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POWER SYSTEM STABLITY ENHANCEMENT USING UNIFIED POWER FLOW CONTROLLER UNDER THREE PHASE FAULT

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Abstract:-

Stability of power system are annualized by using an unified power flow controller(UPFC).
UPFC is used to control the power flow in the transmission system by controlling the voltage magnitude, impedance and phase angle. Mostly unified power flow controller enhances the power system stability under three phase fault. The control strategy is implemented by UPFC FACT devices and it is found that system performance enhanced under three phase fault. Due to three phase fault the problems arises in generator voltage, infinite bus voltage, Generator current, infinite bus current and generator load angle of a power system are investigated in detail and resolved by designing and testing a test system using MATLAB/SIMULINK.

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1.INTRODUCTION:-

The power generation and transmission is a complex process that requiring the working of differentcomponents of the power system in tandem to maximize the output. The shut fault are the most regular type of faults taking place in the field[1].Three phase fault caused due to falling tower failure of equipment (or) even a line braking and touching the remaining phases can cause three phase faults[2].

Gyugyi proposed the Unified power flow controller(UPFC) concept in 1991[3]. The function of FACTS is installing the Power electronics devices at the high voltage side of power grid to make the complete system electronically controllable. Due to high power semiconductor devices and control technology FACT devices plays a vital role in power system. In the Transmission line by connecting UPFC the real and reactive power is controlled[4].UPFC is the most versatile and complex of the fact device, it is the combined features of STATCOM and SSSC. Three most important reasons for using unified power flow controller are as following:

1. Passes reactive power flow bi-directionally
2. Maintaining well regulated DC voltage.
3. Workability in wide range of operating condition

The control strategy is implemented using UPFC FACT Devices. It is found that power system stability enhanced under three phase fault . These parameters are investigated in detail by designing and testing a test system using MATLAB/SIMULINK.

Three different Parameter are represented as follows:-

1. Generator voltage.
2. Generator current.
3. Generator angle.

2. PRINCIPLE AND OPERATION OF UPFC DEVICE:-

The Unified power flow controller (UPFC) was proposed for real turn-off time control and dynamic compensation of ac transmission system,providing the necessary functional flexibility required to solve many of problems facing the utility industry[7]. Unified power flow controller(UPFC) consist of two voltage source convertors sharing a common DC storage capacitor and connected to the power system coupling transformers. DC links creates path for active power exchange between the convertors.

Unified power flow controller(UPFC) is the most gifted version of the FACTS devices. In UPFC Devices the transmitted power can be controlled by changing three parameters, they are following:-

1. Transmission magnitude voltage.
2. Phase angle.
3. Impedance.

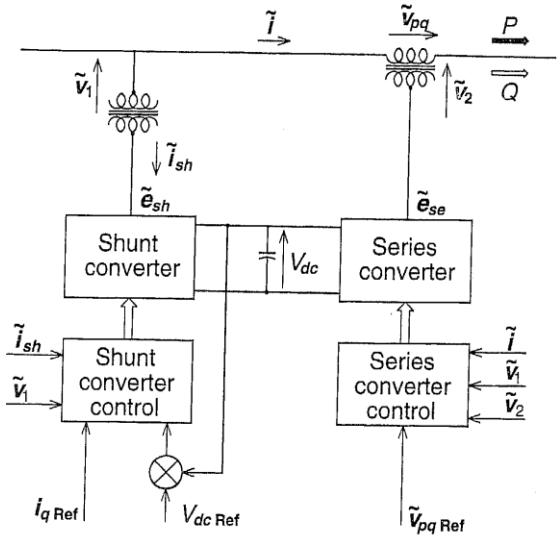
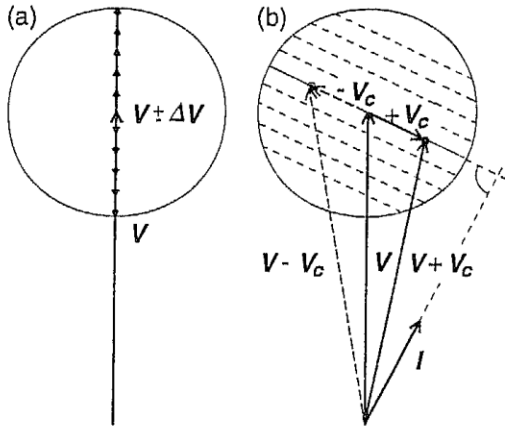


Figure 1. Basic UPFC control scheme.

3.BASIC UPFC DEVICES CONTROL FUNCTION:-

The transmitted power P and Reactive power Q supplied by the receiving end, can be expressed as follows:

$$P - jQ = Vr^*(Vs + Vpq - Vr)/jX$$



(a) Voltage regulation

(b) Line impedance compensation.

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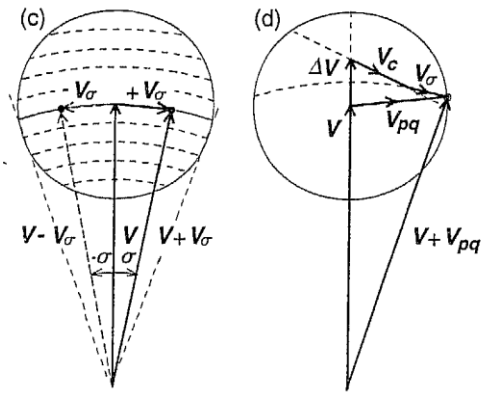

(c) Phase shifting.

(d) Simultaneous control of voltage, impedance , and angle.

