Power System Stability Improvement Using STATCOM

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Abstract: **This present the model of STATCOM which controllers the rotor angle deviation, voltage stability, transient stability for the improvement of power system stability. The development of the Morden power system has led to increase the complexity in the study of power system and also present new challenges to power system. The stability plays an important role to ensure the stable operation of power system in the occurrence of large disturbances and faults. The role of STATCOM will be mitigate the voltage problem like voltage sag, voltage swell which are generally occurs in power system during high voltage and low voltage condition. A power system network is considered which is simulated in phase simulation method and the network is simulated in 3 steps i.e. with and without STATCOM and with PSS. When the load increases suddenly the system has been disturbed so for greater performance STATCOM will be used.**

***Keywords*: MATLAB Simulink STATCOM, PSS, Voltage Regulator, Two Area Power System, FACTS Devices.**

I. INTRODUCTION

FACTS controller have the flexibility of controlling the real and reactive power, which can used for different kind of application to improve power system performance. The major contribution of FACTS device, the FACTS controller have been addressing various kind of issue is like system stability increasing power transmission capacity, damping power oscillations ,rotor angle deviation.[1].the shunt FACTS devices is an important role for active and reactive power compensation. A static synchronous compensator is used for reactive power compensation [2].the various paper informs about modelling, operation and control of various FACTS devices and their applications [3] [4].in the recent year the power system groans continuously due to the requirement of power. The role of long distance and large power transmission are important but the construction of new transmission line are difficult due to economic and environmental problems [5] [6].the active power injection controls function has best performance about power swing damping but the STATCOM cannot control itself the active power injection or abortion due to this producing more flexible and reliable operation [7] [8].a power system is composed of many devices connected buses and loads. Power system controllers are often used to stability and transfer capability improvement[9].in the area of power system the two generating stations are providing power to the area where large no of power are required.in these system the transmission capacity is increases due to adding of power but the losses are more.as increases in demand the system has been more affected[10].a STATCOM control has been found to increases the damping of the system and is used to enhanced the small and large system stability performance of system during source or stressed operating condition. This paper consist of following parts. The first part consist of different FACTS controllers the second part is the operation and application of STATCOM is required.in third part the two area power system represent. The fourth part represent the model of the system which is suitable for stability analysis system is developed, the effectiveness of proposed techniques, various simulation result using matlab Simulink are shown under both change in parameter are discussed in the last part.

II. CONTROL CONCEPT OF STATCOM

STATCOM is the shunt connected solid state switching computer capable of generating or absorbing independently controllable real and reactive power of its output terminal. When it is fed form energy source or storage device at its input terminal the simplified diagram and equivalent model of STATCOM connected to the power system. Which this STATCOM is modelled Xs the STATCOM is a shunt compensation component which injects leading or lagging current into the ac system .it is originally designed for voltage maintained in power system by reactive power short circuit. It is based on a prerogative electronics voltage-source converter and be capable of show as both a track down and sink of imprudent AC dominance to an electricity network. If linked to a fund of sway it be able to moreover bestow on the go AC power. Mostly a STATCOM is installed to endorse electricity networks that partake of a bad muscle cause and habitually bad voltage regulation. A STATCOM is a voltage cause converter (VSC)-based device, with the voltage spokesperson behind a reactor. The voltage track down is produced from a DC capacitor and consequently a STATCOM has enormously modest full of zip state capability. However, it's in force strength capability preserve be bigger if an apt energy cargo space emblem is tied across the DC capacitorr. The reactive power at the terminals of the STATCOM depends on the amplitude of the voltage source [5]A STATCOM is an electrical device for providing fast acting reactive power compensation on high voltage transmission network and it can

be contribute to improve the voltage and power stability after fault in these study a phasor STATCOM without controller and STATCOM with controller is simulated with a view to get better performance, a new PSS has been designed and proposed for STATCOM to inject voltage externally for the improvement of power system stability thyristor based STATCOM with PSS controller has been used to improvement the performance of power system is discussed[1] [10] in PSS controller is used then any rating of STATCOM is enough for stabilization of different type of condition.

