ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2016; 2(7): 999-1001
www.allresearchjournal.com
Received: 25-05-2016
Accepted: 27-06-2016

Shashi Yadav
Research Scholar Singhania University, Rajasthan, India

Dr. Anand Kumar
Associate Professor, Jaat College, Rohtak, Haryana, India

Correspondence
Shashi Yadav
Research Scholar, Singhania University, Rajasthan, India

Study of var flows on specific transformer banks and transmission lines

Shashi Yadav and Dr. Anand Kumar

Abstract
It is necessary to briefly review the current operation practice on western Oregon subsystem in Pacific Northwest before introducing the slow voltage controller framework. This part of system is a large load area without significant local 43 generation. Power is imported from other parts of Pacific Northwest and western Canada. There are tens of small capacitor/reactor banks and LTC transformers available for voltage control purpose in this area. During normal operation, voltage problems are alleviated by reactive compensation performed by system operators based on their experience, current and predicted network conditions. Switching out in-service devices is preferable than switching in alternate devices such that the maximum number of devices are available for future exercises. Tap changing has lower priority than reactive power compensation switching and tap changing frequency is restricted to several tap changes per day because tap changer failure results in transformer outage. Circular VAR flows are monitored by routinely checking the VAR flows on specific transformer banks and transmission paths and are mitigated by switching of capacitor banks or transformer tap changer settings.

Keywords: Operation practice, transformers, preferable, tap changer settings

Introduction

A power system is a proper system to transmit power economically efficiently and reliable manner. As we know everyone desired the uninterrupted supply. But it is always not possible for a system remains in normal state. For more than 99% of the time, a typical system found in its normal state. In this state the frequency and the bus voltages are kept at prescribed value. As these two are responsible for active and reactive power balance. Thematch “Equality” between generation and demand is a fundamental prerequisite for system “Normalcy”. Therefore objective is to maintain the system in normal state. This can be achieved by manage generation as well as demand. Generation can be manage by better AGC loop response which deals with frequency, voltage and economic dispatch control with considering generator rate constraints. Therefore specific objective are:

1. To develop simulation model for each component of AGC and AVR loops.
2. To develop AGC model considering generating rate constraints.
3. To develop model for coupled automatic generation and voltage control.
4. To develop AGC model based on demand side management.

Automatic generation control (AGC) is a significant control process that operates constantly to balance the generation and load in power systems at a minimum cost. The AGC system is responsible for frequency control and power interchange, as well as economic dispatch.

Review of Literature

An extended power system can be divided into a number of load frequency control areas interconnected by means of tie lines in order i. to get commercial benefit from neighboring systems ii. To meet sudden requirement of electric power and improve reliability iv. Reduce in installed capacity. The major disadvantages are control system becomes complex and any disturbance in one system is reflected in the other area. The control objective now is to regulate the frequency of each area and to simultaneously regulate the tie line power as per inter-area power contracts.

As in the case of frequency, PI controller will be installed so as to give zero steady state error in tie line power flow as compared to the contracted power.

Power transported out of area A is given by
Where, are power angles of equivalent machines of the two areas?
2, the incremental tie line power can be expressed as δ1 and δ For incremental changes in Where T12 is synchronizing coefficient. f2), the above equation can be written asΔf1 and ΔSince incremental power angles are integrals of incremental frequencies (Similarly the incremental tie line power out of area B is given by The block diagram of the system based on the above analysis is given below The steady state response of this two area system can be determined as follows. PL2). ΔPL1 and ΔPref2) and there are step load changes in both areas (ΔPref1 and ΔConsider the speed changer position is fixed (Pm1 ssΔThe turbine input change (& Pm2 ss) due to the valve opening by the regulation characteristics in the two areas in steady state condition becomes, Δ Fss; ΔPm1 ss = - (1/R1) Δ FssΔPm2 ss = - (1/R2) Δ Under this condition & Solving for steady state frequency and tie line power, we get & 1 = D1βWhere + 1/R1 2 = D2βand + 1/R.We thus conclude from the preceding analysis that the two area system, just as in the case of a single area system in the uncontrolled mode, has a steady state error but to a lesser extent and the tie line power deviation and frequency deviation exhibit oscillations that are damped out latter. Hence, in interconnected operation to avoid these deviations and also to enable each area control the changes in such a fashion that it absorbs its own load change in steady state, area control error signals should be sent to reference (speed changer) in the two areas respectively as follows Using la place transform The general block diagram for a two area system can now be developed as shown below.

