A Holistic Approach using Fuzzy Logic Statistical Method for VAR Compensation using Effective Power Control

Sanjeevani Gondane[1], Pratik Gutke[2]

[1]PG Student, Department of Electrical Engineering, TGPCET, Nagpur, Maharashtra, India
[2]Asst. Professor, Department of Electrical Engineering, TGPCET, Nagpur, Maharashtra, India

---***---

Abstract:- *Depending on the flexibility and independent operating improve the existing transmission capability of transmission line. Flexible AC Transmission System [FACTS] device has been used. Moreover, concern area remains in the domain of generation, transmission and distribution. The loading capability has been affected which means to be better by use of SHUNT connected. FACTS devices in the power control system. Hence, it has become necessary to used static VAR compensation (SVC) for FACTS devices. Here we have used fuzzy control method to control or regulate firing angle of SVC. With the help of such systems we can be able to provide better, smooth and adaptive control of reactive power*.

Keywords: Control method, FACTS, Fuzzy logic, and SVC.

1. INTRODUCTION

In the more recent year the reactive power places and important role to keep the power system stable. The main element of absorption of power transmission line, transformed and alternator.

Whenever we consider the transmission line, in power system, the load placed an important role. It becomes very important for the parametric configuration and pre-dominant for changing the VAR that generate the reactive power. In order to maintain the voltageat the load side SVC [Static VAR compensator] has become an important factor in achieving better economy in power transfer.

2. MODELING FOR SVC

The model for SVC consists of a thyristor control reactor; consist of fixed induction and two anti-parallels SCR. This device works by taking into consideration the two gate pulses of SCR triggers at the same polarity i.e. duration of current control can be reapplied. It depends on the stability of the SCR to control the specific parameter of the AC system. In this paper, SVC is shunt connected static VAR generator who's O/P is adjusted depending on the inductive and capacitive load. The voltage can be regulated by controlling its equivalent resistance and capacitances. The thyristor control reactors [TCR] which are paralleled with capacitor are shown in Fig below.

Diagram:

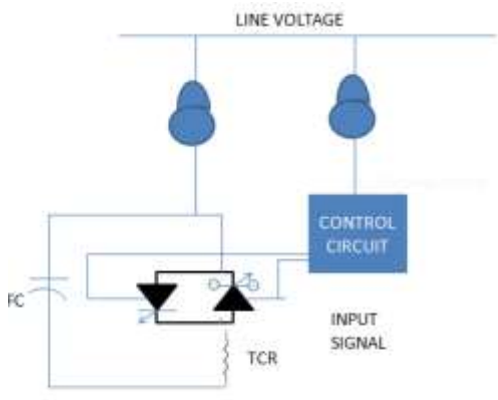


Fig: 2.1 SVC Shunt with Transmission Line

This SVC is a controllable reactive admittance which works with the connected AC system. In an active control range reactive power valid to regulate Voltage according to droops characteristics. The slope value depends on the desirable sharing of reactive power production from different sources and the slope determine the drooping. At the capacitive limit the SVC becomes SHUNT capacitance.

3. FUZZY LOGIC CONTROLLER

Fuzzy interference system with cause effect relationship expels as collection of fuzzy rules in which the precondition uses linguistic variable the consequent must perform the quantities result. In these model mamdeni interference system with has been used. Here the set of sensor I/P is match and then rule is obtained through fuzzy. The response of each rules are applied according to it and hence rules is obtained through fuzzy. The response of each rule is waited according to extent to each rule fire. The result of fuzzy for particular O/P class is combining to obtain to get maximum output. The fig for the rule based Mamdeni system is show in fig below.