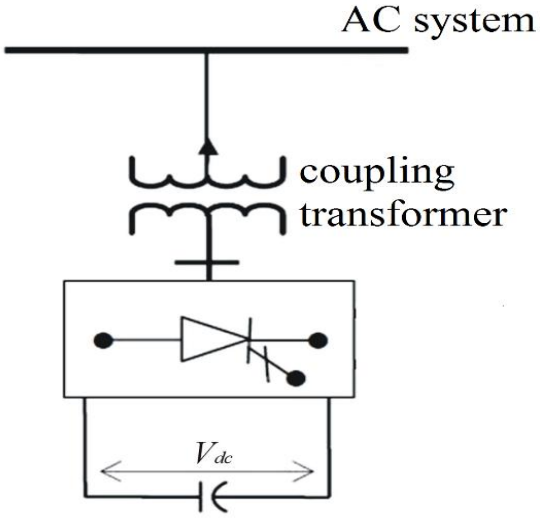


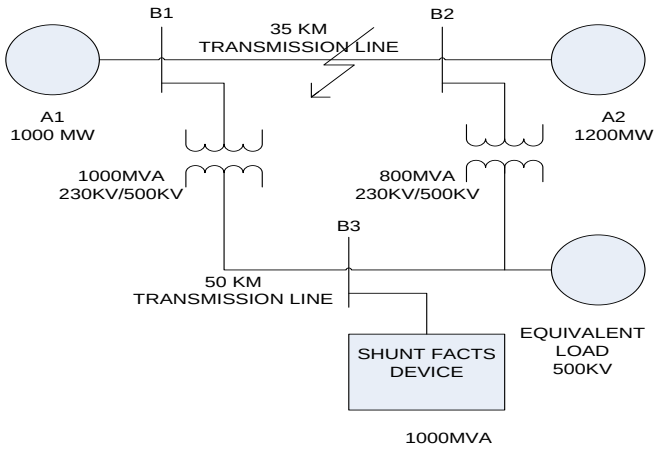
Fig: block diagram of STATCOM

Power System stabilizer

The action of a PSS is to extend the angular stability limits of a power system by providing supplemental damping to the oscillation of synchronous machine rotors through the generator excitation. This damping is provided by an electric torque applied to the rotor that is in phase with the speed variation. Once the oscillations are damped, the thermal limit of the tie-lines in the system may then be approached. This supplementary control is very beneficial during large power transfers. However, power system instabilities can arise in certain circumstances due to negative damping effects of the PSS on the rotor. The reason for this is that PSSs are tuned around a steady-state operating point; their damping effect is only valid for small excursions around this operating point. During severe disturbances, a PSS may actually cause the generator under its control to lose synchronism in an attempt to control its excitation field.

III. TWO AREA POWER SYSTEM MODLE

Fig shows the single line diagram of two area system (area 1 and area 2). Area 1 (1000 MW) connected to area 2(1200 MW) through 500 KV, 100MVA, 35KM double circuit transmission line. The system critical load capacity is 1250 MW both plant feed load. The distance between equivalent load to area of power system 1 and 2 is 100 KM.to maintained system stability after fault, the transmission line is shunt compensated at its centre by 1000 MVA STATCOM with power system stabilizer. Any disturbances occurred in power system due to fault can result in including electromechanical oscillations of the electrical generator are discussed in [9] such oscillating swing must be effectively damped to maintained system stability. A STATCOM has been used to improve transient stability, rotor angle deviation, transmission efficiency, power system oscillation damping.



IV. LITERATURE REVIEW

The stability of an interconnected power system of its ability to return to normal or stable operation after having been subjected to some form of disturbance. Conversely, flux income a shape up denoting bereavement of synchronism or diminishing out of step. Accordingly power system stability problems are classified into three basic type's steady state, dynamic and transient. The study of steady state stability is basically concerned with the determination of the upper limit of machine loading before losing synchronism, provided the loading is increased gradually. Dynamic instability is more probable than other kind of instability. Small disturbances are continually occurring in a power system which excite the system into the state of natural oscillation. This kind of instability behaviour constitutes a serious threat to system security and creates very difficult operating conditions. Following a sudden to disturbance on a power system rotor speeds, rotor angular differences and power transfer undergo fast changes that cause the machines to fall out of step. This type of instability is known as transient instability. The indispensable skin texture of the whole story controllers and their prospective to build up system stability is the superlative disquiet for in force & lucrative action of the brawn system. The location and feedback signals used for FACTS- based damping controllers were discussed. The coordination problem along different types of control schemes was also considered. Performance comparison of different FACTS controllers has been reviewed. The future direction of FACTS

