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Power System Stability Enhancement Using Facts Device

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Abstract— In the power system the role of transmission network is transmits the power to load centre to the interconnected power system. The transmission of electric power has to take place in a most efficient way in addition to provide flexibility in a process. Flexible ac transmission system promotes the use of static controllers to enhance the controllability and increase the power transfer capability. To get better voltage profile we can provide the shunt compensation technique in power system. This compensation technique control on the reactive power depending on load requirement so maintain power factor near about unity in electrical power system

Key words**:** AC transmission, static var compensation(SVC),reactive power compensation, FACTS, Power factor, Thyristor switched capacitor, Thyristor controlled reactor (TSC-TCR)

I. INTRODUCTION

The stability of the power system is defined as "the ability of an electric power system, for a given initial operating condition, to regain a state of operating equilibrium after being subjected to a physical disturbance, with most system variables bounded so that practically the entire system remains intact" . According to above definition it is clear that if system fails to get operating equilibrium then it will be called instable. There are many kind of instabilities exists in the modern power systems (such as voltage, frequency etc.) and accordingly the different stabilization methods are used. The stabilization processes basically works by compensation of the causing the instability in past this is done by connecting and disconnecting the capacitor, inductors or combination of both after that synchronous condenser, saturated reactor, thyristor controlled reactor, fixed capacitor thyristor controlled reactor, thyristor switched capacitor were used; but in present days this is performed by more advanced devices like STATCOM, VSC, TCSC etc.

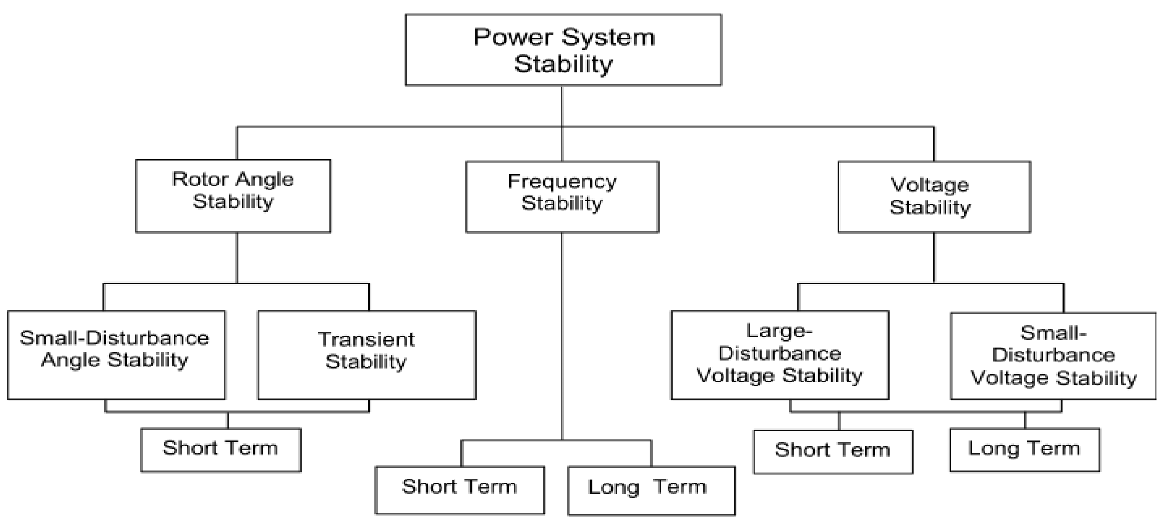

Fig. 1. Classification of power system stability

II. SVC SYSTEM

In transmission line compensation, the main objectives are Improvement of voltage regulation,reactive power control and Improvement in system stability. An ideal compensator must have ability to respond instantaneously in achieving all these objectives. Static V AR Systems (SVS) have emerged as V AR generation and absorption systems. The function of SVS is to provide high speed reactive power load compensation resulting in voltage stabilization and stability improvement. The specific functions of an SVS can be summarized as follows