Material and Method
Since the goal of on-line slow voltage control is to automate actions of an alert and experienced operator, it is necessary to briefly review the current operation practice on western Oregon subsystem in Pacific Northwest before introducing the slow voltage controller framework. This part of system is a large load area without significant local 43 generation. Power is imported from other parts of Pacific Northwest and western Canada. There are tens of small capacitor/reactor banks and LTC transformers available for voltage control purpose in this area. During normal operation, voltage problems are alleviated by reactive compensation performed by system operators based on their experience, current and predicted network conditions. Switching out in-service devices is preferable than switching in alternate devices such that the maximum number of devices are available for future exercises. Tap changing has lower priority than reactive power compensation switching and tap changing frequency is restricted to several tap changes per day because tap changer failure results in transformer outage. Circular VAR flows are monitored by routinely checking the VAR flows on specific transformer banks and transmission paths and are mitigated by switching of capacitor banks or transformer tap changer settings.

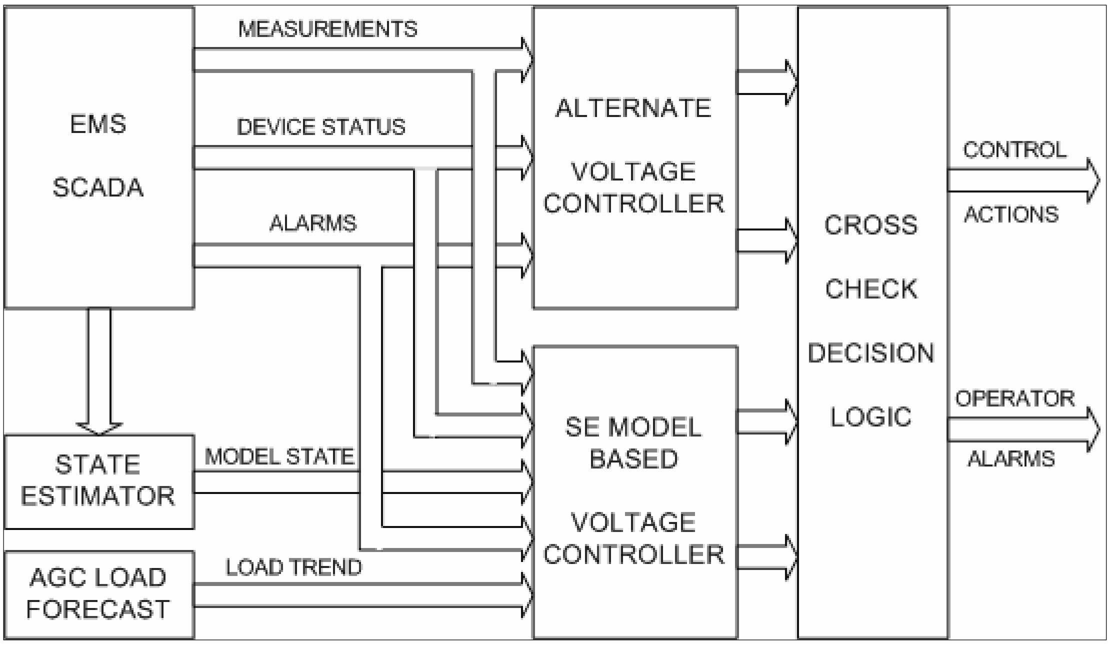

Fig 1: Common on-line slow voltage control framework.

The common slow voltage control framework integrated the state estimator modelbased controller and the alternate heuristic controller is shown in Figure 3.1. The controller is intended to be used for "slow" control and has a time frame of tens of seconds or a few minutes. Similar to a system operator, the automatic controller primarily acts upon voltage alarms and checks SCADA measurements for the acceptability of the system voltage profile. As a first step, the controllers can be required to process only the voltage alarms. Other types of alarms relating to outages and contingencies can be handled directly by the system operators. The common slow voltage controller consists of two sub-controllers that operate independently. Under normal conditions when state estimator program has valid results, the model-based controller will act as main controller and its control decisions will be cross-checked against the outputs of the alternate controller. If the control decisions made by the two controllers are different but similar, the decisions made by model-based controller will be adopted. If there are significant differences between the actions recommended by the two controllers, the system operator will be notified and responsible for making the final control decisions. When the state estimator model is unavailable or unreliable because of topology errors under certain conditions, the model-based controller will go into standby state, and the backup alternate controller will take over to make control decisions based on SCADA measurements only. The model-based controller proposed in calculates the incremental changes in bus voltages after switching control devices by carrying out an adaptive local power-flow starting from the system model output of the state estimation program. Then these incremental changes are assessed with respect to actual SCADA measurements to 45 compute the expected voltage profile after the switching actions. The controller as formulated minimizes the switching cost associated with these devices while keeping the voltage feasible in a robust sense by incorporating load forecast models, and while minimizing circular reactive flow through transformers. Specifically, the penalty for switching each device is a weighted average of the following terms 1) switching penalty based on the switching history and the type of the device, (2) voltage violation penalty based on expected voltages after switching from state estimation power-flow model and future power-flow models, and (3) circular VAR flow penalty computed from the state estimation power-flow model and future power-flow models. Switching action on the device with the minimum penalty will be recommended by the controller. The alternate controller, in contrast, calculates the incremental changes in bus voltages after switching control devices using local voltage estimator proposed in last chapter 46 based purely on the available local measurements from SCADA. The expected voltages after the switching actions also can be computed directly by adding the incremental changes to the actual SCADA voltage measurements.

