Review Paper on Voltage Profile Management in Restructured Power System

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Abstract— One of the major aims of system operator is to maintain system parameters within permissible limit. During certain period of time in a day load changes very rapidly, especially when it tends to increase, a generalized voltage decrement and stressed conditions for reactive power sources occurs. Maintaining Voltage profile under varying load conditions is need of today under unpredictable load scenario. This paper presents First the weak bus is identified using Predictor-Corrector method considering the proximity of the voltage collapse region on P-V Curve. Considering the weak bus as a best place for placement of reactive power improvement device voltage profile is being maintained. Finally we can improve voltage stability margin, so that we can improve voltage for particular load. This voltage stability margin can improve by static and dynamic.

Key words: Weak Bus, Voltage Improvement, Static Voltage Stability and Dynamic Voltage Stability

I. INTRODUCTION

Power systems have been experiencing continuing growth in interconnections, the use of new technologies and controls, and the increased operation in highly stressed conditions. Simply we can say that the operation of an electrical power system (EPS) has become a very complex issue, mainly due to:

1) Continuing increases in demand.
2) The transfer of high powers between several interconnected areas and
3) Economic and environmental constraints that have resulted in investment delays.

Present Power system divide into three major parts Generation, Transmission and Distribution for study purpose. Now a days progress in the direction of improve power system reliability and efficiency, power system engineer take their leg in the direction of reduce losses in the system for made it most efficient. As the transmission networks need to be utilized ever more efficiently the transfer capacity of an existing transmission network needs to be increased without major investments but also without compromising the security of the power system. The more efficient use of transmission network has already led to a situation in which many power systems are operated more often and longer close to voltage stability limits.

Currently, most electrical power systems operate very close to their stability limits and it is crucial to keep both their efficiency and security at appropriate levels. A power system stressed by heavy loading has a substantially different response to disturbances from that of a non-stressed system. The potential size and effect of disturbances has also increased:

When a power system is operated closer to a stability limit, a relatively small disturbance may cause a system upset. In addition, larger areas of the interconnected system may be affected by a disturbance. Voltage instability problems in an electrical power system are associated with an uncontrolled, monotonic voltage drop that eventually leads to a voltage collapse and this voltage collapse may become reason behind major blackout also.

In practice, it is not possible to work or to serve without electricity in modern society So this problem study become necessary for prevent this type of black out. Even although these problems are essentially dynamic in nature, they can be studied using static analysis methods to obtain bus voltage profiles for load and/or generation changes (PV and QV curves). These curves can be helpful in analyzing and discussing system operating conditions under different load and/or topology scenarios.

Many studies exist in which these profiles are used to:

1) Determine power transfer limits,
2) Determine voltage security margins,
3) Observe bus voltage performances,
4) Determine the proximity to voltage collapse and
5) Compare planning strategies.

Out of all above uses determination of the proximity to voltage collapse point is coming into picture after the lots of collapse take place in the past and due to that large power system blackout also. So now it's become necessary to design such tool to give the complete solution of voltage collapse before it take place by tracing PV-curve with maximum loading point.

Continuation power flow is most efficient tool for steady state voltage stability analysis because it gives the complete solution of voltage collapse before it take place by complete tracing PV-curve with maximum loading point or critical point for the given system. Finally from collapse point we can improve voltage profile and also voltage stability margin. For improvement of voltage stability margin and voltage improvement we can use of tap changer and shunt capacitor. This process of improvement is known as static voltage stability.

II. LITERATURE REVIEW

B. H. Lee and K. Y. Lee [1] this paper has demonstrated a detailed dynamic mechanism of the voltage collapse phenomenon using a simple power system model which includes a synchronous motor. Especially in this paper, the mechanism of voltage collapse phenomenon was analyzed from the physical point of view rather than from the mathematical point of view, and some meaningful physical interpretations are given.

R.A Schlueter[2] In this paper, voltage stability security assessment method is developed that can identify (i) each region that experiences voltage collapse and (ii) the equipment outages that cause voltage collapse in each of these regions.

