A Review on FACTS Controller for Two Machine System

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Abstract- The transmission systems are not extended to the same extent because building of new lines is difficult for environmental. Hence, the systems are driven closer to their limits resulting in congestions and critical situations endangering the system security. Static var compensator plays an important role in voltage regulation in AC Transmission Systems the purpose of this paper is to deal with review & performance of SVC for the transient stability improvement of two machine system. FACTS devices are used to analyze the transient stability improvement of the two machine system. Among the FACTS controllers, the SVC performs better than other. It offers greater controllability of the power flow in the line and also increases the transfer limits or to improve the transient stability.

Keywords – FACTS, static var compensator, FACTS controller in HVDC, HVAC, and EHVAC line, SMIB.

I. INTRODUCTION

The increasing demand of electrical energy and power systems reconstruction have caused that these systems work near to their stability limits. One of the issues that must be considered during the design and utilization of power system is that system stability against great signal turbulences [1]. There are various methods to implement transmission system, so it could be designed different controllers with different transmission system for a compensator. Then consider some specially designed controllers by this method for STATCOM. AC transmission and distribution lines are dominantly reactive networks. The load and load power factor changes alter the voltage profile along the transmission lines and can cause large amplitude variations in the receiving end voltage. Most of loads are not tolerant to voltage variation [2]. Shunt FACTS devices play an important role in reactive power flow in the power network. In large power systems, low frequency electro-mechanical oscillations often follow the electrical disturbances. Generally, power system stabilizers (PSS) are used in conjunction with Automatic Voltage Regulators (AVR) to damp out the oscillations [3]. Among all FACTS devices, SVC plays important role in reactive power compensation and Voltage support because of its attractive steady state performance and operating characteristics

II. FACTS CONTROLLER

Flexible AC Transmission Systems in which various power electronics based controllers mitigate dynamic disturbances and regulate the power flow and transmission voltage. The main objectives of Flexible AC Transmission Systems are to increase the transmission capacity of lines and control power flow over selected transmission routes.

Table 1 shows the Technical Benefits FACTS Devices. It shows that the SVC is a best FACTS device as compare to the others in terms of SVC able to Voltage Control, Voltage Stability, Active and Reactive Power control.

Table 1 Benefits of FACTS Devices [19]

S. No.	FACTS Controllers	Type	Controller Used	Benefits
1	Static VAR Compensator (SVC,TCR, TSC)	Shunt	Thyristor	Voltage Control, VAR Compensator,Transient and Dynamic Stability, Voltage Stability, Damping Oscillations, Active and Reactive Power control.
2	STATCOM	Shunt	GTO	Voltage Control, VAR Compensator, Transient and Dynamic Stability, Voltage Stability.
3	SSSC	Series	GTO	Current Control, Transient and Dynamic Stability, Voltage Stability.
4	TCSC	Series	Thyristor	Current Control, Transient and Dynamic Stability, Voltage Stability.
6	IPFC	Series-Shunt	GTO	Reactive Power control, Transient and Dynamic Stability, Voltage Stability.

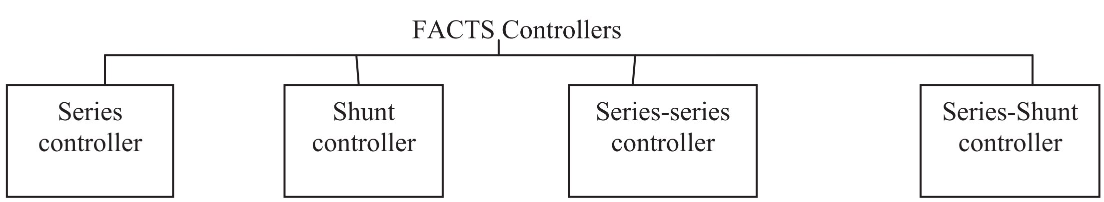
Table 2 shows the comparison between the SVC and other FACTS device. Concluding to voltage control, transient stability that the SVC is more benefit than other FACTS devices.

