTROL

The DPFC has three control strategies: central controller, series control, and shunt control, as shown in Fig. 3.

A. Central Control

This controller manages all the series and shunt controllers and sends reference signals to both of them.

B. Series Control

Every single-stage converter has its own particular arrangement control through the line. The controller inputs are arrangement capacitor voltages, line current, and arrangement voltage reference in the dq-outline. The square chart of the arrangement converters in Matlab/Simulink environment is exhibited in Fig. 4.

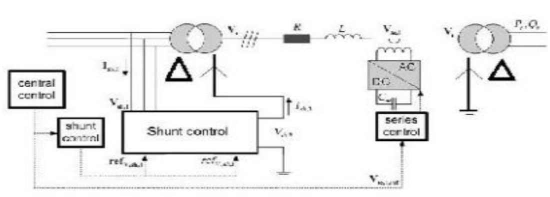

Fig.3. DPFC control structure

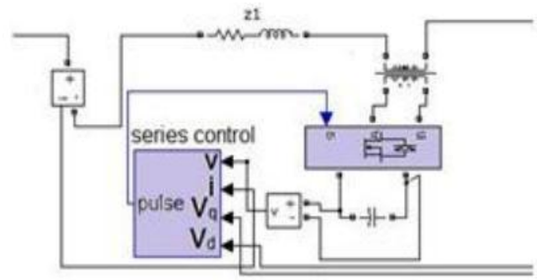

Fig.4. Block diagram of the series converters in Matlab/Simulink

Any arrangement controller has a low-pass and a third pass channel to make principal and third consonant current, individually. Two single stage lock circle (PLL) are utilized to take recurrence and stage data from system. The piece chart of arrangement controller in Matlab/Simulink is appeared in Fig.5. The PWM-Generator square oversees exchanging procedures.

C. Shunt Control

The shunt converter incorporates a three-stage converter associated consecutive to a solitary stage converter. The three-stage converter ingests dynamic force from network at major recurrence and controls the dc voltage of capacitor between this converter and single-stage one. Other undertaking of the shunt converter is to infuse steady third-consonant current into lines through the unbiased link of Δ-Y transformer.

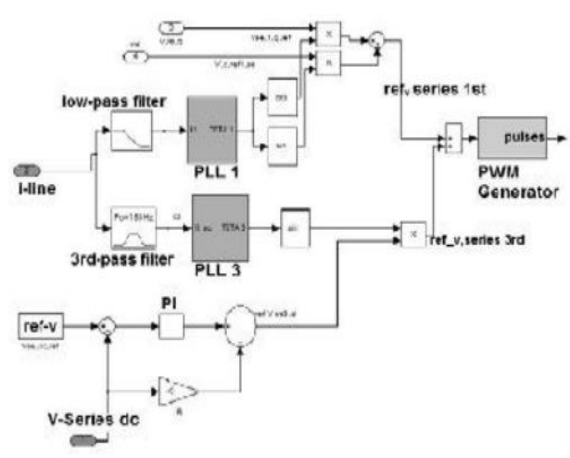

Fig. 5. Block diagram of series control structure in Matlab/Simulink

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Each converter has its own controller at different frequency operation (fundamental and third-harmonic frequency). The shunt control structure block diagram is shown in Fig. 6.

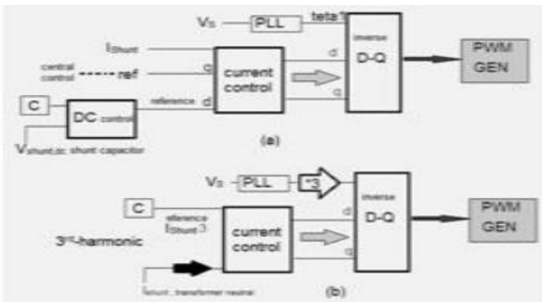

Fig. 6. The shunt control configuration:

(a) for fundamental frequency (b) for third-harmonic frequency

IV. POWER QUALITY IMPROVEMENT

The entire model of framework under study is appeared in Fig. 7. The framework contains a three-stage source joined with a non-straight RLC load through parallel transmission lines (Line 1 and Line 2) with the same lengths. The DPFC is put in transmission line, which the shunt converter is joined with the transmission line 2 in parallel through a Y-Δ three-stage transformer, and arrangement converters is dispersed through this line. To reenact the dynamic execution, a three-stage shortcoming is considered close to the heap. The time term of the flaw is 0.5 seconds

