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Power System Security

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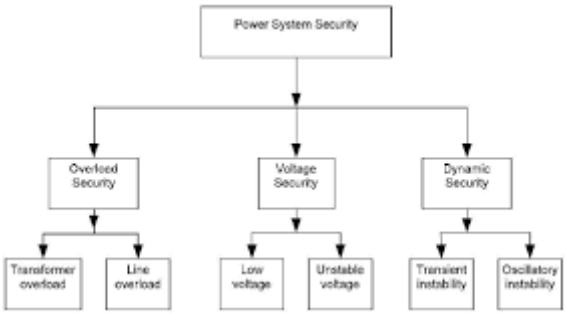
Abstract: With the growing power demand , the need for innovative and novel methods to operate large interconnected power system has increased. As a consequence of many widespread blackouts in interconnected power system, the priorities for operation of modern power systems have evolved to the following . Operate the system in such way that power delivered reliably. We will assume that the engineering group who have design the power system transmission and generation system have done so with reliability in mind . Up until now we have been mainly concerned with minimizing the cost of operating in power system .An overriding factor in the operation of a power system is to desire to maintain system security . System security involve Practices design to maintain the system operating when component fail . In earlier days , security assessment in a power system was mainly online in nature .

Keyword: Flexible AC Transmission System (FACTS), Static Var Compensator (SVC), System Security

INTRODUCTION

Power system security may be define as the probability of the system operationg point remaining within acceptable ranges , given the probabilities of changes in the system and its environment . Power System security involve system monitoring where the real time parameters of the system are monitored by using SCADA System. We know that power system is a complex network consisting number of equipment like generators, circuit breakers , transformers , transmission line , bus bar etc . Failure of any equipment during its operation harms the reliability of the system .



OBJECTIVE : The objective of power system security is to determine whether , and to what extent , the system is reasonably safe from serious interference to its operation. Thus one of the major agenda of power system planning and its operation is to study the effect of outages in terms of its severity .But power system being dynamic in nature does not gurantee that it will be 100 percent reliable. Hence detail security analysis is required to deal with possible failures in the system , its consequences and its remedial action. This analysis is known as Power system anlaysis . to detail the principles and guidelines for achieving and maintaining power system security

SYSTEM STATE CLASSFICATION

Dr Liacco first point out in 1967 that a power system may be identified to be operating in a number of states .

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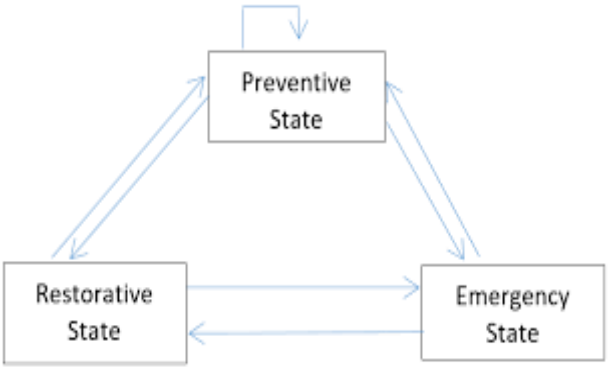

PREVENTIVE STATE

The preventive state is actually the normal state . The term " preventive" was used to stress the " security " aspect of the normal operation .
Normal operating condition usually means that all the apparatus are running within their prescribed limits , and all the system variables are within acceptable ranges .
The system should continue to operate normally even in the case of credible contingencies .
The operator should for see such contingencies and should take preventive control action such that system integrity and power quality is maintained .

EMERGENCY STATE

When some of components operating limits are violated , the system as a whole may go outside the acceptable ranges .
Or when the system frequency starts to decrease.
The main objective during emergency state :
Is to relieve system stress appropriate action.
Economic considerations becomes secondary at this stages.

RESTORATIVE STATE
It is state or condition when some parts has loss power .
The control objective hence is to steer the system to normal state by taking appropriate action.