Table 2 Comparison table of FACTS Devices

S.No	BENEFITS	SVC	STATCOM	SSSC	TCSC	UPFC	IPFC
1	Voltage Control	Yes	Yes	No	Yes	No	No
2	Transient Stability	Yes	Yes	Yes	Yes	Yes	Yes
3	Voltage Stability	Yes	Yes	Yes	Yes	Yes	Yes
4	Damping Oscillation	Yes	No	No	No	No	No
5	Reactive Power Control	Yes	Yes	Yes	Yes	Yes	Yes

III. TYPES OF FACTS DEVICES

FACTS Controller is power electronic-based system and other static equipment that offer control of one or more AC transmission system parameters. It is useful to note the words “other static Controllers” in this definition of FACTS confirm that there can be other static Controllers which are not based on the power electronics. FACTS Controllers are divided into following four types.



IV. FUNCTIONAL BENEFITS OF FACTS FOR TWO MACHINE SYSTEM

The Static Var Compensator for utilities increases the quality of power in many respects. The benefit of stabilized voltage levels and reactive power compensation improves the system stability and increases the power transfer capability of a transmission line.

Reduction of Harmonics
According to transmission line in two machine system there are the non-linear loads generate harmonic currents. The harmonic currents load the network and lead to voltage distortions. The distorted voltage may cause malfunctions in sensitive computerized devices and other process control equipment.

Power Transfer Capacity Increases in Two Machine Transmission System
Transmission of reactive power leads to significant voltage drops and current increases in the network, which limits the transmission capacity of active power. Utilities can maximize their transmission line capacities by compensating reactive power. The Static Var Compensator maintains the demand of reactive power within the limits set by utilities.

Voltage Stabilization, Unbalance Loads in Two Machine Transmission System
Loaded non-transposed lines will create voltage unbalance. The unbalanced voltage causes reduced efficiency, noise, overheating, torque pulses and speed pulses to motor operations. The utility SVC operates in single-phase control mode, thus balancing the voltage.

Flicker Reduction in Two Machine Transmission System
Rapidly varying reactive power causes voltage fluctuations at the point of the common coupling. The human eye perceives this frequency of voltage fluctuations as flickering lights. The SVC will reduce flicker problem very well.

V. SURVEY REVIEW ON FACTS CONTROLLER FOR TWO MACHINE SYSTEM

Table 3 Research Summaries

S. No	Author Name	Technique	Work Done	Results
1	Houari Boudjella, Fatima Zohra Gherbi, Fatiha Lakdja	SVC	Svc mathematical model with Mathcad	Verify the capability of the control parameters. And finally, SVC connected on a power grid to control.
2	Habibur Rahman, Md. Fayzur Rahman, Harun-Or-Rashid	SVC	Modeling of SVC with Power Oscillation Damping (POD)	If POD controller is used then only small rating of SVC becomes enough for stabilization of forceful power system within very shortest possible time for both steady state & dynamic conditions.
3	Alok Kumar and Surya Bhushan Dubey	SVC	Use the Swing equation	Financial benefit from SVC FACTS devices comes from the additional sales due to increased transmission capability
4	Pardeep Singh Virk and Vijay Kumar Garg	SVC	SVC use with Three Phase Fault	The stability improvement of voltage level and real & reactive power in a power system model containing SVC.
5	Ravi Kumar Sahu and Nitin Saxena	SVC	SVC use with proportional integral derivative (PID)controller	Described the switch strategy of internal and external fault based on two generating station.

6	M Asrar Ur Rahman and M Sabah ul Islam	SVC	SVC with single machine infinite bus (SMIB)	It is likely that utilities will continue to use the SVCs ability to resolve voltage regulation and voltage stability problems.
7	B. Lakshmana Nayak	SVC (FC-TCR)	SVC use with fuzzy logic controller	The firing angle control is continuous, effective and it is a simplest way of controlling the active power of transmission line.
8	This Paper	SVC	SVC with TCR and TSC combination	SVC is effective in midpoint voltage regu-lation on transmission line.In this dissertation comparison is also ex-plain what difference between SVC and without SVC under fault condition.

VI. CONCLUSION

This paper contributes the area of transmission studies with FACTS application and also describe the enhance controllability and increasing the power transfer capability of two machine system by using FACTS controller like SVC.

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