Conclusion

In order to reduce the number of switchings during periods of rapid load growths and declines (for instance, during morning and evening pick-ups), load forecasting estimates for individual loads in the area are computed using existing distribution factor formulas and the system total load forecast available from the EPRI AGC load forecasting program. These forecasted loads are then used to form a set of possible future power flow cases in the robust formulation of the controller and each future power-flow case is associated with a confidence level that gradually increases after verifying its reliability during operation. The model-based controller decides whether any control action is necessary by analyzing the SCADA measurement data and the expected voltage levels from future power-flow runs. If an action is required, a subset of candidate control devices which will have an impact on the problem is selected by using the concept of *electrical distance*.

References

1. Sadegheih A. Optimization of Network Planning by the Novel Hybrid Algorithms of Intelligent Optimization Techniques, Energy Journal 2009;34:1539-1551.
2. Panda G, Panda S, Ardil C. Hybrid Neuro Fuzzy Approach for Automatic Generation Control of Two-area Interconnected Power System, World Academy of Science, Engineering and Technology, 2009, 51.
3. Hou G, Qin L, Zheng X, Zhang J. Design of PSO-based Fuzzy Gain Scheduling PI Controller for Four-area Interconnected AGC System after Deregulation, Proceedings of the Conference on Advanced Mechatronic Systems, China, 2011, 72-76, 11-13.
4. Roy R, Ghoshal SP, Bhatt P. Evolutionary Computation based Four-area Automatic Generation Control in Restructured Environment. Proceedings of the 3rd Conference on Power Systems, India 2009, 138, 27-29.
5. Wang L, Chen D. Automatic Generation Control (AGC) Dynamic Simulation in PSS®E, *Power Technology*, Siemens Energy Inc 2013;107:1-11.
6. Electric Energy System Theory. A introduction by Olle L.Elgerd. Generation of Electrical Energy by B.R. Gupta. Power System Analysis and Design by B. R. Gupta.
7. Hicks GV, Jayasurya P, Eng P. An investigation of automatic generation control for an isolatedpower system, IEEE, 1997.
8. Ignacio Egido, Fidel Fernandez Bernai. Modeling of thermal generating units for automatic generation control purpose, IEEE transaction on control system technology, 2004;2(1):205.
9. Power system analysis By HadiSaadatLi Pingkang, Ma Yongzhen; some new concepts in modern automatic generation control IEEE, 1998.
10. Wen Cheng S, Malik OP. A Synchronous Generator Fuzzy Excitation Controller Optimally Designed with a Genetic Algorithm, IEEE Transactions on Power Systems 1998;13:3.
11. Chang CS, FU W, WEN F. Load Frequency Control using Genetic Algorithm based Fuzzy Gain Scheduling of PI Controllers, Electric Machines and Power Systems 1996; 26(1):39-52.
12. Ghoshal SP. Optimizations of PID gains by Particle Swarm Optimizations in Fuzzy based Automatic Generation Control, Electric Power Systems Research 2004;72:203-212.
13. Ma M, Zhou CG, Zhang LB, Dou QS. Automatic Generating Fuzzy Rules with a Particle Swarm Optimization, Proceedings of the 4th Conference on Machine Learning and Cybernetics, Guangzhou, 2005, 18-21.
14. Juang, Lu CF. Load-frequency Control by Hybrid Evolutionary Fuzzy PI Controller, IEE Transactions on Generation, Transmission and Distribution 2006;153:2.