Figure 2. Phasor diagram illustrating the conventional transmission control capabilities of the UPFC.

4. SIMULATION MODEL OF TEST SYSTEM :-

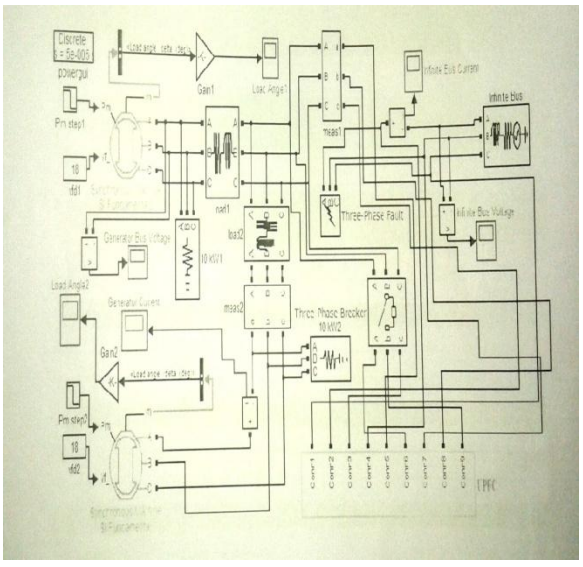

Figure 3 . Test system with UPFC.

5. SIMULATION RESULTS :-

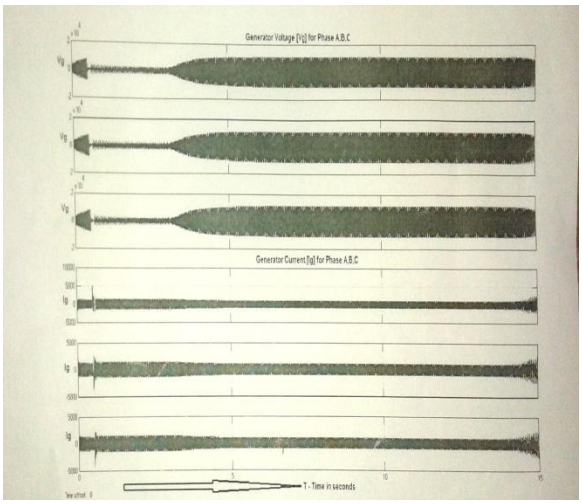

Figure 4. Represent generator voltage and current of test system with three phase fault.

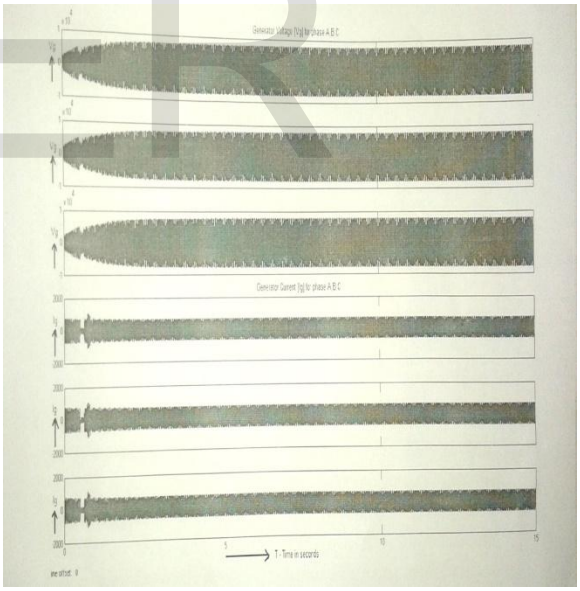

Figure 5. Represent generator voltage and current of test system with UPFC.

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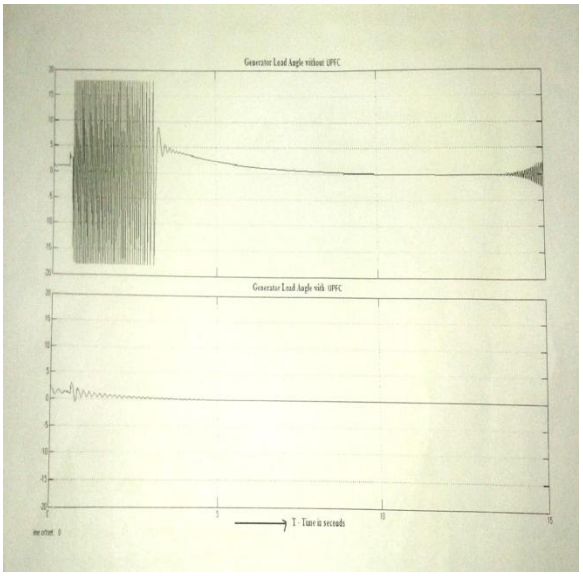

Figure 7. Represent generator load angle of test system with and without UPFC.

Table :- Test system setting time comparisons

Parameters	Setting time Ts	
	Without UPFC	With UPFC
Generator voltage	4.2 sec.	1.3 sec.
Generator current	4.2 sec.	2.1sec.
Generator load angle	7.1 sec.	4.2 sec.

6. CONCLUSION:-

The test system is designed with three phase fault using unified power low controller. By using the unified power flow controller in the test system the bus voltage are controlled and voltage fluctuation is reduced. Generator voltage stabilized at 1.3 seconds. Likewise the generator current is stabilized at 2.1 seconds. But without FACTS device generator voltage and generator current reaches stabilization at 4.2 and 4.2 seconds respectively. Form the table. We infer that the test system with UPFC is much better in stabilization of generator load angle, infinite Bus voltage and current than without FACTS device.

7. REFERENCE:-

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