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A Power System Transient Stability Analysis And Improvement By Facts Controllers.

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ABSTRACT:-Today's Power system is a complex network; power generation usually does not situate near the load center. So meet the growing power demand, it is better to give more interest in utilization of available power system capacities of existing generation and power transmission network, instead of building new transmission lines and expanding substations. On the other hand, power flows in some of the transmission lines are overloaded, causing the deterioration of voltage profiles and decreasing system stability and security due to short circuit or any other external fault. In addition, existing traditional transmission facilities, in most cases, are not designed to handle or control this complex and highly interconnected power systems. This overall situation requires improving the traditional transmission methods and practices, and the creation of new concepts, which would allow the use of existing generation and transmission lines up to their full capabilities without reduction in system stability and security. This paper is highlighting this concept and analysis of a complex network and this approach can be applied in complex power system network.

KEYWORDS:-FACTS CONTROLLER, SVC, UPFC

INTRODUCTION

Successful operation of a power system depends largely on the engineer's ability to provide reliable and uninterrupted service to the loads. The reliability of the power supply implies much more than merely being available. Ideally, the loads must be fed at constant voltage and frequency at all times.

A second requirement of reliable electrical service is to maintain the integrity of the power network. The high-voltage transmission system connects the generating stations and the load centers. Interruptions in this network may unstable power flow to the load. Since almost all power systems are interconnected with neighboring systems. So random changes in load are taking place at all times, with subsequent adjustments of generation. We may look at any of these as a change from one equilibrium state to another. Synchronism frequently may be lost in that transition period, or growing oscillations may occur over a transmission line, eventually leading to its tripping. These problems must be studied by the power system engineer and fall under the heading *power system stability*. Power system stability may be broadly defined as that property of a power system that enables it to remain in a state of operating equilibrium under normal operating conditions and to regain an acceptable state of equilibrium after being subjected to a disturbance. On commercial power systems, the larger machines are of the synchronous type; these include substantially all of the generators and condensers, and a considerable part of the motors. On such systems it is necessary to maintain synchronism between the synchronous machines under steady-load conditions. Also, in the event of transient disturbances it is necessary to maintain synchronism; otherwise a standard of service satisfactory to the user will not be obtained. These transient disturbances can be produced by load changes, switching operations, and, particularly, faults and loss of excitation. Thus, maintenance of synchronism during steady-state conditions and regaining of synchronism or equilibrium after a disturbance are of prime importance to the electrical utilities. Electrical manufacturers are likewise concerned because stability considerations determine many special features of apparatus and under many conditions importantly affect their cost and performance. The characteristics of virtually every element of the system have an effect on stability. It introduces important problems in the coordination of electrical apparatus and lines in order to provide, at lowest cost, a system capable of carrying the desired loads and of maintaining a satisfactory standard of service, both for steady-state conditions and at times of disturbances.

Series capacitor, shunt capacitor, and phase shifter are different approaches to increase the power system load ability. In past decades, all these devices were controlled mechanically and were, therefore, relatively slow. They are very useful in a steady state operation of power systems but from a dynamical point of view, their time response is too slow to effectively damp transient oscillations. If mechanically controlled systems were made to respond faster, power system security would be significantly improved, allowing the full utilization of system capability while maintaining adequate levels of voltage stability. In this paper this concept is establish.

Objective

The objective of this paper is to investigate the power system stability analysis and improvement by Flexible AC Transmission System (FACTS) controllers. Here at first we have analysis a demo network with stable and unstable condition.

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A stable power system network may be unstable at any moment due to external fault, if the fault is cleared but it will effect the transmission line voltage as well it also effect the connecting generators also. as a result the generator output stability is changed so line voltage is differ from its stability limit and make the system unbalance and unstable. As a result huge amount power loss occurred in the line.

So in this paper we have studied a normal power system and make it abnormal in .In Case2 fault is cleared but transmission line voltage has been changed(decrease) .In Case3:-improve it by FACTS controller device and more improve it by using two FACTS controller device then voltage level is improved tremendiously.In Case4:-Networkis analysis again improve by STATCOM Controller. We have also analysis the alternator output curve and make this also more stable by analysis in Mat lab simulation.

