

Improvement of Power Quality in Distribution System Using Photovoltaic Based DPFC

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Abstract— In Modern Power System power quality is the main issue of the power companies. Power quality improvement in distribution system using photovoltaic based DPFC is stated in these paper. Flexible AC Transmission System (FACTS) device which is known as distributed power flow controller (DPFC) is used. DPFC is derived from UPFC by eliminating common dc link between series and shunt converter. Unified power flow controller (UPFC) is widely used and control all parameters of the system. The UPFC handle the current and voltage with high rating; therefore the cost of system is high. Therefore distributed power flow controller (DPFC) is used due to high control capability, high Reliability & low cost. DPFC also measures the transmission angle, line impedance and bus voltage. problem occurs on distribution system like Voltage sag/swell, harmonics etc. In these paper we are using photovoltaic system for DPFC.

Keywords: DPFC, power quality, UPFC, distribution system, voltage sag, voltage swell, harmonics.

I INTRODUCTION

In modern power systems, there is a great demand to control the power flow actively. Power flow controlling devices (PFCs) are required for such purpose, because the power flow over the lines is the nature result of the impedance of each line. Due to the control capabilities of different types of PFCs, the trend is that mechanical PFCs are gradually being replaced by Power Electronics (PE) PFCs. Among all PE PFCs, the Unified Power Flow Controller (UPFC) is the most versatile device. However, the UPFC is not widely applied in utility grids, because the cost of such device is much higher than the rest of PFCs and the reliability is relatively low due to its complexity. The objective of this thesis is to develop a new PFC that offers the same control capability as the UPFC, at a reduced cost and with an increased reliability. The new device, so-called Distributed Power Flow Controller (DPFC), is invented and presented in this thesis. The DPFC is a further development of the UPFC.

The DPFC eliminates the common DC link within the UPFC, to enable the independent operation of the shunt and the series converter. The D-FACTS concept is employed in

the design of the series converter. Multiple low-rating single-phase converters replace the high-rating three-phase series converter, which greatly reduces the cost and increases the reliability. The active power that used to exchange through the common DC link in the UPFC, is now transferred through the transmission line at the 3rd harmonic frequency. The DPFC has been modeled in a rotating dq-frame. Based on this model, the basic control of the DPFC is developed. The basic control stabilizes the level of the of the capacitor DC voltage of each converter and ensures that the converters inject the voltages into the network according to the command from the central control. The shunt converter injects a constant current at the 3rd harmonic frequency, while its DC voltage is stabilized by the fundamental frequency component. For the series converter, the reference of the output voltage at the fundamental frequency is obtained from the central controller and the DC voltage level is maintained by the 3rd harmonic component.

II Literature Review

[1] C. Chengaiah and R. V. S. Satyanarayana, "Power flow assessment in transmission lines using Simulink Model with UPFC," 2012 International Conference on Computing, Electronics and Electrical Technologies (ICCEET), Kumaracoil, 2012, pp. 151-155, doi: 10.1109/ICCEET.2012.6203778.

The paper outlines The planning and operation of interconnected large power systems is becoming complex. The power transfer capability of long transmission lines is usually limited by large signals ability

[2] A. N. V. V. Rajasekhar and M. N. Babu, "Harmonics reduction and power quality improvement by using DPFC," 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), Chennai, 2016, pp. 1754-1758, doi: 10.1109/ICEEOT.2016.7754987. The DPFC is derived from the unified power-flow controller (UPFC). The

DPFC can be considered as a UPFC with an eliminated common dc link.

[3] M. Yadav and A. Soni, "Improvement of power flow and voltage stability using unified power flow controller," 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), Chennai, 2016, pp. 4056-4060, doi: 10.1109/ICEEOT.2016.7755476..In this paper we are discussing about a FACTS device named as UPFC (unified power flow controller). Its special features are to control active and reactive power course in a transmission line.

[4] S. Divya and U. Shyamala, "Power quality improvement in transmission systems using DPFC," 2015 2nd International Conference on Electronics and Communication Systems (ICECS), Coimbatore, 2015, pp. 854-858, doi: 10.1109/ECS.2015.7125035..This paper demonstrates The flexible ac-transmission system (FACTS) family called distributed power flow controller (DPFC).

5] A. Sen, A. Banerjee and H. Nannam, "A Comparative Analysis between UPFC and DPFC in a Grid Connected Photovoltaic System," 2019 IEEE International Conference on Intelligent Techniques in Control, Optimization and Signal Processing (INCOS), Tamilnadu, India, 2019, pp. 1-5, doi: 10.1109/INCOS45849.2019.8951352.

This Paper explains In this paper a comparative analysis between Unified Power Flow Controller (UPFC) and Distributed Power Flow Controller (DPFC) in a grid integrated photovoltaic system is performed.

[6] Z. Yuan, S. W. H. d. Haan, J. B. Ferreira and D. Cvoric, "A FACTS Device: Distributed Power-Flow Controller (DPFC)," in IEEE Transactions on Power Electronics, vol. 25, no. 10, pp. 2564-2572, Oct. 2010, doi: 10.1109/TPEL.2010.2050494.

In this paper the member of Flexible ac Transmission system(FACTS) family , called as Distributed Power Flow Controller . DPFC is derived from UPFC by eliminating common dc link between series and shunt converters. In DPFC multiple small single-phase converter instead of one large converter, reliability of DPFC is increase because redundancy of series converter. The principle and Analysis of DPFC is present in this paper. Due to high control capability, reliability and lower cost DPFC is used.