1. Voltage Control
2. Prevention of Voltage collapse
3. Damping of Power Oscillations

SVS Configurations: Providing reactive shunt compensation with shunt- connected capacitors and reactors is a well established technique to get a better voltage profile in a power system. The basic form of reactive power compensation required, to compensate reactive power loads, is the fixed shunt capacitors being well distributed across the network and located preferably closed to the loads. This would ensure reasonable voltage profile during steady state condition. However, this may not be adequate to ensure stability under overload or contingency conditions. Shunt capacitors are inexpensive but lack dynamic capabilities, thus some form of dynamically controlled reactive power compensation becomes essential. The phase angle between the end voltages, determined by the real component of the line current, is not affected by the shunt compensation. Similarly, adding a reactor instead of a capacitor in shunt will reduce the voltage. Instead of mechanical switching (using circuit breakers) of these devices, we can use thyristor valves, thereby increasing the control capability radically. This approach is called static V AR. The basic reactive components of a static compensator are shunt reactors and shunt capacitors. These reactors are varied by means of thyristors. The capacitor banks are either a fixed amount or are varied in steps by thyristor switching. Based on these principles various static compensators have been developed. These are characterized by fast response, reliability, low operating costs and flexibility.

Basic Description of Static V AR Compensation (SVC)

1. Thyristor controlled Reactor (TCR)
2. TCR plus Fixed Capacitor (FC)
3. Thyristor switched Capacitor (TSC)
4. TSC- TCR

Figure 2 is a one-line diagram of a typical static VAR system for the transmission application. TSC - TCR is very popular and most effective. Figure 2 gives the general idea of realization of SVC using TSC plus TCR scheme. The idea is to sense the voltage of the line and keep it stable by introducing capacitance or inductance in the circuit, depending on the signal generated by Automatic Voltage Regulator (AVR). So obviously, the gating signals to thyristor valves will have to be changed in accordance with the A VR signal.

