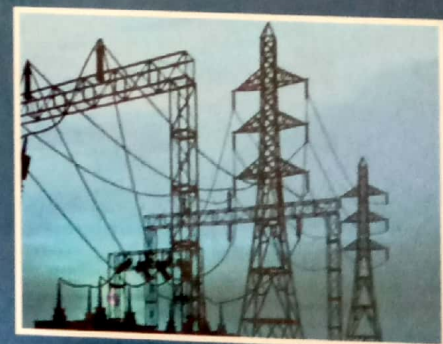


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A New Proposal for Mitigation of Power Quality Problems Using D-STATCOM

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Abstract: *DSTATCOM (Distribution Static Compensator) is Used for Mitigation of Power Quality Problems under unbalance caused by various loads in distribution system. This paper addresses the modeling and analysis of custom power controllers, power electronic-based equipment aimed at enhancing the reliability and quality of power flows in low voltage distribution networks using DSTATCOM. A new PWM- based control scheme has been proposed that only requires voltage measurements the operation of the proposed control method is presented for D-STATCOM. Simulations and analysis are carried out in MATLAB/SIMULINK with this control method for two proposed systems.*

Keyword: *D-STATCOM, VSC, FACTS Controller, PCC.*

I. INTRODUCTION

In recent years, the custom power technology, the low-voltage counterpart of the more widely known flexible ac transmission system (FACTS) technology, aimed at high-voltage power transmission applications, has emerged as a credible solution to solve many of the problems relating to continuity of supply at the end-user level. Both the FACTS and custom power concepts are directly credited to EPRI [1], [2]. At present, a wide range of very flexible controllers, which capitalize on newly available power electronics components, are emerging for custom power applications. Among these, the distribution static compensator (D-STATCOM) based on the VSC principle [3]-[5] has been used to perform the Modeling and analysis of such controllers for a wide range of operating conditions based PWM control reported in this seminar for the D-STATCOM. It relies only on voltage measurements for its operation, i.e., it does not require reactive power measurements [6]. A sensitivity analysis is carried out to determine the impact of the dc capacitor size on D-STATCOM performance.

When used in low-voltage distribution systems the STATCOM is normally identified as Distribution STATCOM (D-STATCOM). It operates in a similar manner as the STATCOM (FACTS controller), with the active power flow controlled by the angle between the AC system and VSC voltages and the reactive power flow controlled by the

difference between the magnitudes of these voltages. As with the STATCOM, the capacitor acts as the energy storage device and its size is chosen based on power ratings, control and harmonics considerations. The D-STATCOM controller continuously monitors the load voltages and currents and determines the amount of compensation required by the AC system for a variety of disturbances.

A D-STATCOM (Distribution Static Compensator), which is schematically depicted in Fig.4.1 consists of a two-level Voltage Source Converter (VSC), a dc energy storage device, a coupling transformer connected in shunt to the distribution network through a coupling transformer. The VSC converts the dc voltage across the storage device into a set of three-phase ac output voltages. These voltages are in phase and coupled with the ac system through the reactance of the coupling transformer. Suitable adjustment of the phase and magnitude of the DSTATCOM output voltages allows effective control of active and reactive power exchanges between the DSTATCOM and the ac system. Such configuration allows the device to absorb or generate controllable active and reactive power. The VSC connected in shunt with the ac system provides a multifunctional topology which can be used for up to three quite distinct purposes [7]:

1. Voltage regulation and compensation of reactive power
2. Correction of power factor
3. Elimination of current harmonics

Here, such device is employed to provide continuous voltage regulation using an indirectly controlled converter.

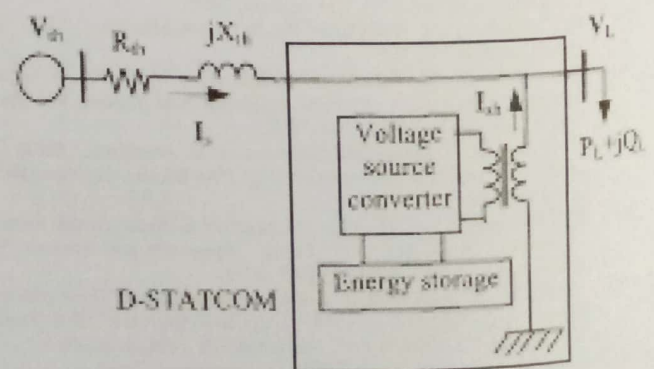


Fig. 1. Single line diagram of D-STATCOM connected distribution system.