**1.INTRODUCTION**

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The growing demand and the aging of networks make it desirable to control the power flow in power-transmission systems fast and reliably. The Flexible AC-Transmission System (FACTS) that is defined by IEEE as a power-electronic based system and other static equipment that provide control of one or more ac-transmission system parameters to enhance controllability and increase power-transfer capability, and can be utilized for power-flow control. Currently, the Unified Power-Flow Controller (UPFC) is the most powerful FACTS device, which can simultaneously control all the parameters of the system the line impedance, the transmission angle, and bus voltage.

The UPFC is the combination of a Static Synchronous Compensator (STATCOM) and a Static Synchronous Series Compensator (SSSC), which are coupled via a common dc link, to allow bidirectional flow of active power between the series output terminals of the SSSC and the shunt output terminals of the STATCOM. The converter in series with the line provides the main function of the UPFC by injecting a four-quadrant voltage with controllable magnitude and phase.

The injected voltage essentially acts as a synchronous ac-voltage source, which is used to vary the transmission angle and line impedance, there by independently controlling the active and reactive power flow through the line. The series voltage results in active and reactive power injection or absorption between the series converter and the transmission line. This reactive power is generated internally by the series converter and the active power is supplied by the shunt converter that is back-to-back connected. The shunt converter controls the voltage of the dc capacitor by absorbing or generating active power from the bus. Therefore, it acts as a synchronous source in parallel with the system. Similar to the STATCOM, the shunt converter can also provide reactive compensation for the bus. The components of the UPFC handle the voltages and currents with high rating. Therefore, the total cost of the system is high. Due to the common dc-link interconnection, a failure that happens at one converter will influence the whole system. To achieve the required reliability for power systems, bypass circuits and redundant backups are needed, which on other hand, increase the cost. Accordingly, the UPFC has not been commercially used, even though it has the most advanced control capabilities.

This project introduces a new concept, called Distributed Power-Flow Controller (DPFC) that is derived from the UPFC. The same as the UPFC, the DPFC is able to control all system parameters. The DPFC eliminates the common dc link between the shunt and series converters. The active power exchange between the shunt and the series converter is through the transmission line at the third-harmonic frequency. The series converter of the DPFC employs the Distributed FACTS (D-FACTS) concept. Comparing with the UPFC, the DPFC have two major advantages

1. Low cost because of the low-voltage isolation and the low component rating of the series converter.
2. High reliability because of the redundancy of the series converters. This project begins with presenting the principle of

the DPFC, followed by its steady-state analysis.

**1.2. Literature Survey**

[1] Y. H. Song and A. Johns to explain the concept of Flexible ac

Transmission Systems (FACTS).

[2] N. G. Hingorani and L. Gyugyi to describe the Concepts and

Technology of Flexible AC Transmission Systems.

[3] L. Gyugyi, C.D. Schauder, S. L.Williams, T. R. Rietman, D. R.

Torgerson, and A. Edris, to propose a new concept of the unified

power flow controller a new approach to power transmission

control.

[4] A.-A. Edris to explain the proposed terms and definitions for

flexible ac transmission system.

[5] K. K. Sen to address the static synchronous series compensator.

**1.3. Problem Of The Formation**

The UPFC is the combination of a static synchronous compensator and a static synchronous series compensator, which are coupled via a common dc link, to allow bidirectional flow of active power between the series output terminals of the SSSC and the shunt output terminals of the STATCOM. The converter in series with the line provides the main function of the UPFC by injecting a four-quadrant voltage with controllable magnitude and phase. The injected voltage essentially acts as a synchronous ac-voltage source, which is used to vary the transmission angle and line impedance, thereby independently controlling the active and reactive power flow through the line.

The components of the UPFC handle the voltages and currents with high rating. Therefore, the total cost of the system is high. Due to the common dc-link interconnection, a failure that happens at one converter will influence the whole system. To achieve the required reliability for power systems, bypass circuits and redundant backups are needed, which on other hand, increase the cost. Accordingly, the UPFC has not been commercially used, even though it has the most advanced control capabilities. But it consists more disadvantages as mentioned above.

**1.4. Objective Of The Project**

This project introduces a new concept, called Distributed Power-Flow Controller (DPFC) that is derived from the UPFC. The same as the UPFC, the DPFC is able to control all system parameters. The DPFC eliminates the common dc link between the shunt and series converters. The active power exchange between the shunt and the series converter is through the transmission line at the third-harmonic frequency. The series converter of the DPFC employs the Distributed FACTS (D-FACTS) concept. Comparing with the UPFC, the DPFC have two major advantages

1. Low cost because of the low-voltage isolation and the low component rating of the series converter.
2. High reliability because of the redundancy of the series

converters.

**1.5. Organization Of Thesis**

Chapter 1 Gives an introduction to the concept of distributed

power flow controller.

Chapter 2 Gives a description of unified power flow controller.

Chapter 3 Covers theStatic synchronous series compensator

Chapter 4 Discusses to the concept of pulse width modulation.

Chapter 5Covers to the simulation of loading balance of

distribution feeders considering PV Power generation

with Loop Power Controller (LPC).

Chapter 6 Summarizes and concludes the thesis and proposes

recommendations for future work.