F. D. Galiana[3] this paper described as the load in a power network increases, eventually a feasibility limit is reached beyond which real solutions no longer exist. At such a point the voltage levels are at a depressed level constituting a voltage collapse situation. It is conjectured here on the basis of experimental and analytical evidence that by monitoring a distance measure of the set of bus inflections from the nearest feasibility limit given some permissible variation of the injections, one can monitor the voltage collapse condition. Thus by staying sufficiently far from such a feasibility limit one can guarantee that voltage collapse can be avoided.

Venkataramana Ajjarapu and C.Christy [4] This paper presents a method of finding a continuum of power flow solutions starting at some base load and leading to the steady state voltage stability limit (critical point) of the system. A feature of the continuation power flow is that it remains well-conditioned at and around the critical point. Thus divergence due to ill-conditioning is not encountered at the critical point, even when single precision computation is used.so that we used of continuum power flow method because of NR method is diverge at critical point. Also intermediate results of the process are used to develop a voltage stability index and identify areas of the system most prone to voltage collapse.

Venkataramana Ajjarapu and Ping Lin Lau [5] this paper employs a predictor-corrector scheme to overcome the singularity barrier at and near the critical point. By using the sensitivity information obtained from the continuation power flow, minimum amount of reactive support is calculated which indirectly maximizes the power transfer capability of the system. It is nothing but reactive power support on weak bus, so that we can increase voltage.

Venkataramana Ajjarapu and C.Christy[6] In the design and operation of heavily loaded power systems, a P-V curve is useful for evaluating the steady-state voltage stability limits of a system for both normal and post-contingency operating conditions. A load flow program is commonly used to calculate the points that compose the P-V curve. This paper shows how the capabilities of a load flow program can be surpassed by solving CPF method. Due to this method ill-conditioning is not encountered at the critical point. Also,results of the algorithm give the locations of the busses most vulnerable to voltage instability.

M.G.O'Grady and M.A.Pai[7] In this paper author extend the singular value decomposition method for detecting voltage collapse to include voltage dependent loads, Q-limited generation sources and also propose a new indicator called the condition number which is more sensitive than the minimum singular value

Y.Tamura,Koji Sakamoto and Y.Tayama[8] This paper deals with an index for predicting voltage instability, based on the relationship between voltage instability and multiple load flow solutions. This index is computed from multiple load flow solutions and can be used for monitoring the system state.

P.Kessel and H.Glavitsch [9] described a method for the online testing a power system is proposed which is aimed at the detection of voltage instabilities. Thereby an indicator L is defined which varies in the range between 0 (no load of system) and 1 (voltage collapse). Based on the basic concept of such an indicator various models are derived which allow to predict a voltage instability or the proximity of a collapse.

Hitarth Buch,R.D.Bhagya,B.A,Shah and Bhavik Suthar[10] In this paper , they first find weak bus using continuum of power flow (CPF) method and finally on that weak bus improve profile of voltage using STATCOM.

M.A.kamarposhti, M.Alinezhad,H.Lesani and N.Talebi[11] In this paper, the effects of four FACTS controllers, SVC, STATCOM, TCSC, and UPFC, on voltage stability is studied with continuation power flow feature of PSAT and accurate model of these controllers. Finally comparison of models.

B. H. Lee and K. Y. Lee[12] In this paper for control of static voltage stability, the shunt capacitor and tap-changer were used. A capacitor, tap changer can increase the stability margin for static voltage stability and the increase of the stability margin improves the overall voltage profile of the power system. This paper also described dynamic voltage stability. For the control of dynamic voltage stability, a capacitor and a tapchanger were also used in addition to PSS.

T.Nagao, K.Tanaka and K.Takenaka[13] In this paper voltage stability margin can be basically identified by the multi-solution load flow calculation method. There is computer code available for new load flow calculation and voltage stability. This computer codes can also calculate the voltage stability index at each load point which is based on the margin to the stability power limit at each load point.

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