Diagram:

Fig: 3.1 Fuzzy Logic System

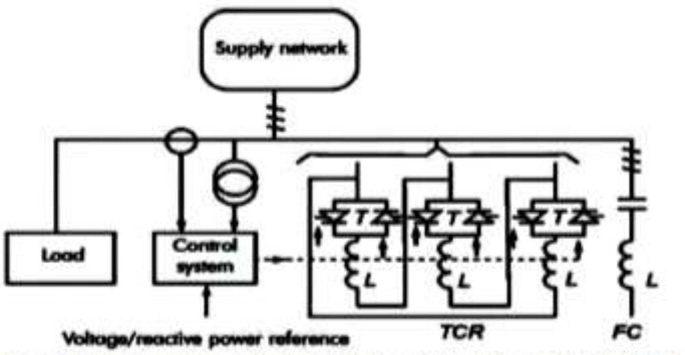
3.1 System design using fuzzy logic controller:

FACT controller such as SVC uses new kind of technology of power electronics for better perform switching operation and to control Voltage and power control. The stability enhancement of the SVC is develop using MATLAB SOFTWARE. It shows that new controller logic gives better, and quick performances compare to other type. The reactive power control achieves by switching the capacitor and inductor. The capacitor [TSC] and the reactor are control by thyristor control reactor (ITCR). Here using these methods when the fault occurs in the power system the SVC will try to inject the reactive power into the line when the voltage go below the reference value in order to control voltage.

4. STABILITY OF THE SYSTEM

Using these systems, the fuzzy logic find an important place among expert control strategic and is one of the important tool. To control Non-linear complex system. These methods compatible on rule base system which will work according to the firing angle. The fuzzy logic controller for voltage improvement is design and implemented to control the difference between the measured voltage and the reference voltage and to provide the appropriate value to SVC to maintain constant voltage.

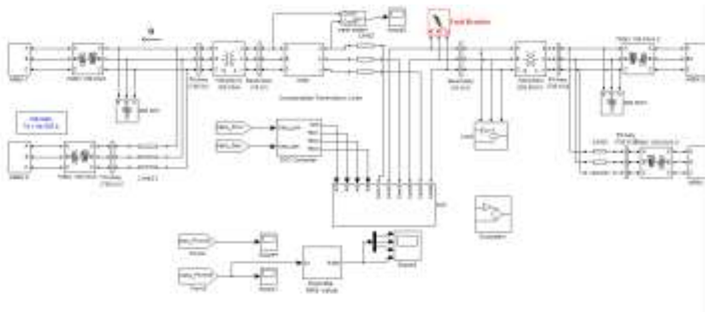
Here we have used [TCR-FC] i.e. thyristor controller reactor fixed capacitor. The SVC is design having two parallel side of coupling transformer. One of the uses the reactor are connected on the secondary side of coupling transformer. One of the uses the reactor are connected in delta in 3-0 application. The discrepancy of reactive power is achieved by controlling thyristor firing angle and accordingly that current flows by the reactance. The diagram for thyristor control reactor is shown in fig below.



igure 1. Thyrsitor-controlled Reactors with Fixed Capacitors (or Shunt Filters)

5. MATLAB SIMULATION:

5.1 Simulation Model



6. RESULTS

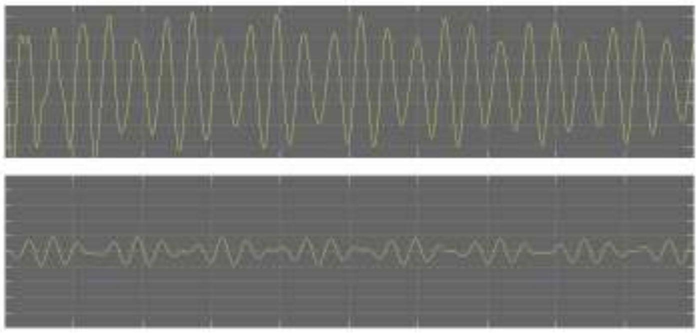


Fig 6.1

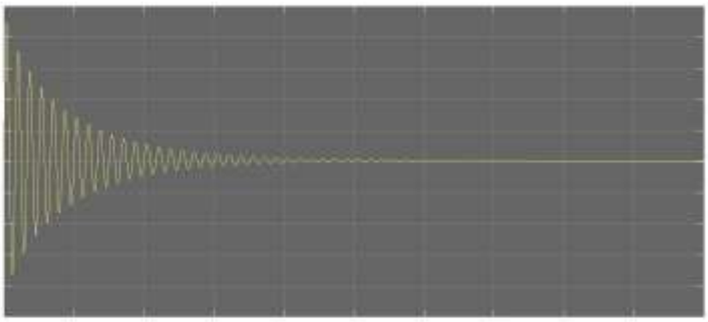


Fig 6.2

7. CONCLUSION

In this paper we have design a fuzzy control VAR compensator for reactive control of transmission line. this paper represents on SVC prototype that will be used to tell and validating a variety of control method for reactive compensation under unbalance or distorted voltage are minimise using these systems with help of fuzzy logic control.