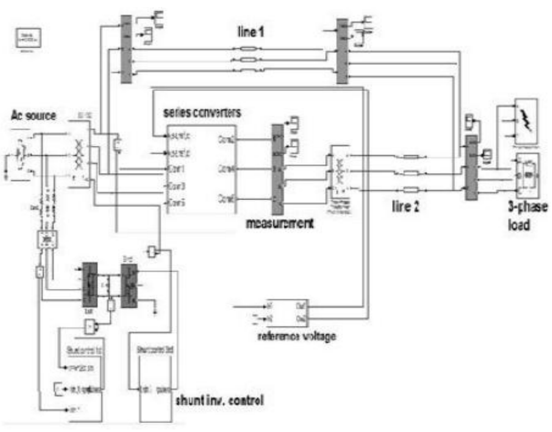

Fig.7. Simulation model of the DPFC

V. SIMULATION RESULTS

The DPFC controls the force move through transmission lines by differing the voltage infused by the arrangement converter at the major recurrence. Figs. 8-12 represent the stride reaction of the trial setup. A stage change of the principal reference voltage of the arrangement converter is made, which comprises of both dynamic and responsive varieties, as appeared in Fig. 8. As demonstrated, the dc voltage of the arrangement converter is balanced out previously, then after the fact the stride change. To check if the arrangement converter can infuse or assimilate dynamic and receptive force from the framework at the crucial recurrence, the force is computed from the deliberate voltage and current in Figs. 9 and 10.

The deliberate information in one stage are prepared in the PC by utilizing MATLAB. To dissect the voltage and current at the central recurrence, the deliberate information that contains symphonious bending are sifted by a low-pass advanced channel with the 50-Hz cut off recurrence. In view of this channel, the figured voltage and current at the crucial recurrence have a 1.5 cycle postponement to the real values, along these lines bringing about a deferral of the deliberate dynamic and responsive force. Fig. 11 represented the dynamic and receptive force infused by the arrangement converter.

A correlation is made between the deliberate force and the computed power. We can see that the arrangement converters have the capacity to retain and infuse both dynamic and receptive energy to the framework at the basic recurrence.

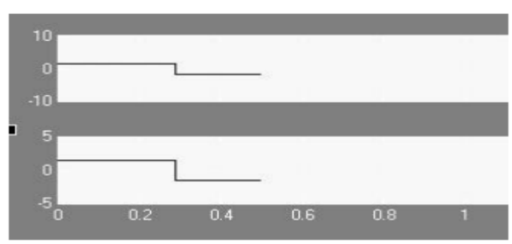

Fig.8. Reference voltage for the series converters.

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Fig.9. Step response of the DPFC: series converte voltage.

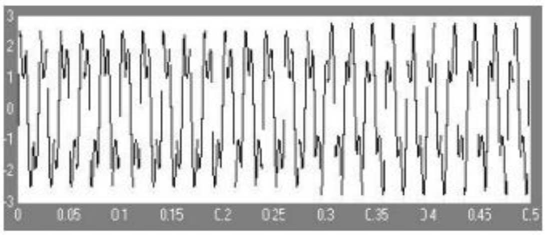

Fig.10. Step response of the DPFC: line current.

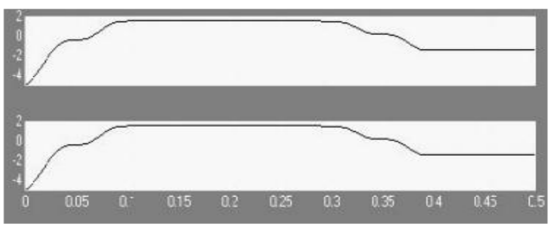

Fig. 11. Step response of the DPFC: active and reactive power injected by the series converter at the fundamental frequency.

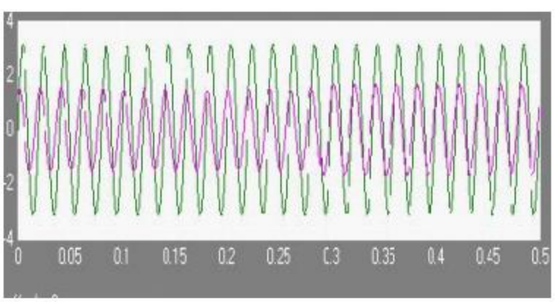

Fig. 12. Step response of the DPFC: bus voltage and current at the Δ side of the transformer

The load voltage harmonic analysis without presence of DPFC is illustrated in Fig. 13. It can be seen, after DPFC implementation in system, the even harmonics is eliminated, the odd harmonics are reduced within acceptable limits, and total harmonic distortion (THD) of load voltage is minimized from 45.67 to 0.65 percentage (Fig. 14), i.e., the standard THD is less than 5 percent in IEEE standards.

