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Power System Stability Improvement Using STAT-COM

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Abstract-

This paper presents the STATCOM model, which controls rotor angle deviation, voltage stability, and transient stability to improve power system stability. The evolution of The Modern power system has resulted in a rise in the complexity of the investigation of power systems and the presentation of new challenges to power system. The stability is critical to ensuring the steady operation of the electricity system in the event of a large power outage disruptions and flaws. STATCOM's role will be reduced. voltage issues such as voltage sag and voltage swell Typically occurs in power systems under high voltage and low voltage. The voltage situation. A power system network is explored, and it is simulated using the phase simulation approach in three steps: with and without STATCOM, and with and without PSS. When the load unexpectedly increases, the system is disrupted, hence STATCOM will be used for enhanced performance. The increase in electricity cost and unavailability of electricity to EV users will be a major problem in the future scenario where number of EVs will increase on road. Intelligent charging technologies can facilitate hassle-free integration of EVs to the grid.

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

1. INTRODUCTION

The FACTS controller has the ability to control both actual and reactive power, which may be utilised for a variety of applications to improve power system performance. The FACTS controller has made a significant contribution to system stability, boosting power transmission capacity, dampening power oscillations, and reducing rotor angle deviation. The FACTS

shunt devices play a vital role in active and reactive power compensation. For reactive power compensation, a static synchronous compensator is utilised.

The papers discuss the modelling, operation, and control of various FACTS devices and their applications. The power grid has been groaning incessantly in recent years due to the need for power. Long-distance and high-power transmission play vital roles, but building new transmission lines is challenging due to economic and environmental constraints. The active power injection controls function provides the best performance in terms of power swing damping, but the STATCOM cannot manage the active power injection or abortion, resulting in more flexible and dependable operation.

A power system is made up of numerous devices that are linked through buses and loads. Power system controllers are frequently utilised to improve stability and transfer capability. In the power system, two producing stations provide power to areas where a considerable amount of power is necessary. The transmission capacity of these systems rises owing to the addition of power, but the losses are higher. The system has been more impacted as demand has increased. A STATCOM control has been discovered to boost system damping and is utilised to improve the small and large system stability performance of the system during source or stressful operating conditions. This paper is divided into the following sections.

2. STATCOM CONTROL CONCEPT

STATCOM is a shunt-connected solid-state switching computer that can generate and absorb separately programmable real and reactive power at its output terminal. When it is supplied by an energy source or a storage device The simplified diagram and comparable model of the input terminal STATCOM was linked to the power system. In which case STATCOM is a shunt that has been modelled. a compensating component that injects either leading or lagging current entering the ac system .It was initially intended for voltage. Reactive power short circuit keeps the power system running. It is built around a privileged electronics voltage-source converter and be able to demonstrate as both a track down and sink of An electricity network should not have unwise AC dominance.

If connected to a power source, it can also provide on-the-go AC power. A STATCOM is typically implemented to support electricity networks that have a faulty muscle cause and consistently poor voltage control. A voltage cause converter (VSC)-based device, with the voltage spokesperson behind a reactor, is a STATCOM. The voltage track down is provided by a DC capacitor, and so a STATCOM has extremely limited full of zip state capacity. However, if an appropriate energy cargo space symbol is connected across the DC capacitor, its in force strength capability will be increased.

The reactive power at the STATCOM terminals is proportional to the amplitude of the voltage source. A STATCOM is an electrical device that provides fast acting reactive power compensation on high voltage transmission networks and can help to improve voltage and power stability after a fault. In this study, a phasor STATCOM without controller and STATCOM with controller are simulated with the goal of improving performance. A new PSS has been designed and proposed for STATCOM to inject voltage externally for the improvement of power system stability. When [10] in the PSS controller is used, any STATCOM grade is sufficient for stabilisation of different type of condition.