Factor affecting Power system security

The following factor are affecting power system security :
Operate the system in such a way that power is delivered reliably.
Within constraints places on the system operation by reliability consideration , the system will be operated most economically . The power systems transmission and generation systems are always designed by engineer with reliability in mind .
This means that adequate generation has been installed to deliver the load and adequate transmission has been installed to deliver the generated power to load.

COMPONENT OF POWER SYSTEM SECURITY

System security can be broken down into three major functions that carried out in an operations control center:
1.SYSTEM MONITORING
2.CONTIGENCY ANALYSIS
3.PRVENTIVE AND CORRECTIVE ACTION

SYSTEM MONITORING : It provides the operators of the power system with pertinent up-to-date information on the conditions on the power system . Generally speaking , it is most important function of three . From the time that utilities went beyond system of one unit supplying a groups of loads , effective operation of the system required that critical quantities be measured and the value of the measurement be transmissted to a central location . Such system of

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measurement and data transmission , called telemetry system ,have evolve to scheme that can monitor voltages , current ,power flow , and status of circuit breakers, and switches in every substation in a power system transmission network. Measurement devices dispersed throughout the system help in getting a picture of the current operating state. The measurements can be in the form of power injections, power flows, voltage, current, status of circuit breakers, switches, transformer taps, generator output etc., which are telemetered to the control centre. I Usually a state estimator is used in the control centre to process these telemetered data and compute the best estimates of the system states. I Remote ontrol of the circuit breakers, disconnector switches, transformer taps etc. is generally possible. The entire measurement and control system is commonly known as supervisory control and data acquisition (SCADA) system.

CONTIGENCY ANALYSIS

For the power system to be secured there must have continuity in the supply without any loses. Whenever the operating variable are out from the specified limits the power system comes into the emergency system. These violation of the operating variable result into the contingency occurring into the system. Thus an important of the security analysis moves around the power system to with stand affect of contingency.

The contingency analysis basically involves the simulation of ever contingency of the power system. But this analysis involves three major difficulties

1. Difficulty to develop the appropriate power system model.
2. Confusion to choose contingency case.
3. Difficulty in computing the power flow and the bus voltages which leaves to high time consumption. Preventive and corrective actions are needed to maintain a secure operation of a system or to bring it to a secure operating state. I Corrective actions such as switching of VAR compensating devices, changing transformer taps and phase shifters etc. are mainly automatic in nature, and involve short duration. I Preventive actions such as generation rescheduling involve longer time scales. Security-constrained optimal power flow is an example of rescheduling the generations in the system in order to ensure a secure operation.

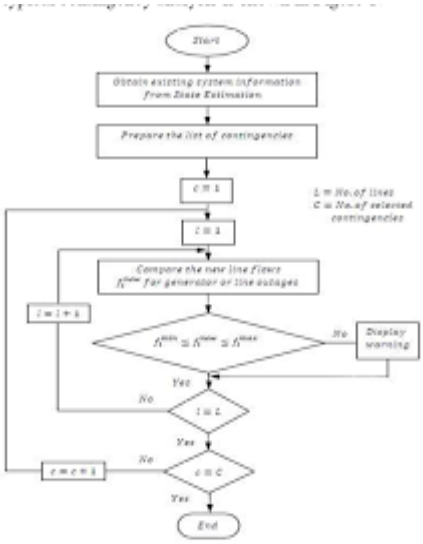

Figure 1: Algorithm of a typical contingency analysis

PRVENTIVE AND CORRECTIVE ACTION

Preventive and corrective actions are needed to maintain a secure operation of a system or to bring it to a secure operating state. Corrective actions such as switching of VAR compensating devices, changing transformer taps and phase shifters etc. are mainly automatic in nature, and involve short duration. Preventive actions such as generation rescheduling involve longer time scales. Security-constrained optimal power flow is an example of rescheduling the generations in the system in order to ensure a secure operation.

CONCLUSION

The paper presents a solution to the problem of the power system security. Most power system are operated such that any single initial failure event will not leave other component heavily overloaded , specifically to avoid cascading failures. Secure operation of power system requires not only that the system operates within specified system operating condition is maintained when contingencies occur ..

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