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DESIGN OF FUZZY LOGIC CONTROLLED SVC FOR LONG TRANSMISSION LINE

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ABSTRACT: The Flexible AC Transmission System (FACTS) is used to improve the exiting transmission capabilities of transmission system by making it more flexible & independent operating. Static VAR Compensator (SVC) is a shunt connected FACTs device, used for voltage control and for reactive power compensation. An efficient Fuzzy Logic Controller is used to improve the transient stability of the Power System, to improve the controllability of a SVC and it also complements the voltage control function and provides better performance in damping the power system oscillations. Effectiveness of this kind of proposed technique is demonstrated by simulation studies on long transmission line.

I. INTRODUCTION

Due to the vast increase in the demand of electric power, the industry supplying electricity undergoes a profound transformation worldwide. To meet this increasing demand, there is need of improving the transmission system. This can be done by increasing the transmitted power either by installing new transmission lines or by improving the existing transmission lines by adding new devices. By installation of these new transmission lines in power system will lead to the technological complexities such as economic and environment considerations that includes cost, delay in construction and so on. Now for overcoming these problems, Flexible Alternating Current Transmission System (FACTS) gave up new ways for controlling the power flow and increasing the usable capacity of transmission lines. FACTS are systems that comprised of static equipment that are used for the AC transmission of electrical energy. There are wide varieties of FACTS devices like as shunt type, series type, combined shunt-series type & combined series-shunt type. Among the various FACTS devices, the Static Var Compensator (SVC), a shunt connected controller that provides more reliable operation damping the power oscillations, improves the transient stability, helps in voltage regulation & reactive power control and improves the power factor in distribution system. FACTS devices play an important role in reactive power flow in the power network. In large power systems low frequency electro-mechanical The Static Var Compensator (SVC) is the one most widely used shunt type FACTS devices in power system regulation, which is based on power electronics. It can be ideally inserted in the middle of a line. Its main objective is to increase the power that transits in the existing line oscillations often follow the electrical disturbances. To achieve damping, a shunt FACTS device - "Static Var Compensator (SVC)" is designed with auxiliary controllers.

A. Static VAR Compensator (SVC)

The Static Var Compensator (SVC) is the one most widely used shunt type FACTS devices in power system regulation, which is based on power electronics. It can be ideally inserted in the middle of a line. Its main objective is to increase the power that transits in the existing line.

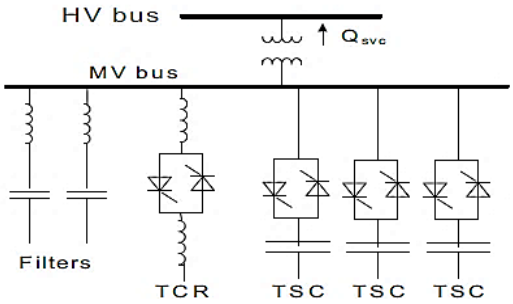

Figure 1.1: Configuration of SVC

Typically, the SVC comprises one or more banks of fixed or switched shunt capacitors or reactors, of which at least one bank is switched by thyristors. Mechanically switched banks can be included on both side of SVC transformer to increase the total reactive power support outside the dynamic range.

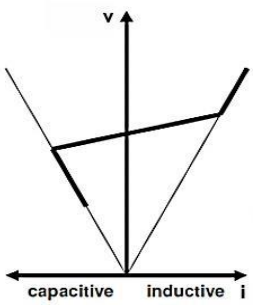

Figure 1.2: V-I Characteristic of SVC

Here, when system voltage is low the SVC will generate reactive power (SVC capacitive). When system voltage is high, it will absorb reactive power (SVC inductive). It helps in voltage regulation, reactive power control and improving the transient stability of the system. The voltage regulation by SVC is done, by controlling the amount of reactive power injected into or absorbed from the power system.

II. LITERATURE REVIEW

Among the various FACTS devices, the SVC, a shunt type controller that provides more reliable operation damping the power oscillations, improves the transient stability, helps in

voltage regulation & reactive power control and improves the power factor in distribution system. Different types of controllers are like PI, PID, Fuzzy, ANN etc. In this paper PI and Fuzzy controller are used and the concept of this controller no of papers is studies as below;

C. Udhyashankaret al [1] published a paper in which the idea about Transient Stability Improvement in Transmission System using SVC with Fuzzy Logic Control" was demonstrated. Here, the model of Static Var Compensator (SVC) with the combination of both PI and Fuzzy Controller was used. Therefore, the new artificial technique called 'Fuzzy Logic" was used which is effective technique with the capability of tolerating uncertainty and imprecision in the system parameters and operation condition changes. The simulation studies showed that the combined PI and Fuzzy based SVC controller gives enhanced performance in terms of stability and reliability of system during large disturbances.

N. A. Arzeha et al [2] published a paper which deals with the Fuzzy-based Static Var Compensator for Damping Power System Disturbances. Here, one of the methods in SVC implementation based on a simple fuzzy logic combined with the conventional Takagi-Sugeno type of fuzzy controller was utilized implementation in of the SVC. The Simulation is done in MATLAB software to perform its effectiveness in damping oscillation after being subjected to a three phase fault. The system implemented with the F-SVC controller showed better performance compared to conventional SVC in damping oscillations of the observed parameters after the system is subjected to disturbance.

B. Lahshmananayak et al [3] published a paper which deals with Reactive Power Control in Long Transmission Line. In this paper, the operating principle and modelling of FC-TCR type Static Var Compensator and the basic study of Fuzzy Logic Controller were demonstrated.Fuzzy Logic Controller was designed to achieve the firing angles for SVC such that it maintains a flat voltage profile. The use of fuzzy logic has facilitated the closed loop control of system, by designing a set of rules that decides the firing angle given to SVC to attain the required voltage.

Ibrahim Mansour et al [4] published a paper which deals with a study of Fuzzy Logic Control of SVC to improve transient stability of ac power systems. This paper presents the simple study of the most popular FACTS devices, i.e., shunt (SVC, STATCOM), series (SSSC) and series shunt (UPFC) and also describe the principle of SVC and the basic study of Fuzzy Logic Controller with its basic three steps. It was concluded the proposed new controller is compared with a PI regulator in terms of steady-state and dynamic response and the simulation results point out the better performances of our controller.

P. R. Sharma et al [5] published a paper in which a study about Fuzzy based SVC auxiliary controller for damping low frequency oscillations in a power system was discussed. In this paper, the operating principle and modelling of FC-TCR type Static Var Compensator and the basic study of Fuzzy Logic Controller was discussed. The simulations were carried out in MATLAB/Simulink for a two area four generators system and showed the results about the effectiveness of fuzzy logic auxiliary controller over conventional PI controller in damping low frequency oscillations at high power transfer level and severe disturbances conditions.

III. CONCLUSION

After studying number of research papers, it is concluded that SVC is used in power system primarily for the purpose of voltage and reactive power control in power system network. To get better performance in terms of transient stability analysis and the reliability of the power system during large disturbances when the power system is nonlinear and in damping low frequency oscillations& voltage profile of the terminals and transmission line active power, the Fuzzy Logic Controller (FLC) is used.

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