RESEARCH ARTICLE OPEN ACCESS

Performance Of UPFC Integrated With a DC Source For Reactive Power Compensation

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Abstract:

FACTS components are composed of power electronics devices causes problems such as voltage flicker and transient stability problems. These problems can be avoided by sufficient power flow . UPFC is the most effective device among FACTS devices. DC link capacitor is unable to supply controllable real power .This paper proposes MATLAB/simulink model and controlling of UPFC integrated with a DC source .It can reduce the stability problems by controlling the real power and reactive power compensation for different modes of operation.

Keywords **— UPFC ,DC Source ,STATCOM ,SSSC.**

I. INTRODUCTION

The unified power flow controller is a effective FACTS device that is capable of simultaneous control of transmission line parameters. The presented control system enables the UPFC to following the exchanges of line active power and reactive power values, maintaining the DC link voltage and voltage at system. UPFC has the fast response and hence it is required for improving transient behaviour of power system after transient conditions. The presented control system acts properly in the steady and transient conditions. Introducing a supplementary control system to the it is possible to balance line current in the system.[1].

UPFC is a FACT device for providing fast acting reactive power compensation.UPFC mainly operates on high voltage transmission systems.Three phase controllable bridges are used in UPFC to produce current that is injected to transmission line using a step up transformer.The real power and reactive power flows in transmission line can be controlled by using controllers.The UPFC uses solid state devices,which provide functional flexibility,the conventional thyristor control systems can't be attained this. The UPFC is a combination of static synchronous compensator and a static synchronous series compensator connected via a common DC voltage link.Controlling the real and reactive power is the main advantage of UPFC.If there are any disturbances or faults in the source side,UPFC will not work.The UPFC operates only under balanced condition. Reactance in the line,phase angle of voltage and magnitude of voltage were the controllable parameters of UPFC. L.Gyugyi of westing house explained the UPFC concept in 1995[1].Stability control is obtained by improving the transient stability of power system is a secondary as well as important function of UPFC.

The main objective of this paper is to study the performance of UPFC and to improve power system stability by controlling power flow and also compensate reactive power.

II. OPERATING PRINCIPLE

The UPFC is placed in between the sending end and receiving end.Shunt device and series device are the main parts of UPFC These two converters are connected by using a DC voltage link.The shunt device is operated in such a way that injecting a current to the transmission line.This current consists of two components real component and reactive component.According to the requirement of real power by the transmission line,the direct component is automatically determined.The

quadrature component can set independently to any desired reference level with in the capability of inverter to absorbs or consumes reactive power.The shunt converter is used for voltage regulation injecting an opportune reactive power in to the line and to balance the exchange of real power with series inverter and transmission line.Series converter is used for controlling real power and reactive power injecting opportune with controllable magnitude and phase angle of voltage in series with the transmission line.

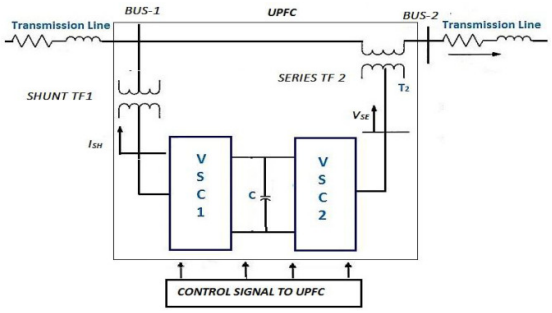

Fig.1.Basic configuration of UPFC.

IV. SIMULINK MODEL OF UPFC-DC SOURCE.

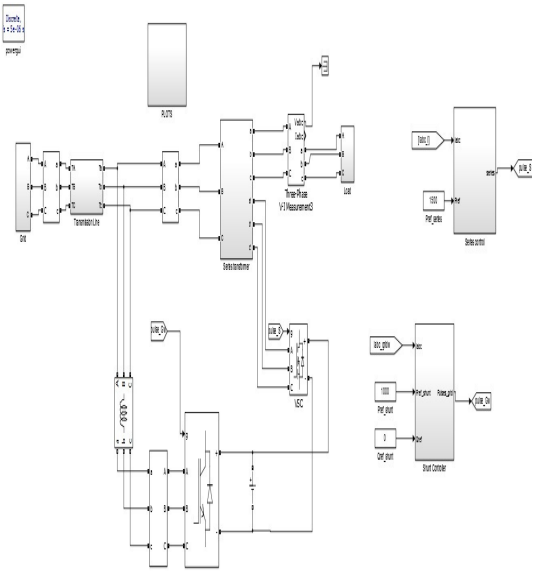

Fig. 2 SIMULINK model of UPFC with DC source.