[7] Y. Zhang, G. Lu, W. A. Khan, Y. Zhang and Q. Zhu, "Direct Power Flow Controller—A New Concept in Power Transmission," in IEEE Transactions on Power Electronics, vol. 35, no. 2, pp. 2067-2076, Feb. 2020, doi: 10.1109/TPEL.2019.2920423

In This paper the new concept Direct Power Flow Controller (DPFC) is introduced in transmission system. DPFC was based on single-stage AC to AC converter with controllable phase and amplitude(ACCPA).It is similar to Unified Power Flow Controller(UPFC).DPFC has ability to regulate the amplitude and phase angle of grid node

III CONCEPT

The dispersed age framework and the utilization of renewable assets like breeze ranch, photovoltaic system has expanded the force quality issues. The force variety from sustainable sources, for example, wind and sun based can cause voltage changes. The utilization of electrical framework for interfacing the framework to utility framework can cause power quality issues. The central force quality issue related with wind age is voltage guideline. Wind age will in general be situated in meagerly populated regions where the electrical framework is frail comparative with the age limit [3]. This outcomes in voltage varieties that are hard to oversee. In this manner, it is now and again difficult to serve loads from the very feeder that serves a breeze ranch. The force vacillation from wind turbine during consistent activity causes voltage variance on matrix. The plentifulness of this change relies upon framework quality, network impedance, and stage point and force factor [4]. The voltage vacillation and glimmer are caused because of exchanging activity, pitch blunder, yaw mistake, vacillation of wind speed. The evaluation of intensity quality on matrix associated wind turbine is characterized by IEC 61400-21 and expressed that the brief normal of voltage variance ought to be inside +/- 5% Traditional wind turbine is furnished with acceptance generator. Enlistment Generator is favored on the grounds that they are reasonable, tough and requires little support. Shockingly acceptance generators require responsive power from the framework to work. The collaborations between wind turbine and force framework network are significant part of wind age framework

IV OBJECTIVES

In the customary network framework we are utilizing two FACT gadgets to get the ideal yield. This drove me to the proposed arrangement of utilizing a consolidated arrangement shunt compensator, for example, DPFC. DPFC is a serious rendition of bound together force stream regulator (UPFC) which is likewise a joined arrangement shunt compensator. By and large the DPFC are depicted to use for dispersion side, yet as it has the element of both arrangement and shunt compensator it very well may be planned so that it can repay the transmission side force quality issues. To control the numerous converters, DPFC comprises of three kinds of regulators; they are focal regulator, shunt control, and arrangement control. The focal control is to create reference signal

The third-consonant recurrence control is the significant control circle with the DPFC arrangement converter control. The rule of the vector control is utilized here for the dc voltage control [9]. The third-consonant current through the line is chosen as the pivot reference outline for the single-stage park change, since it is anything but difficult to be caught by the stage bolted circle (PLL) in the arrangement converter. As the line current contains two recurrence parts, a third high-pass

channel is expected to diminish the major current. The d-segment of the third symphonious voltage is the boundary that is utilized to control the dc voltage, and its reference signal is produced by the dc-voltage control circle. To limit the receptive force that is brought about by the third consonant, the arrangement converter is controlled as a obstruction at the third-consonant recurrence. The segment of the third-symphonious voltage is kept zero during the activity. As the arrangement converter is single stage, there will be voltage swell at the dc side of every converter. The recurrence of the wave relies upon the recurrence of the current that courses through the converter.

IV PROTOTYPE

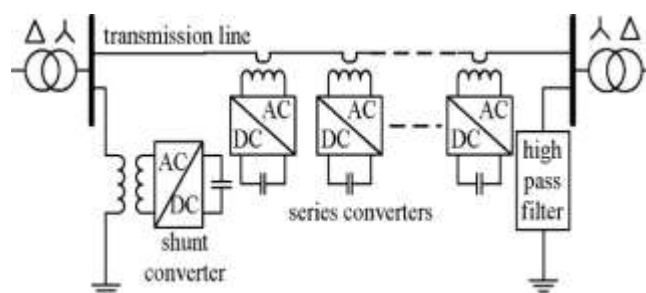


Fig 1. Circuit diagram of DPFC

V Conclusion

Expanding request of intensity has lead to improvement of transmission capabilities. The work completed in this paper is identified with improvement of another Power stream controlling gadget that gives same control capacity as the UPFC with diminished expense and expanded unwavering quality. This FACTS gadget named "The Distributed Power Flow Controller" (DPFC) is a further improvement of the UPFC with a killed normal d.c connect. The transmission lines at third symphonious recurrence are utilized for dynamic force trade among shunt and arrangement converters. The DPFC comprises of one shunt and a few seriesconnected converters. The shunt converter is comparable as a STATCOM, while the arrangement converter utilizes the D-FACTSconcept, which is to utilize numerous single-stage converters rather than one huge appraised converter. Every converter inside the DPFC is autonomous and has its own dc capacitor to give the necessary dc voltage. D-FACTS converters are singlephase and skimming regarding the ground. High-voltage disconnection is not, at this point needed between the stages. Nearly, the expense of the DPFC framework is not exactly the UPFC. DPFC has points of interest like decreased force misfortune and voltage profile. In this paper execution examination of UPFC and DPFC are looked at and comparing test results are completed by Simulink model .

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