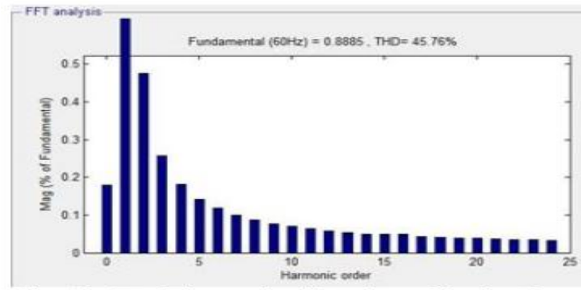

Fig. 12. Total harmonic distortion of load voltage without DPFC

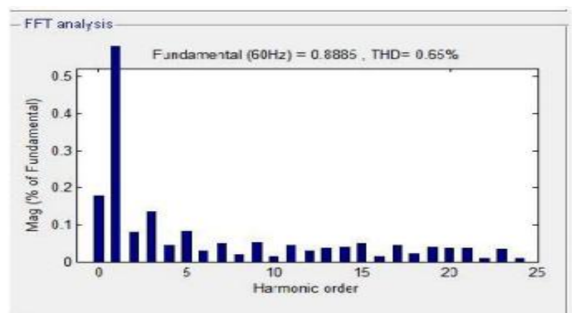

Fig. 13: Total harmonic distortion of load voltage with DPFC.

VI. CONCLUSION

To enhance power quality in the force transmission framework, there are successful techniques. In this paper, the voltage hang and swell moderation, utilizing another FACTS gadget called disseminated force stream controller (DPFC) is introduced. The DPFC structure is like brought together power stream controller (UPFC) and has a same control ability to adjust the line parameters, i.e., line impedance, transmission edge, and transport voltage size. Nonetheless, the DPFC offers a few favorable circumstances, in examination with UPFC, for example, high control ability, high dependability, and minimal effort. The DPFC is displayed and three control circles, i.e., focal controller, arrangement control, and shunt control are configuration. The framework under study is a solitary machine unending transport framework, with and without DPFC. To recreate the dynamic execution, a three-stage issue is considered close to the heap. It is found that the DPFC gives an adequate execution in force quality alleviation and force stream control.

REFERENCES

[1] Alexander Eigels Emanuel, John A. McNeill “Electric Power Quality”. Annu. Rev. Energy Environ 1997.

[2] J. R. Enslin, “Unified approach to power quality mitigation,” in Proc. IEEE Int. Symp. Industrial Electronics (ISIE ’98), vol. 1, 1998

[3] B. Singh, K. Al-Haddad, and A. Chandra, “A review of active filters for power quality improvement,” IEEE Trans. Ind. Electron vol. 46, no. 5, 1999

[4] P. Pohjanheimo and E. Lakervi, “Steady state modeling of custom power components in power distribution networks,” in Proc. IEEE Power Engineering Society Winter Meeting, vol. 4, 2000

[5] A. L. Olimpo and E. Acha, “Modeling and analysis of custom power systems by PSCAD/EMTDC,” IEEE Trans. Power Delivery, vol. 17, no.1,2002.

[6]M. A. Hannan and Azah Mohamed, member IEEE, “ PSCAD/EMTDC Simulation of Unified Series-Shunt Compensator for Power Quality Improvement”, IEEE Transactions on Power Delivery, vol. 20, no. 2, 2005.

[7] I Nita R. Patne, Krishna L. Thakre “Factor Affecting Characteristics of Voltage Sag Due to Fault in the Power System” Serbian Journal of Electrical engineering. vol. 5, no.1, 2008

[8] Zhihui Yuan, Sjoerd W.H de Haan and Braham Frreira “DPFC control during shunt converter failure” IEEE Transaction on Power Electronics 2009.

[9] Zhihui Yuan, Sjoerd W.H de Haan, Braham Frreira and Dalibor Cevoric “A FACTS Device: Distributed Power Flow Controller (DPFC)” IEEE Transaction on Power Electronics, vol.25, no.10, 2010.

[10] S. Masoud Barakati, Arash Khoshkbar Sadigh and Ehsan Mokhtarpour, “Voltage Sag and Swell Compensation with DVR Based on Asymmetrical Cascade Multicell Converter”,North American Power Symposium (NAPS), 2011 .

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