A Review on SVC Controller for Four Machine System

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Abstract : Transmission systems of present day power structures are getting to be progressively focused on in light of the fact that of developing interest and confinements on developing new era. In order for the secured operation of power system to withstand the disturbances Flexible AC transmission system (FACTS) devices are used. STATCOM (Static Synchronous Compensator) and SVC (Static VAR Compensator) are the devices belongs to FACTS family are used to exchange the power between the interconnected power system and keep the voltage and frequency constant or regulated. In this paper Modeling of transient stability and FACTS devices using MATLAB/Simulink are discussed using PSS(Power system Stabilizer).

IndexTerms **- : Transient Stability, SVC, STATCOM, PSS, MATLAB/Simulink**

I. INTRODUCTION

Electric power system is meeting numerous challenges day to day due to expanding unpredictability. The power system instability was a major issue in the past. The demand of power system becomes high due to its fast and efficient improvement[1]. It is crucial to elevate the power, transmitted alongside the existing transmission offices to compensate this demand. This suggests the control of power stream in system. With the expanded stacking of transmission lines, the issue of transient dependability after a real blame can turn into a transmission force restricting element. The power framework ought to adjust to flashing framework conditions, as such; power framework ought to be adaptable. In an air conditioner power framework, the electrical era and burden must parity at all times up to some degree, the force framework is automatic. If era is less than load, the voltage and recurrence drop, and along these lines the heap goes down to equivalent the era short transmission misfortunes. But there are just a few percent edges for such a selfdirecting . Power system convey electrical from generating station to the end consumer. Electrical power is generated at generating station and it is supplied to the consumer for the local use. This transmitted power should be stable in the sense that it voltage and frequency should be stable. So power system stability is one of the major concern which should be briefly explained in this paper. In this paper Basis of power systems. Its types, components, important term used in power system and different methods adopt for voltage regulation are discussed. Power system stability can be define as "the capability of an electric power system, for a given working circumstance, to recover a state of working synchronization in the wake of being exposed to a physical unsettling influence, with most system variables limited so that for all intents and purpose the whole system remains in place" [2]. As reported by above definition it is clear that if system neglects to get working balance then it will be called instable. There are numerous sort of insecurities exists in the present day power system, (for example, voltage, frequency and so on.) and appropriately different stabilizing methods are utilized. This stabilizing is carried out by disengaging the capacitor, inductors or mix of both after that synchronous condenser, saturated reactor, Thyristor controlled reactor, altered capacitor Thyristor controlled reactor, Thyristor exchanged capacitor were utilized; however in present days this is performed by more propelled gadgets like STATCOM, VSC, TCSC and so on. these gadgets develops the perceptive controlling and quick exchanging power device like MOSFET and IGBT the capacity of quick exchanging makes them practical for giving exact and smooth controlling. The learned controlling is performed by the complex calculations which are carried out by possibly simple circuits or chip. Despite the fact that simple gadgets performed well however in later past improvements in the semiconductor innovation makes the computerized controllers as first decision on the grounds that of their capacities and easier cost.

Now modeled and simulated by a software tool or MTLAB/SIMULINK. Each and every module of the system is modeled and then integrated later on to make an overall system, which is then simulated in SIMULINK environment in order to get the stable power system. We will actually divide the overall system model into two sub section. In first section the synchronous machine model, Turbine and regulator, Power system stabilizer (Generic and multiband) and excitation system and the second section Load flow bus, SVC, Faults (Single phase or 3 phase), Transformer, distributed parameters line, RLC load are modeled. After that we integrate these two subsections to get the overall system

II. POWER SYSTEM STABILIZER (PSS) MODELS

Generic Power System Stabailaizer When power system face disturbances which may cause electromechanical oscillation in electrical generators, these oscillations are also named as power swing. The power swing must be damped in order to get the stable system. The addition of this damping in order to maintain the power system in stable state is done with help of power system stabilizer The input of the PSS is w d called deviation in the machine speed or the acceleration power a m e P– P =P where m P is the mechanical power and e P is the electrical power. The output signal of PSS is the stab V which may be used as additional input of Excitation system The model of the Generic Power System Stabilizer is modeled and shown in figure 1 by using a nonlinear system

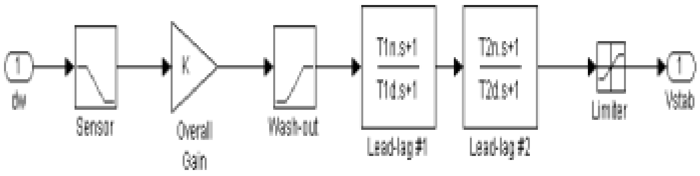

Figure 1. The Block Diagram of the Generic Power System Stabilizer

Low-pass filter, a general gain, a washout high-pass filter, a phase-compensation system, and an output limiter are the different blocks used in the PSS model. The amount of the damping developed by the stabilizer is found by K (General gain). The low frequencies in the deviation in speed signal (w d) is removed by the washout high pass filter. The lag in the phase angle between the excitation voltage and electrical torque is compensated by connecting two first order lead lag blocks in cascade called phase compensation.[3,4]. B. Multi – Band Power System Stabilaizer The disturbances or power swing in electrical generators must be damped in order to stabilize the system. These oscillations are divided into four main types : 1. Local oscillations: The frequencies of these oscillations are in between 0.8 to 4 Hz. They are the oscillation between the generator and rest of power system. 2. Interplant oscillations: The oscillation between two neighboring generation station is known as interplant oscillation it frequency range is 1 to 2 Hz. 3. Inter area oscillations: These are the oscillation between two big classes of generating plants between two major groups of generating plants it frequency ranges from 0.2 to 0.8 Hz. 4. Global oscillation: The oscillation of all generator in phase is called global oscillation it frequency is below 0.2 Hz [5, 6, 7].