Analysis

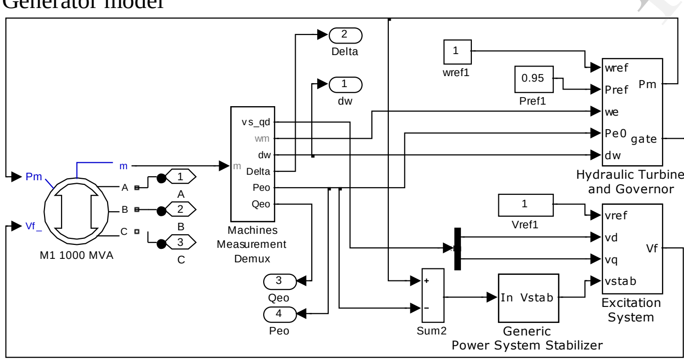
1. At first effect of different FACTS controller mainly SVC and STATCOM on transient stability is analyzed in a demo power network..

2. Comparison between effect of SVC and STATCOM on two machine system is carried out with and without controller.

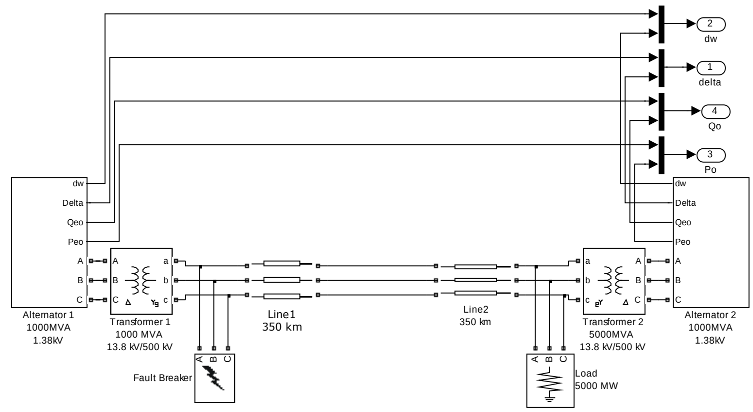
3. Transient stability in two fault condition – three phase to ground fault and line to line fault is studied and analyze the different curves of transient stability with different parametric condition with respect to time and how they are vary with respect to time and get the idea of transient stability and get how the system is different from the actual curve of respective parameter.

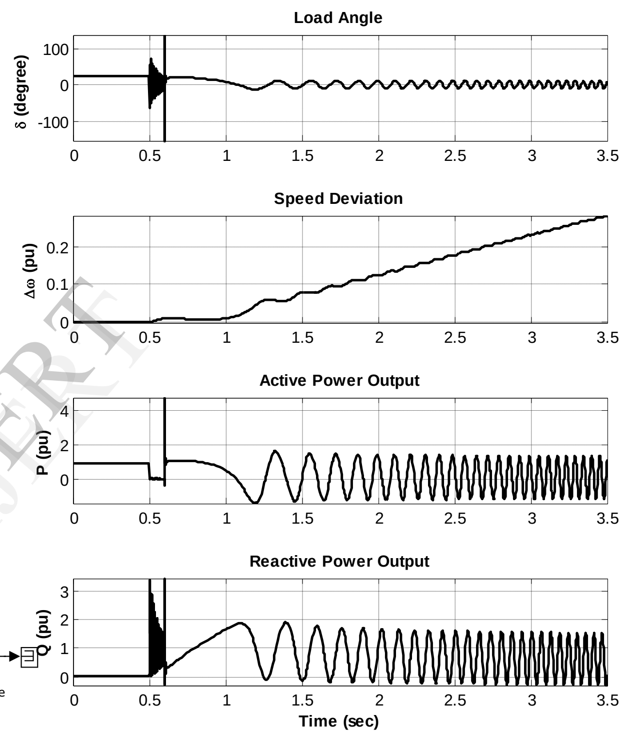
Case Study 1: Two Machine System :-System is faulty due to three phase fault and its simulation has studied here

Generator model



Demo power network





Load Angle, Speed Deviation, Active Power Output and Reactive Power Output of Alternator 1 without FACTS Controller.