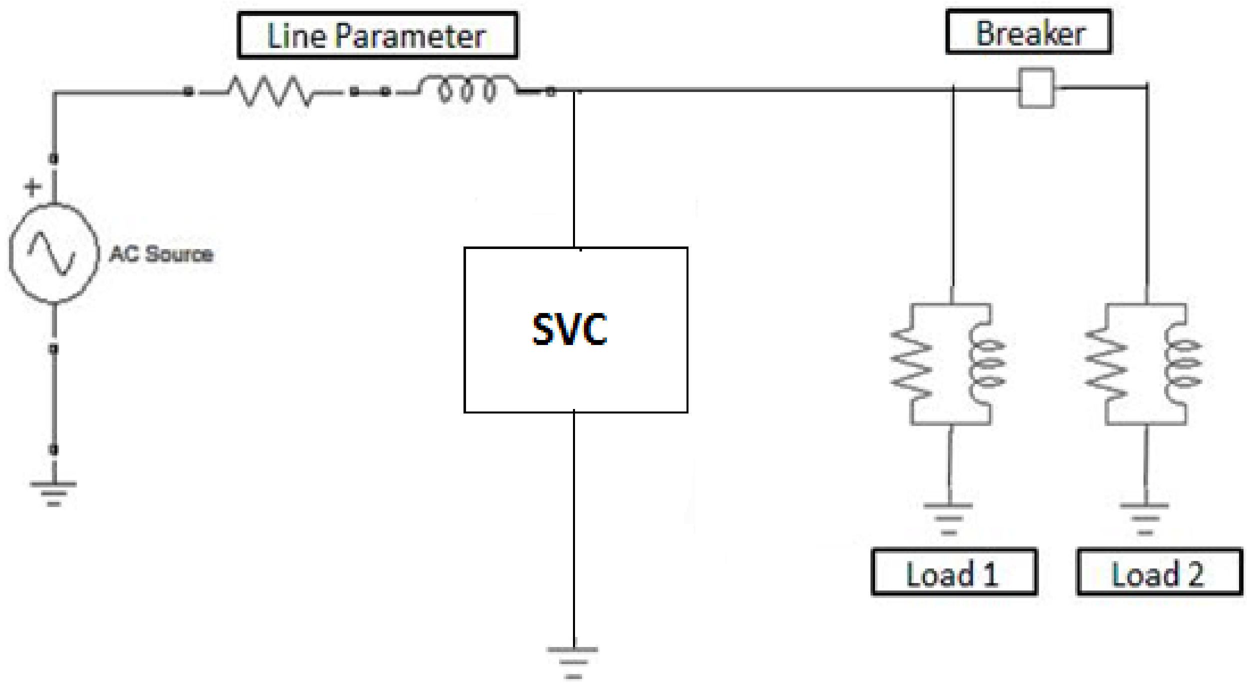

Fig. 2 Basic diagram of svc in transmission system

III. SVC SIMULATION AND RESULTS

Simulation of single phase TSC-TCR

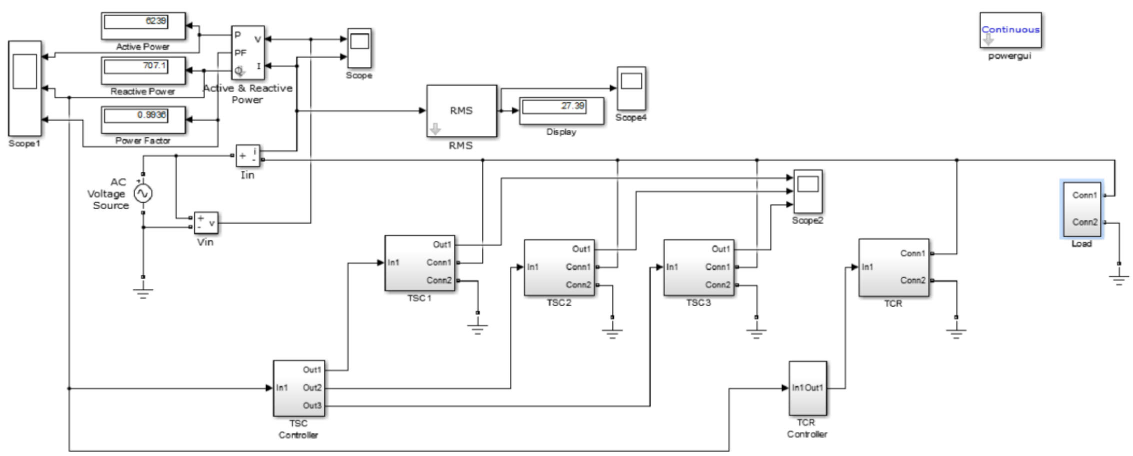

Figure 3 simulation of single phase tsc-tcr

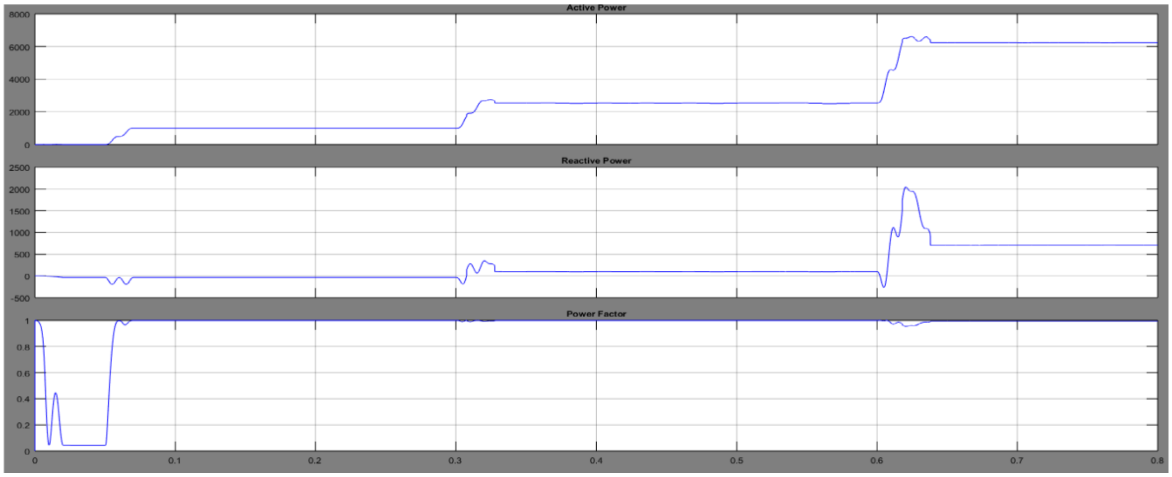

Figure 4 active power, reactive power and power factor

When no compensation is available and full load demand is present. We shall see the voltage as well as reactive power at load side, source side and at SVC. Measurements such as active & reactive power, power factor are made through subsystem that has been created in MATLAB. When no compensation is provided, reactive power,power factor as well as voltages are as follows

Vs(v)	P(watt)	Q(var)	PF
230	6235	3247	0.8869

Table 1 System parameters of uncompensated line

When the line is compensated by the TSC-TCR we shall see the results. Here in this case load demand remains same but as the compensation is provided

Vs(V)	P(watt)	Q(var)	PF
230	**2922**	**1357**	**0.9989**

Table 2 System parameters of compensated line

IV. CONCLUSION

From the simulation results of SVC it is found that SVC can effectively use to control voltage and reactive power compensation. Single phase TSC-TCR simulated and results shows that the power factor goes to near about to unity shown in this the paper.

V. REFERENCES

[1] Pravin Chapadel, Dr. Marwan Bikdash, Dr. Ibraheem Kateeb, Dr. Ajit D. Kelkar, "Reactive Power Management and Voltage Control of large Transmission system using SVC", IEEE 2011.

[2] Habibur Rahman, Md. Fayzur Rahman, Harun, "Voltage Level Improvement of Power System by Using SVC with POD Controller", International Journal of Advanced Technology & Engineering Research (IJATER) Volume 2, July 2012.