8. REFERENCES

1) Boynuegri AR, Vural B, Tascikaraoglu A, Uzunoglu M and Yumurtacı R (2012). Voltage regulationcapability of a prototype Static VAr Compensator for wind applications, Applied Energy 93 422–431.

2) Al-Kandari AM, Soliman SA and Alammari RA (2006). Power quality analysis based on fuzzy estimation algorithm: voltage flicker measurements. International Journal of Electrical Power & EnergySystem 28(10) 723–8.

3) Eminog˘lu U, Yalcınoz T and Herdem S (2003). Analysis of FACTS devices for dynamic loads using matlab. In: 38th International Universities Power Engineering Conference 2 377–80.

4) Joshi NN and Mohan N (2006). Application of TCSC in wind farm application. IEEE PowerElectronics, Electric Drives, Automation and Motion, SPEEDAM 1196–200.

5) Jowder FAL (2007). Application of SSSC to wind farm. Power Engineering Conference IPEC 544-9.

6) Molinas M, Suul JA and Undeland T (2008). Low voltage ride through of wind farms with cage generators: STATCOM versus SVC. IEEE Trans Power Electron 23(3) 1104–17.

7) Mohammadi M, Hosseinian SH and Gharehpetian GB (2012), Optimization of hybrid solar energy sources/wind turbine systems integrated to utility grids as microgrid (MG) under pool/bilateral/hybrid electricity market using PSO, Solar Energy 86 112–125.

8) Paulo Fischer de Toledo and Hailian Xie (2005). Wind farm in weak grids compensated with STATCOM. Nordic PhD course on wind power.

9) Papantoniou A and Coonick A (1997). Simulation of FACTS for wind farm application. IEEE PowerElectron Renew Energy 1–5.

10) Qiao Wei, Venayagomoorthy GK and Harley RG (2009). Real time implementation of a wind farm equipped with double feed induction generator. IEEE Transactions on Industry Applications 45 98–107.

11) Qi L, Langston J and Steurer M (2008). Applying a STATCOM for stability improvement an existing wind farm with fixed speed induction generator. In: IEEE power and energy society general meeting –conversion and delivery of electric energy in the 21st century 1–6.

12) Qiao Wei, Ronald G Harley and Ganesh K Venayagomoorthy (2006). Effect of FACTS devices on a power systems which includes a large wind farm. In: IEEE power system conference and exposition2070–76.

13) Suul Jon Are and Undeland Tore (2008). Low voltage ride through of wind farms with cage generators:STATCOM versus SVC. IEEE Trans Power Electron 23 1104–17.

14) Neha Kumari, Isha Awashthi," Harmonic Compensation Using Shunt Active PowerFilter in Power System Using Matlab", International Journal of Scientic Engineering and Research, Volume 1, Issue 3, November 2013.

15) Byung-Moon Han, Bo-Hyung Cho, Seung-Ki Sul, "Unied Power Quality Conditioner for Compensating Voltage Interruption ", Journal of Electrical Engineering Technology, Vol. 1, No. 4, 2006.

16) M.Sunitha, B. N .Kartheek ,"Elimination of Harmonics Using Active Power Filter Based on DQ Reference Frame Theory", International Journal of Engineering Trends and Technology ,Volume4 ,Issue4 , April 2013

17) Ankita Sharmah, A.K.Upadhyay, "Harmonic Mitigation Using Inverter Based Hybrid Shunt Active Power Filter", International Journal of Electronic and Electrical Engineering, Volume 7, Number 8, 2014.