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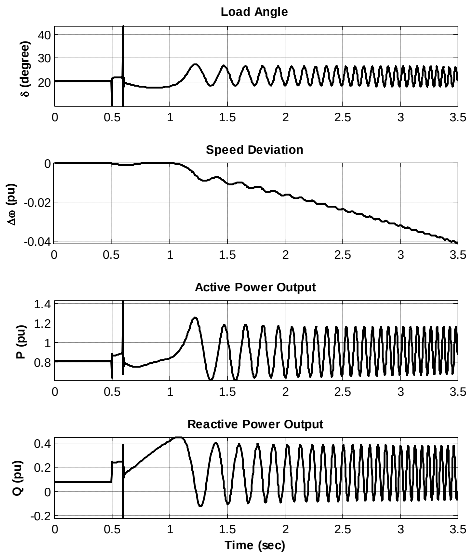
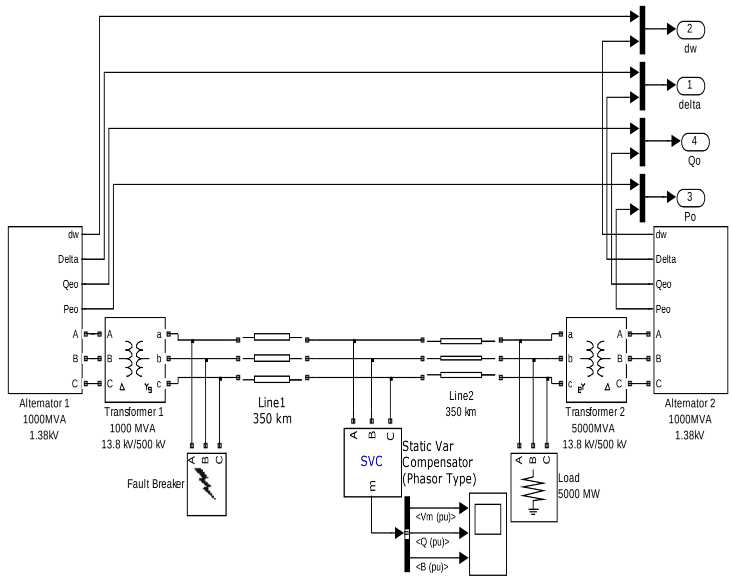


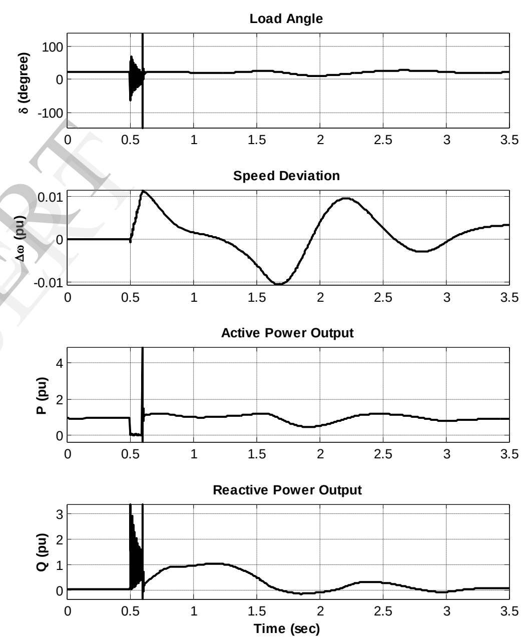
Load Angle, Speed Deviation, Active Power Output and Reactive Power Output of Alternator 2 without FACTS Controller.

So here active power ,reactive power,speed,load angle has been changed So transient effect is occure in the netwok,asa result the voltage stability is differ from its rated value.This situation is occure any live power network.if these deviation is exits for a long time in transmission line or alternator our stable voltage is differ from is stability and we can not get desired power output from alternator.we have also seen that alternator active power decreases and reactive power is increases,so unblance is created in transmission line as a result power system stability will be hampered which directly effect to the distribution line and our shopesticated load.So it is the bad effect of our power transmission line as well as our costly equipment alternator.

