Indian Journal of Science and Technology, *Vol 10(1), DOI: 10.17485/ijst/2017/v10i1/110295, January 2017*
ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645

Evolution of Coordinated control strategy for SVC and Fixed Capacitors for Reactive power control

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Abstract

To control the reactive power, voltage regulation is very difficult in power system from aspects of load compensation. Reduce the power losses and voltage improvement as main aim to compute best setting of shunt devices such as shunt capacitors, SVC, tap changing transformers etc., in power system, when load will gradually increased, then automatically voltage is not maintain reference value due inductive load and energy storage elements. In this paper proposed reduce the power losses and improve voltage profile by using SVC and, switched capacitors with co-ordination have been included in the system. The proposed system has been validated to 9-bus test system considered.

Keywords: Bedak sejuk, Cosmetic Powder, Natural Cosmetic, Rice Starch, Safety Evaluation

1. Introduction

Power system has generation, transmission and Distribution networks. The power is transfer from generation station to distribution side through transmission lines. In power system, generate the electrical energy on generation side and send through the transmission line to distribution side. The operation of power system give importance to two kinds of powers, they are real power i.e consumable power and reactive power i.e storage power in energy storage elements like inductance and capacitance. J.V. Parate, A.S. Sindekar[1] presents reduce the transmission loss by using Thyristor controlled series compensator (TCSC), Static var compensator (SVC) which implemented on 9-bus system and 14-bus system. Voltage regulation achieved by controlling the absorption of reactive power in distribution system. The power require is growing day by day, bulk of loads are inductive character in the distribution side. It is also effect on power factor. If maintain the low Power factor on distribution side, it effect on current carrying conductor i.e it draw more current from the supply mains, then automatically effect on the KVA rating, losses and requirements of equipment. It effect on the unit price of power. To reduce the losses by control reactive power on distribution side. Dhruvang R. Gayakwad, C. R. Mehta[2] discuss load compensation is provide by shunt compensating device and scrutinize the power factor compensator FC-TCR category on 3 phase, 440 volt by the use of series R-L load and adopt PSIM software simulation and implement on the 3 phase, 440 volt. Vito calderaro, Vincenzo galdi[3], proposed mixed sensitivity analysis applied on distribution system with help of local coordinating regulation method and give importance to small grids. Small grids play key role in distribution system. Here to reduce the reactive power and lessen the voltage problem on distribution network with four distributed wind turbines. Ms. Shilpa Gupta[4] discuss demonstrate the Static var compensator on con-

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trol transmission system and its dynamic performance to regulate the voltage. Here control the imaginary part of current by using the TCR varies with firing angle.

9-bus system Data Sheet:

Table 1. 9-bus system Generators data:

Generators Details:	**Ratings**
9 Bus G-1	247.5MW, 18KV, 60Hz X_d=0.995, X_d^1=0.195,X_d^{11}=0.155, X_q=0.568, X q^1 =0.38, Xq11=0.155, X^1=0.16
9 Bus G-2	192MW, 18KV, 60Hz X_d=1.651, X_d^1=0.232,X_d^{11}=0.171, X_q=1.59, X q^1 =0.38 X_q^{11}=0.171, X^1=0.102
9 Bus G-3	128MW, 18KV, 60Hz X_d=1.68, X_d^1=0.232,X_d^{11}=0.171, X_q=1.61, X q^1 =0.232, X_q^{11}=0.171, X^1=0.095

9-Bus system Transmission line data sheet:

Table 2. 9-Bus Transmission line data sheet

Bus No	**Resistance R p.u**	**Reactance X p.u**	**Admittance B p.u**
7-8	0.009	0.075	0.0756
9-8	0.0099	0.1009	0.1055
9-6	0.049	0.19	0.199
4-6	0.019	0.095	0.089
4-5	0.009	0.087	0.089
7-5	0.035	0.165	0.155

Simulation Results:

Case I: In 9-Bus system, loads are maintained as given below:

Load A, Load B, Load C: Base Voltage-230KV, Base MVA=100, Frequency =60Hz.

Load A	125MW, 50MVAR
Load B	90MW, 30MVAR
Load C	100MW, 35 MVAR
Local load	100MW, 35MVAR

Case ii: In 9-Bus system, if loads are increase then simulation results are given below:

Table 4. Increased Load values

Load A	150MW, 70MVAR
Load B	100MW, 40MVAR
Load C	200MW, 45 MVAR
Local load	100MW,35MVAR

From case I to case II at Load A Voltage decreases from 0.9797 to 0.9288, at Load B Voltage decrease from 0.9977 to 0.9509 and At Load C Voltage decreases from 1.012 to 0.98. The simulation Block of Case II result is given below:

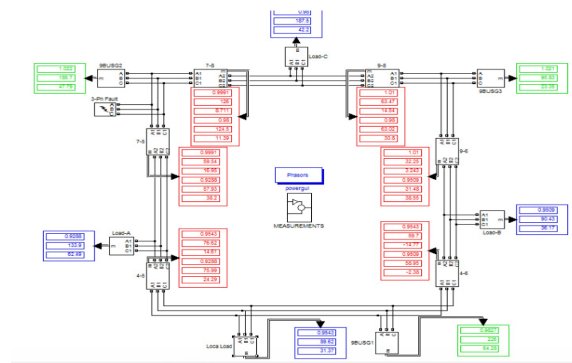

Figure 2. Simulation Block for 9-Bus system Case II Result.

