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UPFC- Review

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Abstract

The unified power flow control is a device which is used to control the reactive power & voltage in the power grid by using fuzzy logic controller. It includes the control of flow of voltage in the conductor while distribution of load. It is the component of flexible ac transmission system (facts) device. It consists of two inverters. One in series & second one is in parallel to the transmission line. The control of flow of voltage is done through the Newton Raphson power flow algorithm. The examples to prove the feasibility & the performance of Newton Raphson power flow algorithm are IEEE 118 bus system & IEEE 30 bus system. The control of the active & reactive power is done by the change in magnitude & the phase angle of the applied voltage. This paper will help us to improve the active & reactive power in the power grid to increase the efficiency of the grid.

Keywords: UPFC, FACTS, Voltage Stability, Power Flow Improvement.

Introduction

The progress of the high power semiconductor device has been developed by using flexible ac transmission system(FACTS). The main motive of the facts device is to increase the controllability & the flexibility of the flow of voltage. The unified power flow controller (UPFC) is the most convenient component of the facts device which has the two inverters connected in the series & the shunt places. In power flow & optimal power flow the computer modelling is increasing now a day. Due to the utilization of the electrical power & customer disturbances the distortions & fluctuations are occurred in power quality. Power quality means to maintain the waveforms of current & voltage at rated magnitude & frequency. The factors which affects the power quality are electronic equipment, variable speed drives, electronic control gears etc. Efficient operation of the equipment is only depending on the power quality if the power quality is high the operation of equipment is safe & good and vice versa.

FACTS device is responsible for the control of flow of voltage, increased in loading of transmission line. The UPFC plays the role of static synchronous compensator(STATCOM), Thyristor switched capacitor (TSC) Thyristor controlled reactor (TCR), and the phase angle regulator.

The magnitude & the phase angle of the voltage is independent. The UPFC is the combination of the three compensators i.e. impedance, phase angle & voltage magnitude. Series & shunt converters are connected through the dc link shunt converter or static synchronous compensator. The power generated by the series converter is equal to the power generated by shunt converter in the power flow control. A coupling transformer is also connected in the transmission line to increase the feasibility & controllability of the voltage.

This paper consists the technique to improve active & reactive power flow control with the help of the FACTS device which is unified power flow controller(UPFC).

The power is separately generated, transmitted & distributed for the production of cheaper electricity. Losses should be minimum in the transmission line that's why UPFC is introduced in the power grid. Voltage instability occurs in the system when transmission line doesn't fulfil the voltage load. When the system is faulted a reactive unbalance is occurred in the system.

As we know the main function of UPFC is to control the reactive power in series with the transmission line, magnitude & phase angle is varied according to the distribution of the load.