For that reason we should analysis of faulty network and improvement our stability limit by improving our various parameter.which is highlighted in case2

Case2:-Here we improved our fault and active power by reduceing FACTS controller devices





Load Angle, Speed Deviation, Active Power Output and Reactive Power Output of Alternator 1 with SVC.

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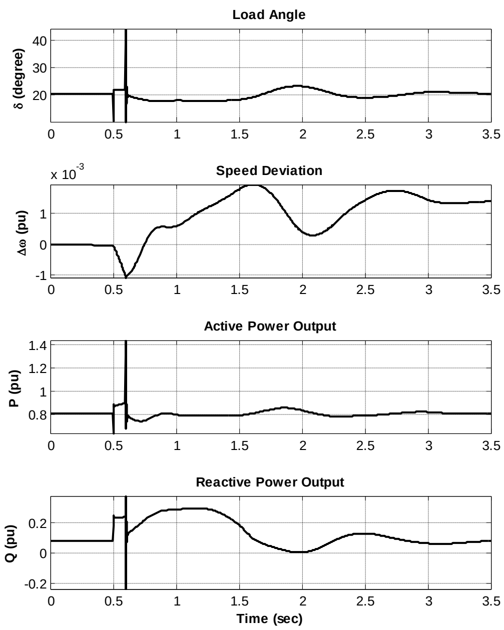
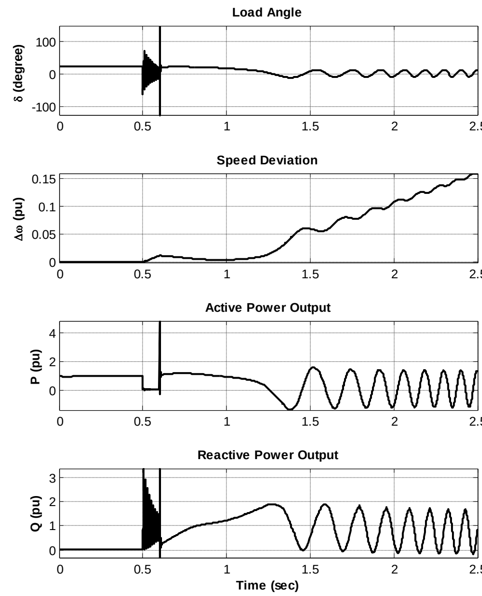


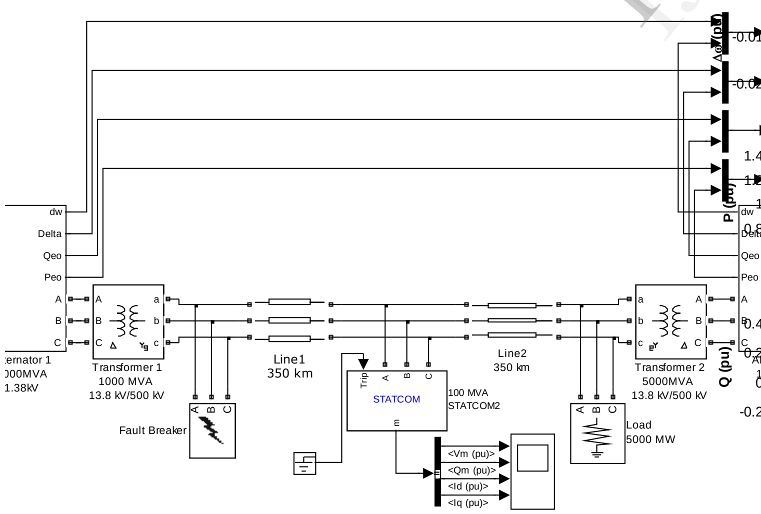
Load Angle, Speed Deviation, Active Power Output and Reactive Power Output of Alternator 2 with SVC.