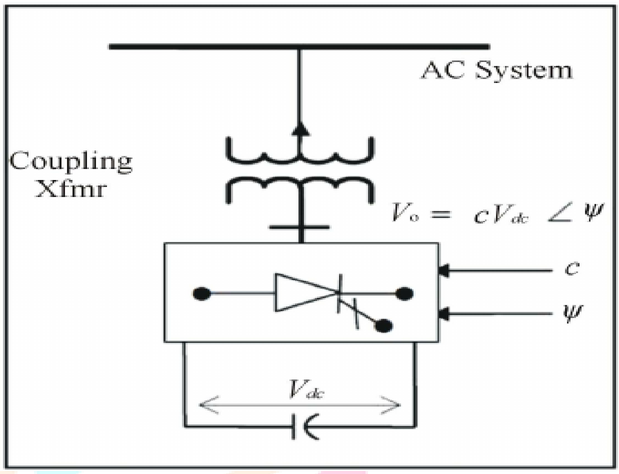

Fig: block diagram of STATCOM

3. 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. Because PSSs are tuned around a steady-state operating point, their damping effect is only valid for minor deviations from this operating point. In an attempt to manage its excitation field during severe disruptions, a PSS may actually cause the generator under its control to lose synchronism.

4. MODEL TWO AREA POWER SYSTEM

Figure displays a single line schematic of a two-area system (areas 1 and 2). Area 1 (1000 MW) is linked to Area 2 (1200 MW) with a 500 KV, 100MVA, 35-kilometer double-circuit transmission line. The critical load capacity of the system is 1250 MW for both plant feed loads. The corresponding load to area of power systems 1 and 2 is 100 km apart. The transmission line is shunt compensated at its core by a 1000 MVA STATCOM with a power system stabiliser to preserve system stability after a fault. Any disturbances in the power system caused by a failure might result in electromechanical oscillations of the electrical generator, as are detailed in [9], and such oscillatory swing must be adequately damped to preserve system stability. Transient stability, rotor angle deviation, gearbox efficiency, and power system oscillation damping have all been improved by using a STATCOM.

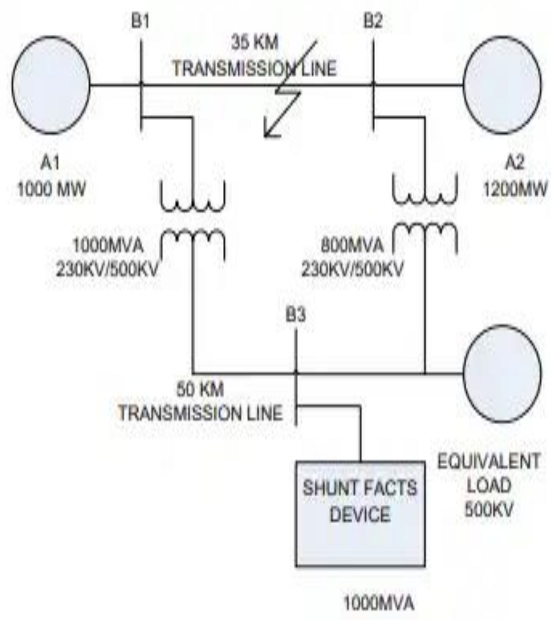

Fig: a single line schematic diagram of a two-area system

5. REVIEW OF LITERATURE

The ability of an interconnected power system to resume regular or stable operation after being subjected to some sort of disturbance. In contrast, flux income a form up signifying loss of synchronism or fading out of step. As a result, power system stability issues are categorised into three types: steady state, dynamic, and transient. The study of steady state stability is primarily concerned with determining the upper limit of machine loading before losing synchronism, given that the loading is steadily increased. Dynamic instability is more likely than other types of instability. Small disturbances are always occuring in a power system, causing it to enter a condition of natural oscillation.

This type of unstable activity poses a severe threat to system security and generates extremely tough operational conditions.Following a power system disturbance, rotor speeds, angular disparities, and power transmission suffer rapid fluctuations, causing the machines to fall out of sync. Transient instability is the name given to this form of instability. The supreme concern for the brawn system's powerful and profitable action is the indispensable skin texture of the entire tale controllers and their potential to set up system stability.