III. STATIC VAR COMPENSATOR (SVC)

In order to control the power flow and to improve the transient stability a static VAR compensator is used which is one of the most participants of FACTS family. The amount of reactive power injected into or absorbed from power system is the key role of SVC to regulate the terminal voltage. SVC generate reactive power (SVC capacitive) when the system voltage is low and SVC will produce SVC capacitive when the voltage of the system is high. The capacitor bank and the inductor bank which are connected to the secondary side of the coupling transformer are changed in order to produce the variation in reactive power. The single-line diagram of a static VAR compensator and a simplified block diagram of its control system is shown in figure 2. The SVC is used in three-phase power systems together with synchronous generators, motors, and dynamic loads to perform transient stability analysis and detect influence of the SVC on electromechanical oscillations and transmission capacity of the power system [3, 4, 8]

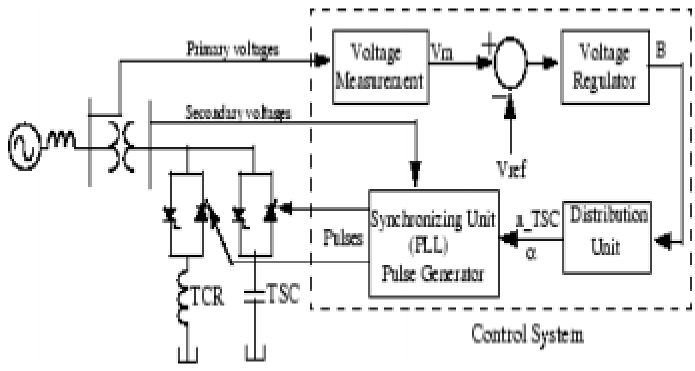

Figure 2. The Single-Line Diagram of a Static VAR Compensator and its Control System

SVC Mode of Operation There are two mode of operation of SVC i. In voltage regulation mode. ii. In VAR control mode (the SVC susceptance is kept constant) The V-I characteristics as shown in figure 3 is obtained when SVC is set to operate in voltage regulation mode.

1) V-I CHARACTERISTIC OF SVC

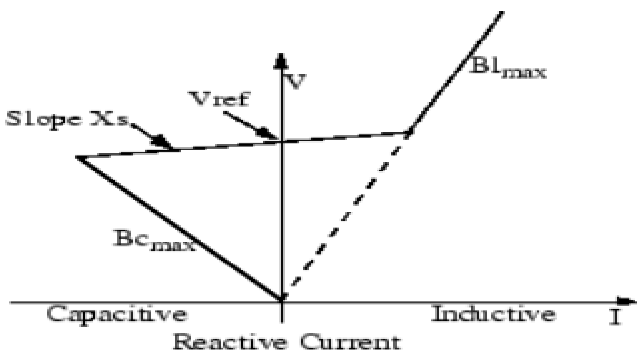

Figure 3. The V-I Characteristics of the SVC

The slope of SVC voltage current characteristics is given by the equation 1

$$slop = \frac{\Delta V_{C\max}}{I_{C\max}} = \frac{\Delta V_{L\max}}{I_{L\max}} \quad (1)$$

The V-I characteristics of SVC is explained by using equation 2, 3 and 4

$$V = V_{ref} + X_s . I \quad (2)$$

Then SVC will be in regulating mode If

$$V = \frac{1}{-B_{C\max}} \quad (3)$$

Now if then SVC will fully capacitive.

$$V = \frac{1}{B_{L\max}} \quad (4)$$

IV. STATIC VAR COMPENSATOR (SVC) MODELING

A problem has been taken of two machine model consisting of two three bus model for analysis of transients stability using MATLAB Simulation. To see the effect of the SVC in the system to stabilize the voltage wave form when the system subjected to three phase fault,a two machine system system is developed with three buses as shown in fig. 4.

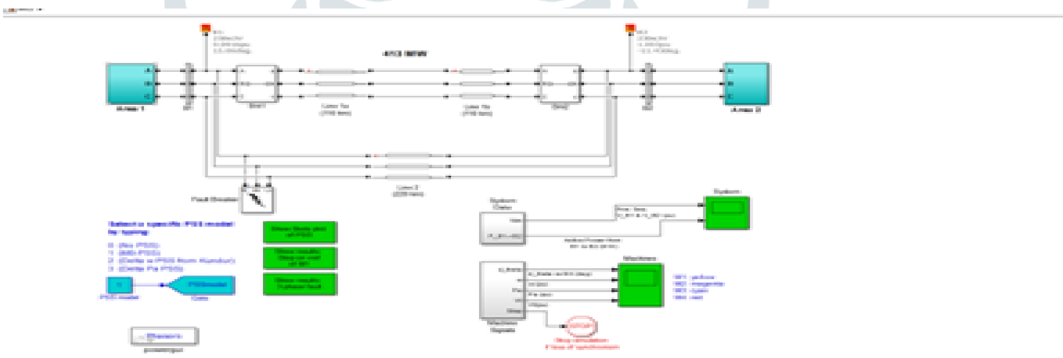

Figure 4. The Simulation of the SVC

V. CONCLUSION

It is known that the SVCs with an auxiliary injection of a suitable signal can considerably improve the dynamic stability performance of a power system. Therefore SVCs have been applied successfully to improve the transient stability of a synchronous machine . This paper presents the stability improvement of voltage level and real & reactive power in a power system model containing SVC . Simulations carried out confirm that SVC could provide the fast acting voltage support necessary to prevent the possibility of voltage reduction and voltage collapse. Analysis of SVC reactive power output (pu) in response to voltage steps is presented in this paper. This paper inspects actual positive sequence voltage in a system model with or without SVC.

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