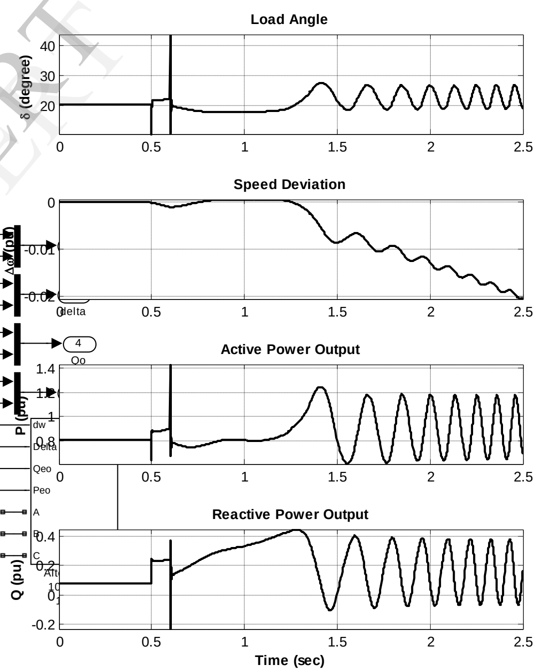
So result is improved by using SVC but we need more stable output So we have analysis this in case3

Case3:- Here we have analysis and test this model by using STATCOM device which give more accurate result copare than SVC



Load Angle, Speed Deviation, Active Power Output and Reactive Power Output of Alternator 1&2 with One No STATCOM.





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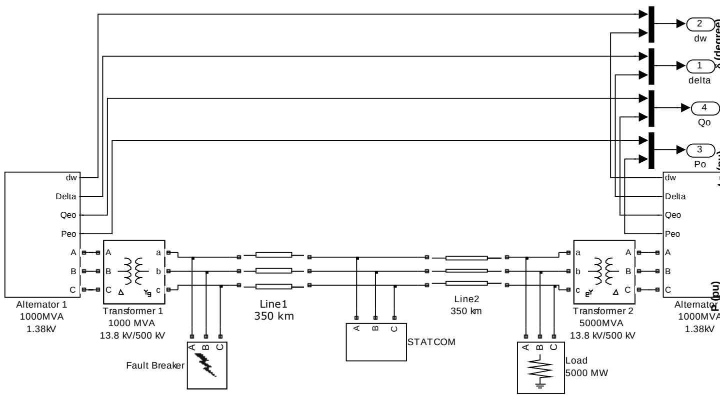
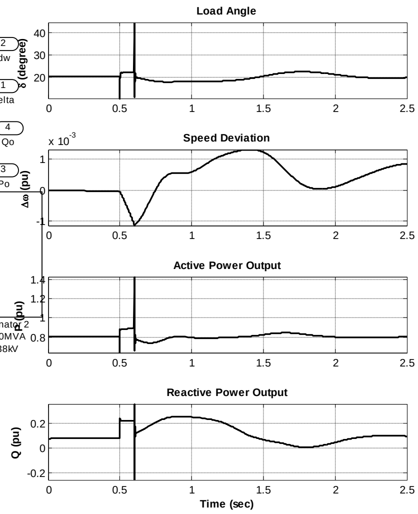
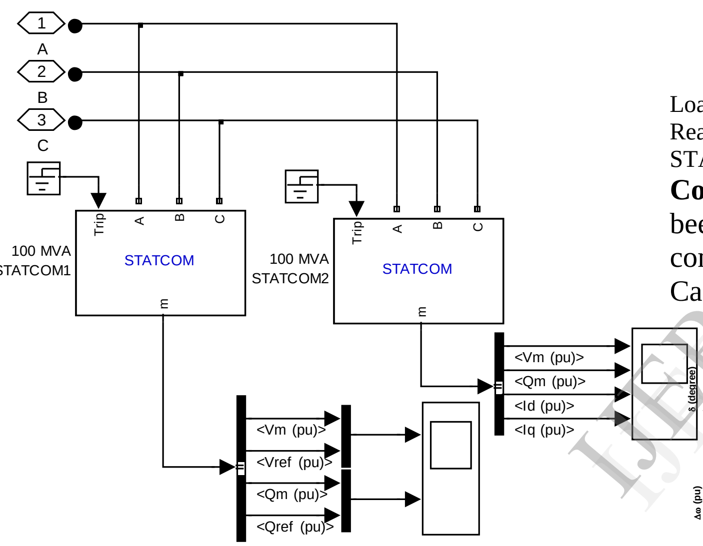
So here we have seen that active and reactive power,speed devation &rotor angle has been improved,but this is more improved when we connect two STATCOM parallel in the network .this case has been studied in case4.