FACTS-based damping controllers' location and feedback signals were discussed. The coordination challenge along various sorts of control schemes was also taken into account. The performance of several FACTS controllers has been compared. It discussed the future path of FACTS technology. A summary of FACTS' application to optimal power flow and the deregulated electricity market has been provided. The paper describes how to improve the voltage profile and stability of a power system using STATCOM. Three bus test system and STATCOM Simulink models are created. The test system was examined both with and without STATCOM. As a result, it was established that the addition of STATCOM enhances power system stability and voltage profiles. When an LLG fault is evaluated in different circumstances, such as the sending end, receiving end, and transmission line midway, STATCOM increases system performance by sustaining voltage, power, and current under fault conditions. Reactive voltage injection is used to control real powerflow. Indirect reactive power flow control via voltage control at the STATCOM's two ports. The controllers are created independently and are implemented locally. The results of a case study simulation show that this is a workable control strategy. It is feasible to vastly increase power system stability, stability, and damping by modifying transmitted power.

6. SIMULATION MODEL IN MATLAB

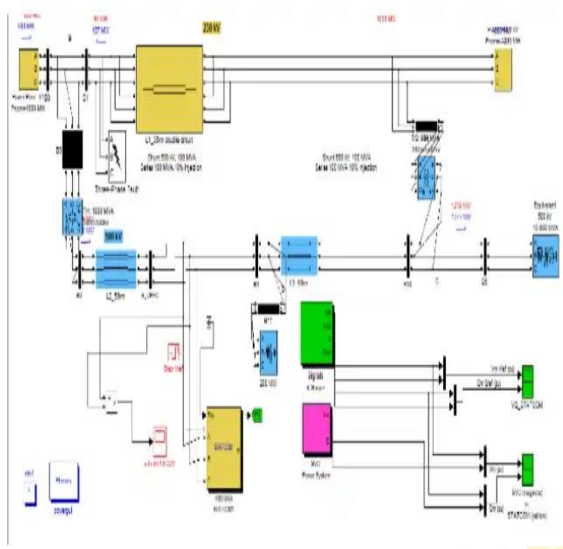

Figure a: STATCOM simulation model

7. RESULT

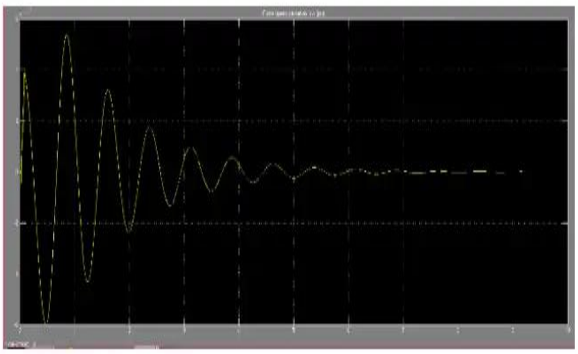

Fig b: Rotor angle deviation STATCOM without PSS

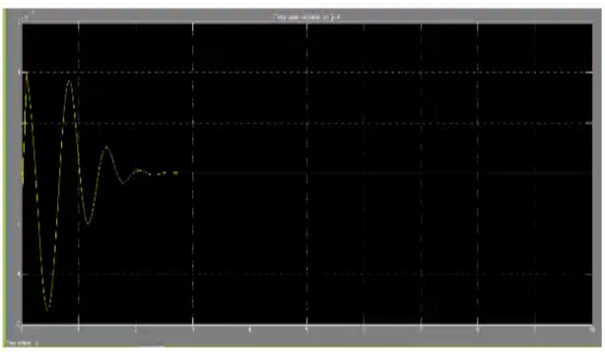

Fig c: Rotor angle deviation STATCOM with PSS

8. CONCLUSION

This paper described how to increase the stability of a generator by reducing rotor angle variation when linked to a power supply. A STATCOM is suggested, which is linked to the same bus as the transmission line. The simulation results indicate that the suggested STATCOM can be used to improve the performance of voltage stability, transient stability, rotor angle deviation, and transmission line to power grid under various operating situations.

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