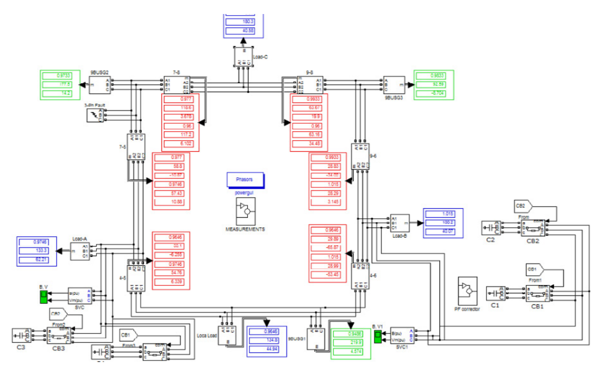

Figure 4. Simulation Block of 9-Bus system with SVC at Load A and at Load B.

Simulation Results for both the cases are as follows:

Table 5:

	Load A			**Load B**			**Load C**		
	V p.u	**P MW**	**Voltage Angle**	**V P.U**	**P MW**	**Voltage Angle**	**V P.U**	**P MW**	**Voltage Angle**
Case I Result	0.9797	124.1	49.66	0.9977	89.59	29.86	1.012	100.1	35.02
Case II Result	0.9288	133.9	62.49	0.9509	90.43	36.17	0.98	187.5	42.2

Simulation Results of Capacitors and SVC combination are given below:

Table 6:

	Load A			Load B			Load C		
	V P.U	P MW	Voltage Angle	V P.U	P MW	Voltage Angle	V P.U	P MW	Voltage Angle
Capacitor at Load A & B	0.9543	136.6	40.98	0.92	106.6	42.62	0.8873	157.4	35.42
Capacitor at Load A, SVC at Load B	0.9472	134.6	53.83	0.9367	131.6	43.87	0.9028	163	52.97
SVC at Load A &SVC with FC at Load B	1.018	138.7	55.46	1.001	142.9	47.63	0.9639	179	58
SVC with FC at Load A, Load B and Load C	0.9746	133.3	62.21	1.015	100.2	40.07	0.96	180.3	40.58

After increasing Loads, By installing Capacitors and SVCs 9. Bus system Voltage Profile and system capacity are improved by connecting different combinations. The details of capacitors and Svcs combinations of simulation blocks are given below:

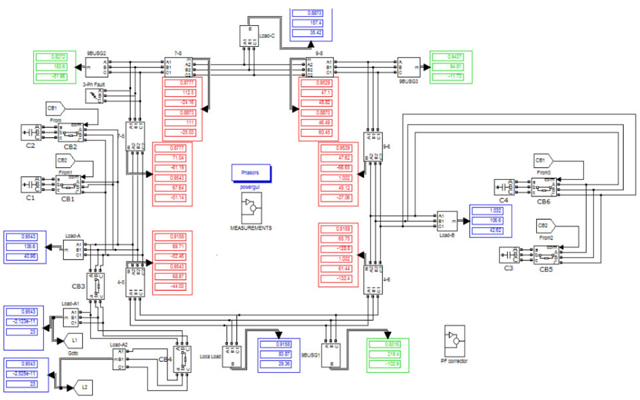

Figure 3. Simulation Block for 9-Bus system with Capacitors installing at Load A & B.

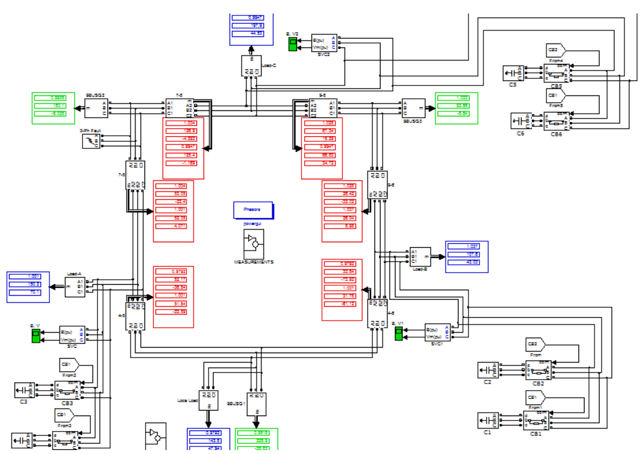

Figure 5. Simulation Block of 9-Bus system with SVC at Load A, Load –B and Load-C.

The Curve for different combinations of shunt devices installed at load A, B and C:

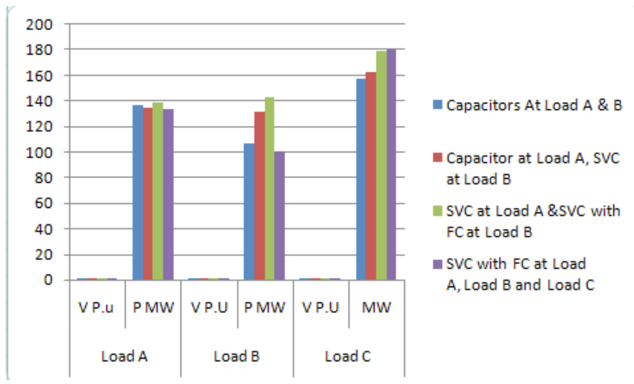

Figure 6. Graphical representation for above Table 6.

5. Conclusion

A Scheme for reactive power control and improve the Voltage Profile by using Capacitors and SVCs on 9-Bus system. Observation of results clears that by using SVCs, Voltage profile is improved with a better manner than by using combination of capacitor and SVCs. According to Unit price combination of Capacitors and SVCs will decrease cost than using only SVCS because SVCs are more cost than capacitors. But while comparing system stability and voltage profile there will be better performance by using SVCs.

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