Distributed Power Flow Controller (DPFC) to Improve the Power Quality

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Abstract

Recently, within the family of FACTS, the distributed power flow controller is an additional device. This paper highlights on voltage sag mitigation which is one of the burgeoning power quality issues. It deals with the working concept of distributed power flow controller for compensating unbalanced three phase line currents in the transmission system. The single phase series converters of DPFC are able to compensate. The unique control capability of the UPFC is given by the back-to-back connection between the shunt and series converters, which allows the active power to freely exchange. To ensure the DPFC has the same control capability as the UPFC, a method that allows active power exchange between converters with an eliminated DC link is required. An unsymmetrical fault (L-G fault) is considered near the load end side. A proper selection of controlling variables of DPFC relieves the load voltage sag, compensates the unbalance and diminishes the load voltage harmonics in few seconds. Furthermore the performance of DPFC is simulate using Matlab simulink and results denote an improvement in power quality.

Index Terms- -DPFC, power flow control, reduction of load voltage harmonics, voltage sag mitigation, unbalance fault condition

I. INTRODUCTION

THE growing demand of electricity and increase in non linear loads need high electrical power quality. It is a well known fact that in the recent few decades, the need of electrical power has become high drastically whereas currently the enlargement of electrical power transmission as well as generation has been bounded caused by scarcity of resources and environmental limitations. As such the consequences are complexity of power system, heavy loading of transmission line and also the power system stability changes into power transfer limiting factor. For better utilization of prevailing ac transmission system and control of power flow the concept of power electronic based FACTS devices were investigated [1]. The FACTS devices which can control parameters like the bus voltages, the line impedance and the transmission angle simultaneously come under the category of most powerful FACTS devices. Among which one is unified power flow controller (UPFC),

Ideally, this injected voltage is in quadrature with the line current, such that the SSSC behaves like an inductor or a capacitor for the purpose of increasing or decreasing the overall reactive voltage drop across the line, and thereby, controlling the transmitted power. In this operating mode, the SSSC does not interchange any real power with the system in steady-state. The unified power-flow controller (UPFC) is the most versatile device of the family of FACTS devices, since it is able to control the active and the reactive power, respectively, as well as the voltage at the connection node. The Unified Power Flow Controller (UPFC) is comprised of a STATCOM and a SSSC, coupled via a common DC link to allow bi-directional flow of active power between the series output terminals of the SSSC and the shunt output terminals of the STATCOM. Each converter can independently generate (or) absorb reactive power at its own AC terminal. The two converters are operated from a DC link provided by a DC

storage capacitor[5]. An unsymmetrical fault (L-G fault) is considered near the load end side. A proper selection of controlling variables of DPFC relieves the load voltage sag, compensates the unbalance and diminishes the load voltage harmonics in few seconds. Furthermore in this paper the performance of DPFC is studied and results denote an improvement in power quality as well as enhanced power flow control

II CONTROL SCHEME OF SERIES FILTER

DPFC Topology

By introducing the two approaches outlined in the previous section (elimination of the common DC link and distribution of the series converter) into the UPFC, the DPFC is achieved. Similar as the UPFC, the DPFC consists of shunt and series connected converters. The shunt converter is similar as a STATCOM, while the series converter employs the DSSC concept, which is to use multiple single -phase converters instead of one three-phase converter. Each converter within the DPFC is independent and has its own DC capacitor to provide the required DC voltage. The configuration of the DPFC is shown.
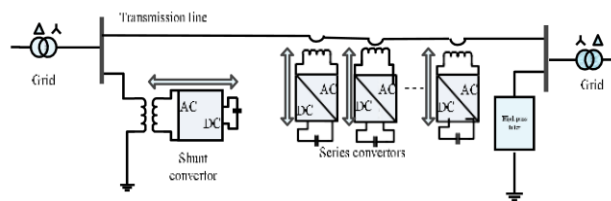
The central control unit generates reference signals for the shunt and series converters of the DPFC to regulate the bus voltage and to control power flow in transmission line. All the reference signals generated by the central control unit are corresponded to the fundamental frequency components.

CONTROL SCHEME OF SERIES FILTER

A simple algorithm is developed to control the series and shunt filters. The series filter is controlled such that it injects voltages (vca; vcb; vcc), which cancel out the distortions and/or unbalance present in the supply voltages (vsa; vsb; vsc), thus making the voltages at the PCC (vla; vlb; vlc) perfectly balanced and sinusoidal with the desired amplitude. In other words, the sum of the supply voltage and the injected series filter voltage makes the desired voltage at the load terminals.

CONTROL SCHEME OF SHUNT FILTER

The control algorithm for a shunt AF consists of the generation of 3-phase reference supply currents and it is depicted in Fig. 3. This algorithm uses supply in-phase, 120_ displaced three unit vectors computed using eqn. (1). The amplitude of the reference supply current (I_ sp) is computed as follows. A comparison of the average and the reference values of the dc bus voltage for the shunt AF results in a voltage error, which is fed to a proportional integral (PI) controller and the output of the PI controller is taken as the reference amplitude of the supply currents. The three in-phase reference supply currents are computed by multiplying their amplitude (I_ sp) and in phase unit current vectors

III. OBJECTIVES

Objectives are as follows.

1. To develop signature recognition & verification
     System by using artificial neural network

2. To verify an entered signature with the help of an
     Average signature, which is obtained   from the set of, previously collected signatures

3. To accurately characterize each user's signature, thus offering good verification and   recognition performance

4. To reduce the time required for Signature verification and recognition

5. To maintain the Security in various financial domain such as banking, Insurance etc.

IV. PROPOSED METHODOLOGY

The above discussed Unified Power Flow Controller (UPFC) offers good promise to enhance the performance of the electric power grid by providing voltage stability while improving the power flow potential. The UPFC of present technology is typically located at either the sending end or receiving end of a transmission line. It will be referred to as a concentrated UPFC (CUPFC). There are three major problem areas associated with the CUPFC that have hindered its widespread acceptance by the electric utilities - reliability, cost, and footprint requirement. This work studies a new UPFC technology that addresses these three impediments. This novel technology is called the Distributed Power Flow Controller (DPFC).

A symmetrical fault is considered near the load end. By taking appropriate controlling parameters of DPFC, DPFC mitigates the load voltage sag as well as reduces the load voltage harmonics in seconds. Further the dynamic performance of DPFC is studied and results indicate improvement power quality and enhanced power flow control

V. CONCLUSION

This paper has presented a new concept called DPFC. The DPFC emerges from the UPFC and inherits the control capability of the UPFC, which is the simultaneous adjustment of the line impedance, the transmission angle, and the bus-voltage magnitude. The common dc link between the shunt and series converters, which is used for exchanging active power in the UPFC, is eliminated. This power is now transmitted through the transmission line at the third-harmonic frequency. The series converter of the DPFC employs the D-FACTS concept, which uses multiple small single-phase converters instead of one large-size converter. The reliability of the DPFC is greatly increased because of the redundancy of the series converters

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