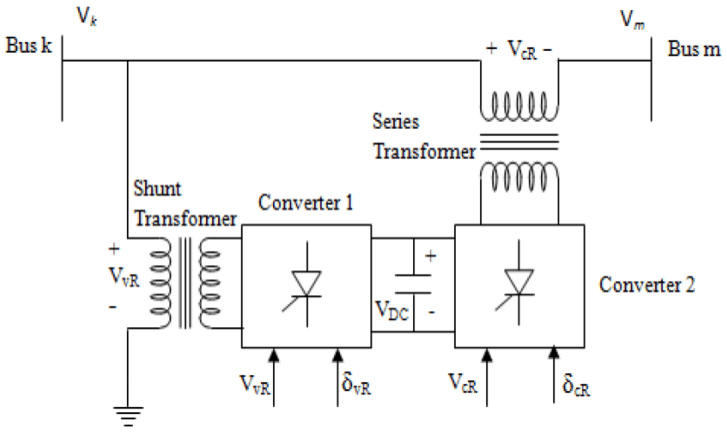

Fig.1: Schematic diagram of a UPFC

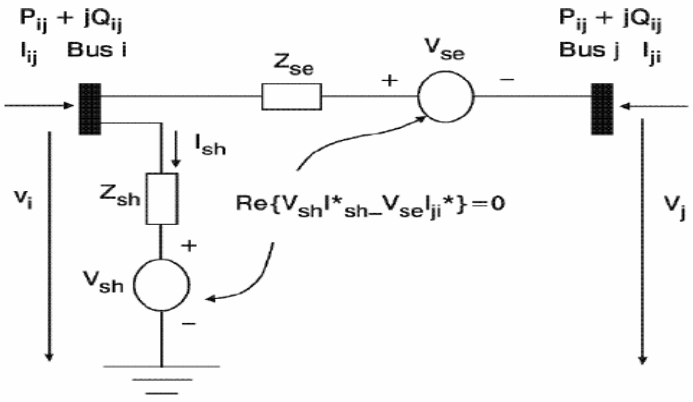

Fig.2 : Circuit of UPFC

UPFC Literature Review

By utilizing power electronic controllers an adaptable air conditioning transmission framework (FACTS) can offer more noteworthy control of power stream, secure stacking and damping of intensity framework motions. FACTS refers to electronic structural control, for example, fixed VAR compensator (SVC), thyristor-controlled capacitor (TCSC), fixed capacitor (STATCON) and linked force flow control unit (UPFC). The together force flow flow control unit is an electronic force frame that can provide VAR compensation, line impedance control, and step point displacement. UPFC

has two fully controlled electronic power transformers as shown in Figure 1, and inverter 2 is connected in order to the transmission line by the T2 transformer, while inverter 1 is connected to the correspondence with the transmission line. Transmission by TI converters. In addition, the true flow of receiving power in the transmission line can be directed instantly by changing the size and step point of the accompanying voltage that the inverter provides. The primary power of Inverter 1 is to supply the actual power required by Inverter 2 via a normal DC connection. Inverter 1 can also generate or accommodate manageable reception power.

In (1994) Laszlo Gyugyi and Fellow depicted a novel approach in which strong state synchronous voltage sources are utilized or the dynamic remuneration and constant control of intensity stream in transmission frameworks. The synchronous voltage source is actualized by a multi-beat inverter utilizing ate turn-off (GTO) thyristors. It is fit for producing inside the receptive force vital for organize pay, and is additionally ready to interface with a suitable vitality stockpiling gadget to haggle genuine force trade with the air conditioner framework. They builds up a far reaching treatment of power stream control utilizing strong state synchronous voltage hotspots for shunt pay, arrangement remuneration, and stage point control. It additionally portrays the remarkable brought together force stream controller that can control simultaneously or specific every one of the three system parameters (voltage, impedance, transmission point) deciding force transmission.

In 1995, Gyqyi et al. Describes the main ideas of the proposed brief P and Q control summary and thinks of more uniform but related force flow controllers, for example, a thyristor-controlled series capacitor and a thyristor-controlled regulator. In addition, they also show the consequences of restarting computers indicating UPFC implementation under different framework conditions.

In (1996) Round, et al. The UPFC presentation was examined with four exceptional controllers and evaluated through rebuilding and implementation in an Exploration Research installation model. The explored controllers are the PI controller, the PI controller with the separator, the crossover console and the H hearty control unit. We discover that the powerful cross-coupling H∞ controllers have the best execution when the final rating of the power transmission parameters is ambiguous.

In (1997) M. Noroozian, et al. manage ideal force stream control in electric force frameworks by utilization of bound together force stream controller (UPFC). What's more, they created and broke down Models reasonable for fuse in power stream programs. What's more, exhibited the use of UPFC for ideal force stream control through numerical models. It is demonstrated that an UPFC has the ability of managing the force stream and limiting the force misfortunes at the same time.

In (2000) Zhengyu Huang, et al. talk about four head primary control systems and the PC tests results support the conversation end and furthermore they closed the steady power stream control is useful for consistent state control and the consistent arrangement remuneration control is valuable for first swing steadiness. The advantageous control is extremely effective in damping the force wavering. The recommended UPFC control can understand the ideal control procedure deftly and improve framework dynamic execution fundamentally.

In (2010) Muthukrishnan and Nirmal Kumar dialed with computerized reproduction and execution of intensity framework utilizing UPFC to improve the force quality. They find that UPFC is likewise fit for improving transient dependability in a force framework.

In (2010) Mathukrishanan and nirmalkumar dialed with computerized reproduction of 14 – transport power framework utilizing UPFC to improve the force quality, they presume that the UPFS has the capacity of improving the transient soundness in a force framework.