technology, was discussed in it. A brief review of FACTS application to optimal power flow and deregulated electricity market has been presented. Voltage profile improvement and stability enhancement of power system using STATCOM is presented in the paper. Simulink models of three bus test system and STATCOM are developed. The test system was analyzed with and without incorporating STATCOM. Thus, it was concluded that stability of power system and voltage profiles improves with incorporation of STATCOM. When an LLG fault is considered under different cases i.e. sending end, receiving end and midpoint of transmission line it is observed that STATCOM improves the system performance by the way of maintaining voltage, power and current under fault condition. Real powerflow control by reactive voltage injection. Indirect reactive power flow control by control of voltage at the two ports of the STATCOM. The controllers are designed independently and it use locally for the inmplementation. The simulation results for a case study indicate that this is a viable control scheme. By modulating the transmitted power it is possible to bring a vast improvement in power system stability stability and damping.

V. MATLAB SIMULATION MODEL

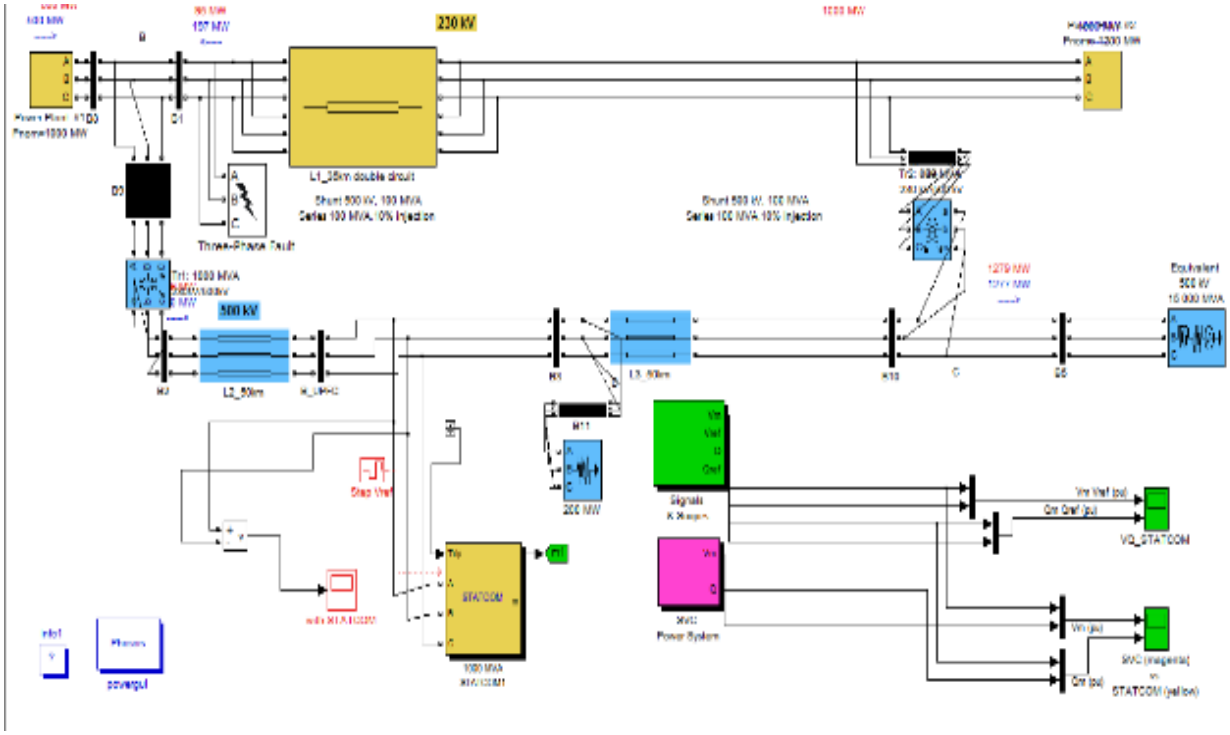


Fig a: Simulation model of STATCOM

VI. RESULT

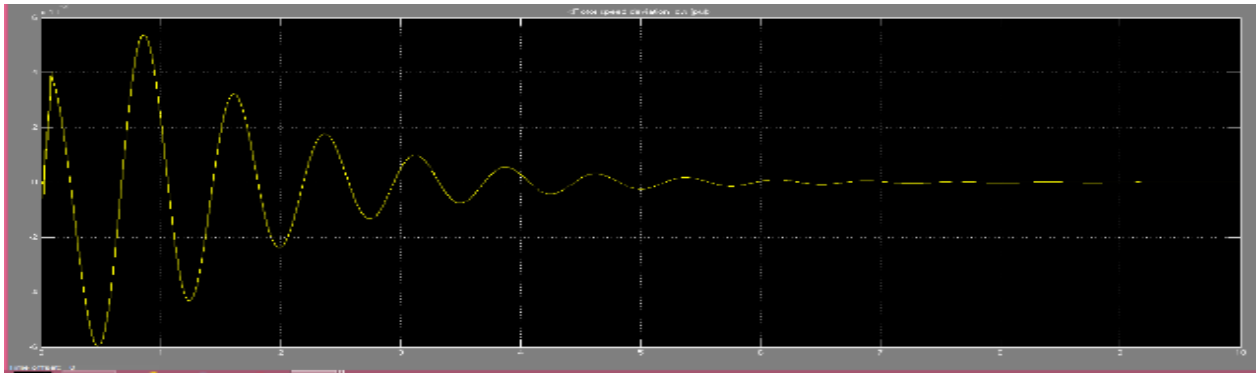


Fig b: Rotor angle deviation STATCOM without PSS

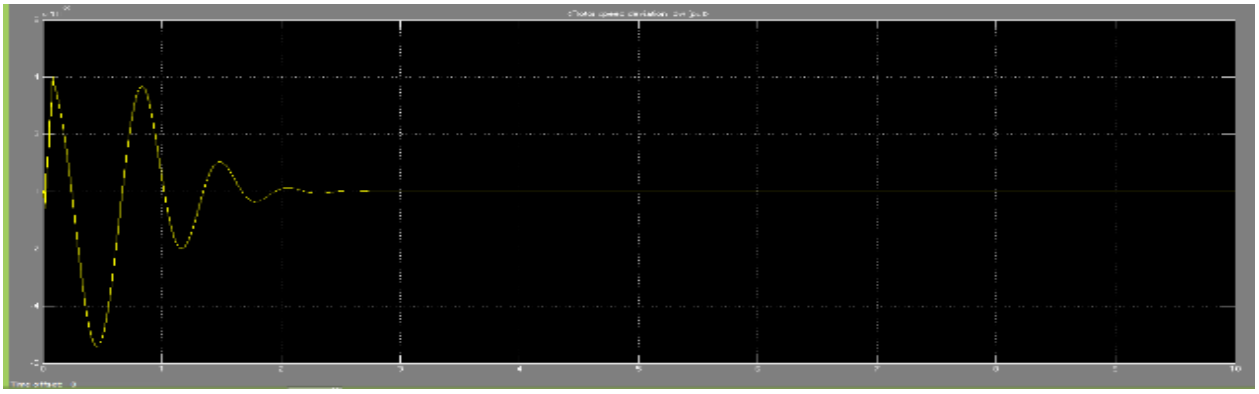


Fig c: Rotor angle deviation STATCOM with PSS

VII. CONCLUSION

This paper has presented the stability improvement of a generator, rotor angle deviation connected to power system. A STATCOM is proposed and is connected to the same bus with the transmission line. It can be concluded from the simulation results that the proposed STATCOM can be used to improve the performance of the voltage stability, transient stability, rotor angle deviation, transmission line to power grid under different operating conditions.

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