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A Review Article Of Hv Relay Based Protection And Power Stabilization Using Scheduling Switching Time

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Abstract- Due to the increasing demand of energy and the need for nonconventional energy sources, distributed generation (DG) has come into play. The trend of unidirectional power flow has been gradually shifting. With new technology comes new challenges, the introduction of DG into the conventional power system brings various challenges; one of the major challenges is system protection under DG sources. These sources pose a significant challenge due to bidirectional flows from DGs as well as lower fault current contribution from inverter interfaced DGs. This paper reviews existing protection schemes that have been suggested for active distribution networks. Most of these protection strategies apply only to smaller distribution systems implying that they may need to be extended to larger systems with a much higher penetration of distributed generation. In the end, a potential protection scheme has also been recommended as a future work.

Keyword- power system protection, power system controls, PMU, wide area monitoring, and power system contingencies.

I. INTRODUCTION

The task of protection and control in substations and in power grids is the provision of all the technical means and facilities necessary for the optimal supervision, protection, control and management of all system components and equipment in high and medium – voltage power system. The task of the control system begins with the position indication of the HV circuit – breaker and ends in complex systems for substation automation, network and load management as well as for failure and time based maintenance. For all these functions the data acquisition at the switch yard and if applicable, the command execution at the switch yard are part of the network control and management [1]. Modern automation technology provides all the means necessary for processing and compressing at the actual switchgear locations in order to simplify and secure normal routine operation. This allows more efficient use of the existing equipment and quick localization and disconnection of faults in case of troubles, thereby also reducing the load on the communication links and in the network control centers.

II. LITERATURE REVIEW

Krzysztof Solak, Transmission line impedance-differential protection with improved stabilization for external fault cases: In this paper, the enhanced impedance-differential protection algorithm dedicated for transmission lines is described. Measurements of current and voltage at both line ends allow to formulate a differential impedance which constitutes efficient criterion for transmission lines protection. The considered impedance-differential protection can be used as a main transmission line protection. It can be observed that this protection may face problem when external faults with CT saturation take place. Therefore this paper presents an improved scheme based on phase angle impedances calculated at both ends. The proposed algorithm provides better stabilization for cases of external fault with CT saturation. The developed protection solution has been thoroughly tested with the signals generated with use of ATP-EMTP program.

Jun Wu, Power System Emergency Control Based on Load Stratification: Because of the Aug. 14 blackout in the U.S. and Canada, the subject of maintaining grid security and stabilization after great disturbance increasingly becomes the focus of power companies all around the world. Power system emergency control is the conventional method for maintaining transient stabilization of power grid while disturbance occurs. The emergency control based on load stratification is advanced. Comparing with normal low frequency load/generator shedding,, the theory of load stratification provides the fast creating of control strategy table on stratified load or generator, and the expressions of power balance protection provides rapid calculating on the real value of load/generator shedding. The result of simulation shows that the principle of emergency load control is effective.

Oliver Janke, The directional reactive power undervoltage protection A protection concept for connecting decentralized renewable energy sources: With their increasing number, it is getting important that decentralized and renewable energy sources are supporting the stabilization of the system voltage after short voltage

dropouts. Often, in the past, these generators were disconnected during network faults. This is not adequate anymore, as it would lead to a loss of a considerable amount of feed-in power. However, if the generators stay connected, it must be ensured that they are not receiving reactive power, as this would lead to a collapse of the grid. In Germany, a number of legal requirements and grid codes are regulating the connection of such generators. These documents also stipulate the use of Directional Reactive Power Undervoltage Protection (Q→& U<; protection) that would disconnect such energy sources if they received reactive power during faults on the network. This paper gives an overview about the legal documents and an introduction to the protection function mentioned above. The basic principle of the Q→& U<; protection is explained by means of its requirement specifications. Furthermore, the paper will show up standardized test methods evaluating the Q→& U<; protection. It will describe how to test the releasing functions, the reactive power direction determination and also all binary inputs and outputs that are necessary for the protection function.

F. Ichikawa, Development of self-commutated SVC for power system: For power system stabilization, an advanced static VAr compensator (SVC) using the world largest GTOs, that is a self-commutated SVC, has been developed. The series connection technique of many high power GTOs for realization of a high voltage power converter was established. The effectiveness of voltage stabilization in power systems was verified through field tests and these large capacity self-commutated converters offer prospects of application to power systems. This paper introduces essential techniques for development, present the state of field tests, and proposes a new overcurrent protection method for high voltage power converters composed of many series-connected devices.

A Wixon, Load blinding stabilisation for DOC relays subjected to reverse load flow: Evolution of modern power systems have seen an increase in the generation at the distribution end of the system, thus bringing to an end the uni-directional power flow of traditional systems. Reverse load flow from distribution to transmission is now becoming more common, which is problematic for the DOC protection which could mal-operate if the exported load exceeds the current threshold. This paper discusses the use of load blinders to prevent mal-operation of the DOC relay during export conditions, whilst maintaining maximum sensitivity for resistive faults on the sub-transmission network.

H. Hayashi, Development of an optical current transformer by using a Bi-YIG crystal for electric power system protection and stabilization control: A compact laser based current transformer (CT) is developed for electric power system protection. Bi-YIG crystal is selected as a useful material based on measurements. A prototype model Bi-YIG laser CT was compared with a resistance shunt CT using a simulation device of transmission lines and similar behavior was observed, clearly demonstrating its usefulness.