Case4:- Here the network model has been studied by two STATCOM device and tremendious improvement is occure in the network.







Load Angle, Speed Deviation, Active Power Output and Reactive Power Output of Alternator1& 2 with Two No STATCOM

Comparison:-In this paper three case study has been used for improving transient stability the comparison as follows in alternator one Case1&2&3:-

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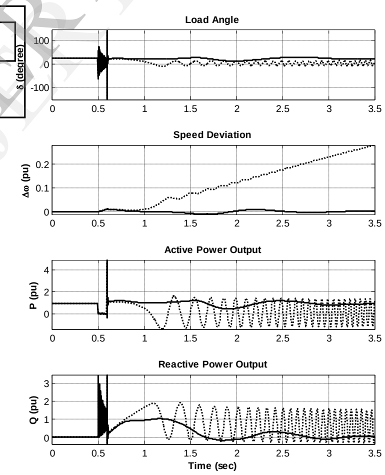
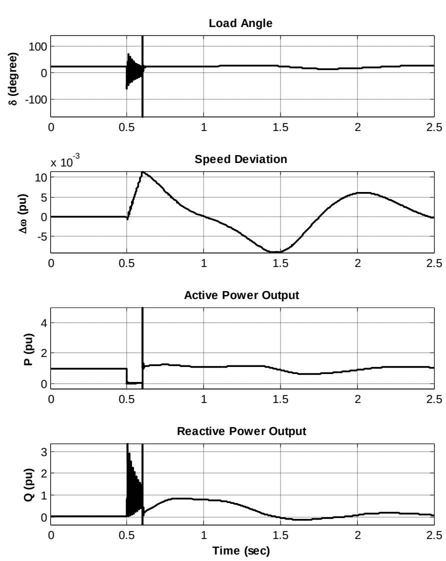
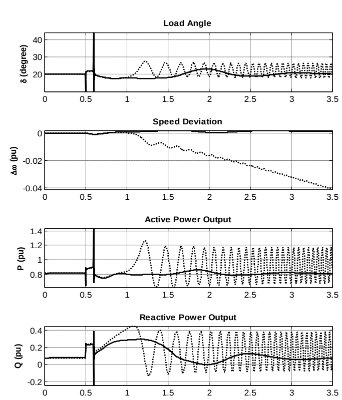
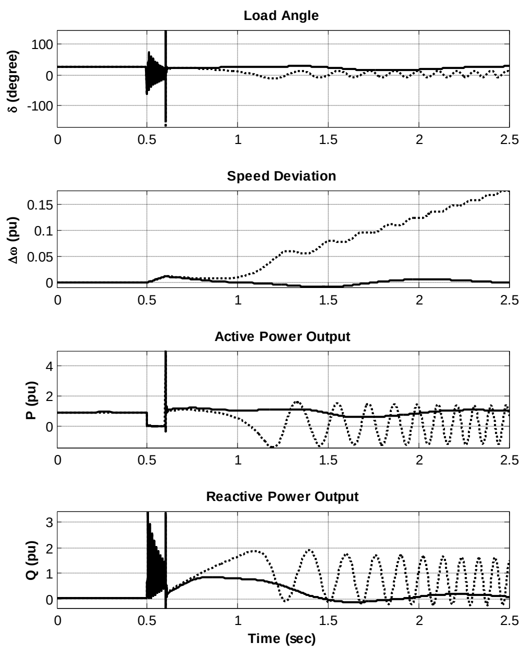






Case4:-



So we observed that case case4 is give better result for improving of transient stability.

Conclusion:-

In this paper first effect of various FACTS controller (SVC and STATCOM) is studied and compared their effect. It was found that after introducing the FACTS controller system can be stable depending on their reactive power supply capability. It is also notice that two no STATCOM connected in parallel gives more reactive VAR than SVC. This kind of power system transient stability can be improved by using suitable FACTS controller applied at proper location. Thus we can solve our transient stability and improve the alternators parameters that power system maintained its stability limit through the system operating in a complex synchronous system .This paper is just basic improvement of power system we can apply this idea through genetic algorithm.

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