B. Series injected voltage control

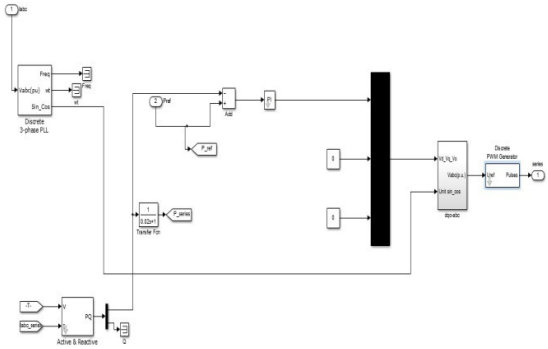

Fig .3. series controller.

Series controller is used to control the injection of voltage in series with the transmission line. Series controller provides series compensation with the line. It injects the three phase voltage at the point of connection.PWM technique is used for controlling the power flow in converters. .Error value is obtained from the PI controller. Decoupled control scheme is used .The voltage given to the voltage source converters are based on the reference value.

B .Shunt current control

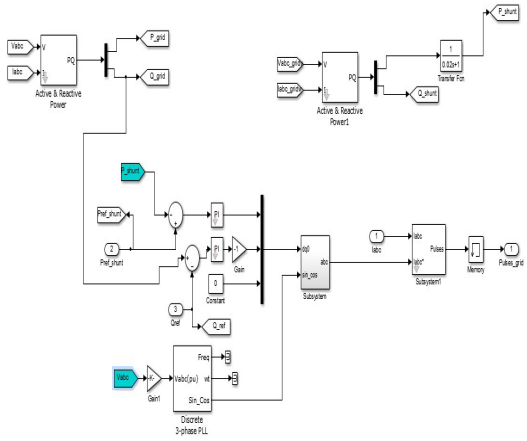

Fig.4.Shunt controller

The magnitude of voltage is the output of converter .Controller which creates a pulse signal to control the magnitude of voltage at point at which is connected to the transmission line.For controlling the real and reactive power flow, automatic power control is used.ie The real power and reactive power are the reference inputs in despite changes of controllable parameters in transmission line.

V. SIMULATION RESULTS

Figure 4 shows the reactive power at unity power factor

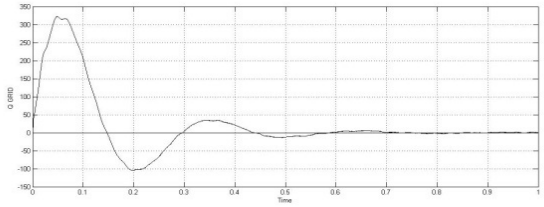

Fig.5. Reactive power at unity power factor.

Figure 5 shows the reactive power at lagging power factor, ie reactive power gets absorbed from the transmission line

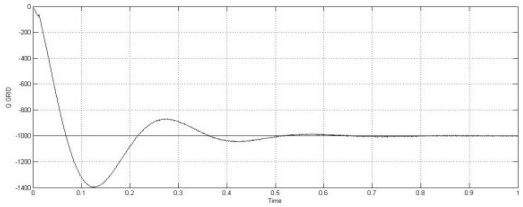

Fig.6.Reactive power at lagging power factor.

Figure 6 shows the reactive power at leading power factor, ie reactive power is generated to the transmission line.

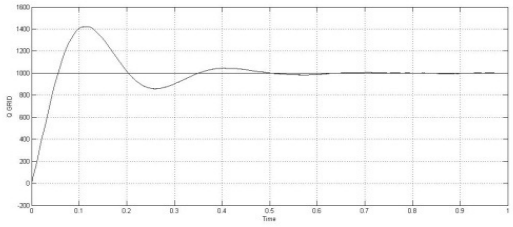

Fig.7.Reactive power at leading power factor.

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