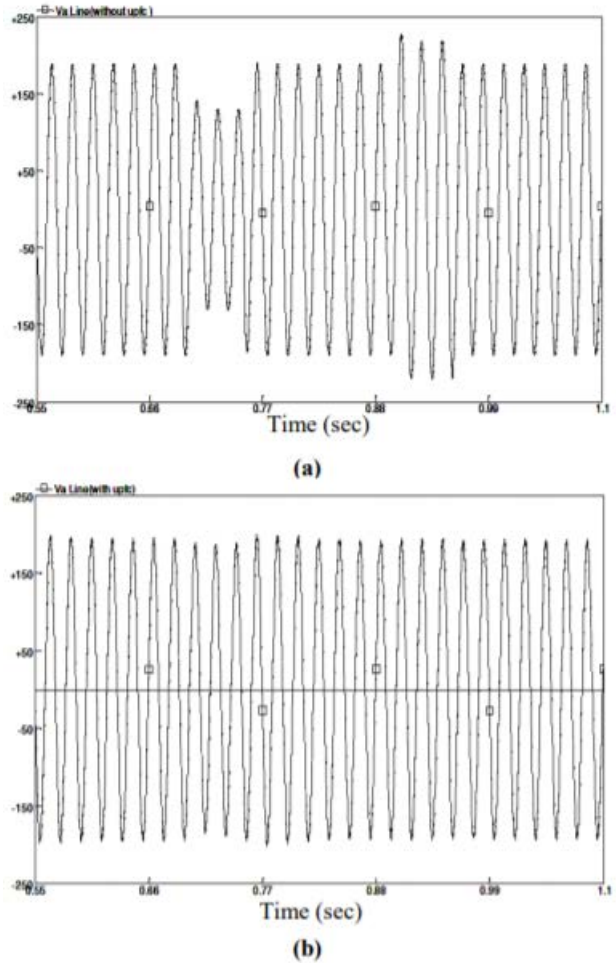

Fig.3: The practical results for voltage sag and swell in phase A, where: (a) before connection of UPFC. (b) After connection of UPFC

Analysis Of Controller And Simulation Results

The sufficiency of the proposed UPFC POD controller has been demonstrated to dampen motions in near position with the SMIB frame. The SMIB linear case space model presented with UPFC is presented above. Likewise, in order to improve damping and hence the short stabilization time of the reaction, we want to move the true piece of the intrinsic value related to the LHS balancing method at the complex level. To do this, we want to place the eigenvalue compared to the LHS balancing method for the complex plan. A change in the working conditions of a density frame is a basic wonder, for example, stacking of fonts varies in a wide range of fonts that can change from time to time. For a decent

damping control structure, other than the most extreme extreme control unit, the damping controller sensitivity to a variety of working conditions for a severity frame is an equally important factor to consider. Later on, it is interesting for the UPFC POD controller that it should have the ability to respond to changes in the work point besides happy implementation. In this way, it is necessary to explore the influence of the small burden that deviates from the width of the ECU. In light of this, the width of the UPFC POD controller under the following working conditions (I) is a 20% decrease in line stacks (ii) a 20% increase in line stacks. For such examinations, an investigation of the intrinsic values was completed with the results of reconfiguration in each case of stacking. The effect of diversity is also taken into account in the Settings menu and the edge of the converter for converters when introducing the proposed console. To conduct such an examination again, scanning for auto-values with reconstruction brings a variety in the settings menu and ends the conversion point for converters.

Conclusion

The real and reactive power stream in the transmission line can be constrained by changing the greatness and stage point of the infused voltage delivered by the arrangement inverter.The basic function of the parallel inverter is to supply the real power demanded by series inverter through the common dc link. The parallel inverter can also generate or absorb controllable reactive power. The aims of this paper, to study and analyze most researches that topics cover the unified Power flow controller (UPFC) and made a comparison between them in order to improve its functions in addition to obtain a best controlling method for active and reactive power flow of the power system, where this paper offered most papers that used a UPFC to carrying out the following point after finding an optimal location of the FACTs device:

1- Improving the active and reactive control power flow of the power systems.

2- Increasing the transient stability.

3- Increasing the damping of sub synchronous resonance.

4- Controlling the steady state or dynamic performance.

5- Optimizing power flow.

6- Minimizing the operational costs of the electrical grid.

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