[3]Avneesh Kumar Vishwakarma, Dhaneshwari Sahu, "Efficient Voltage Regulation in Three Phase A.C. Transmission Lines Using Static VAR Compensator", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, May 2013.

[4]Pouyan Pourbeik, Anders Boström, and Bhaskar Ray, "Modeling and Application Studies for a Modern Static VAr System Installation", IEEE TRANSACTIONS ON POWER DELIVERY, VOL. 21, NO. 1, JANUARY 2006.

[5] Venu Yarlagadda, B. V. Sankar Ram and K. R. M. Rao, "Testing and Control of TSC-TCR Type Static Var Compensator Using Microcontroller", International Journal of Control and Automation Vol. 5, No. 3, September, 2012

[6] Nirvisha V. Vyas, Nitin H. Adroja, Ashish Doorwar,"Modeling of Reactive Power & Unity Power Factor Control of Inductive Load", International journal of advanced engineering and research development(IJAERD), ETCEE – 2014.

[7] H. K. Tyll, " Application of SVCs to Satisfy Reactive Power Needs of Power Systems",IEEE 2006.

[8] Rajib Roy "Design of microcontroller based Static Var Compansator", International Journal of Scientific & Engineering Research, Volume 3, Issue 11, November-2012.

[9] Nang Sabai, Hnin Nandar Maung, and Thida Win "Voltage Control and Dynamic Performance of Power Transmission System Using Static Var Compensator", World Academy of Science, Engineering and Technology 2008

[10] R. Patil and U. Gudaru, "Firing Angle Range Control For Minimising Harmonics in TCR Employed in SVC's", World Academy of Science, Engineering and Technology Vol:5 2011.

[11] Thyristor-based FACTS controllers for Electrical Transmission Systems: R. Mohan Mathur, R K Verma, Wiley IEEE Press.

[12] Power Electronic control in Electrical System: T.J.E. Miller, NewNes Power Engineering Serise.