WaldemarRebizant, Fuzzy adaptive transmission line differential protection with improved stabilization for near-by transformer inrush cases: In this paper enhanced differential current protection scheme dedicated for HV transmission lines is described. The adaptive fuzzy relay scheme is proposed that combines strengths of both current and phase comparison protection criteria. The relay stabilization characteristic is adapted on-line depending on the output of the fuzzy reasoning scheme supplied with information from the phase comparison unit. The resulting protection is characterized by improved selectivity for external fault cases as well as when near-by transformer inrush currents cause saturation of CTs installed in the protected line. The performance of fuzzy protection scheme has been tested with the use of Real Time Digital Simulator (RTDS) and compared to the traditional solutions.

Charles Mozina, Power Plant Protection and Control Strategies For Blackout Avoidance: Recent misoperations of generation protection during major system disturbances have highlighted the need for better coordination of generator protection with generator capability, generator automatic voltage regulator (AVR) control and transmission system protection. This paper discusses in detail the important role the generator AVR plays during major system disturbances. The generator AVR needs to properly control VAr support to rapidly stabilize system voltage during major disturbances. This paper provides practical guidance for relay engineers on proper coordination of generator protection and generator control to enhance security and system stability.

W. Rebizant, Fuzzy inference supported current differential protection for HV transmission lines: In this paper enhanced differential current protection scheme dedicated for HV transmission lines is described. The adaptive fuzzy relay scheme is proposed that combines strengths of both current and phase comparison protection criteria. The relay stabilization characteristic is adapted online depending on the output of the fuzzy reasoning scheme supplied with information from the phase comparison unit. As a result improved performance of the scheme for cases of external faults with CT saturation is reached. The performance of presented fuzzy protection scheme has been tested with the signals generated with use of EMTP-ATP program and compared to the traditional solutions.

Y. Serizawa, Use case study on a decentralized modular device network for wide-area monitoring, protection and control: This paper describes a use case study on a novel Intelligent Electronics Device (IED) network for wide-area power system monitoring, protection and control

(WAMPAC), featuring wide-area Ethernet and IEEE 1588-based time synchronization associated with decentralized modular devices. Use cases include configurable WAMPAC system architecture accommodating various applications and enabling redundant configurations, wide-area integrated primary and backup protection with a current differential scheme, and special protection with centralized synchronous cyclic and data-driven communication and processing. Preliminary evaluations and experiments indicate that the wide-area current differential protection requires a bandwidth of several tens or hundreds of Mbps for its Ethernet network, and that IEEE 1588-embedded IEDs associated with an off-the-shelf IEEE 1588 time server achieve time synchronization accuracy to within a few microseconds. The need for wide-area network engineering guides is also discussed.

TomislavRajić, The influence of current transformer saturation on the longitudinal differential protection of transmission lines: This paper explains the algorithm for the longitudinal differential protection of transmission lines. In case of current transformer saturation, conventional stabilization is insufficient for avoiding an unnecessary protection tripping. Such a problem may occur due to a fault outside the protected zone of the transmission line. In such cases, additional stabilization ought to be implemented as well. The paper presents simulations of various potential faults, and offers a comparison of relay operation with and without additional stabilization.

Chen Jiong-Cong, Research of beidou system in electric power system time service: Time service with the satellite time transfer has the benefits of high precision, anti-disturbance, around-the-clock broadcasting and so on. In virtue of these profits it will be widely used and fine foreground in research of timing service and application domain. For the moment, the most extensive used in research of timing service and application domain is GPS (Global Position System), but it is faulty in application that depending on GPS time service only. One of the problems is that being only a means in application is insecure. On the other hand, our country has no independence control power on GPS. According to above-mentioned reasons, our country has begun to research and actualize The Beidou navigation positioning system since 80's, and successfully complete set up of this navigation positioning system by launching the satellite 'Beidou No. 1' in 2003.

On the basis of the brief introduction of the Beidou satellite time service system, This thesis analyses the necessity and feasibility which the Beidou time synchronization system applied to our country's electric power system.. In this thesis, theoretics and realization of electric power system time service signal - 1PPS (one pulses per second) which integrate the two characteristics of both Beidou satellite system time signal and OCXO (oven controlled crystal oscillators) are introduced, and the hardware of the Beidou satellite synchronous clock equipment based on the SCM and Beidou satellite OEM chip is designed. This Beidou satellite synchronous clock equipment make up of Beidou OEM receptor, central proceeding unit and output connectors. Using the standard time signals supplied by Beidou OEM receptors, the central proceeding unit could deal with the data and domesticate OCXO, the output unit can export 1PPS which is provided with good characters of short and long term stability. It could make all clock in the power net synchronous by use of the output 1PPS standard time signals , thus, all clock in the power net could retain running highly synchronously. This new synchronous clock equipment has many advantages, such as simple, high precision, wide extension, no confine of geography and weather environment and so on. It is the ideal way to synchronize the clock.

III. CONCLUSION

Modern protection and control of power system have been made more robust than the conventional type through the use of pmu which has reduced the time lag between the measured system state and the time these system states are sent to the control centers for procession. The incorporation of PMU has to the adaptation of real time self healing system which has definitely easy off some of the operator's control job with great improvement in speed and precision. The dynamic system assessment which in this modern protection and control are been done on – line rather than offline simulation and have led to operation of power system closer to their limits with its attendant economical advantage especially in this modern world embraced with deregulated power system environment. The time stamped PMU data other known as synchronized PMU data offers opportunities for more efficient wide area protection and control as such some stubborn protection like the protection of series compensation lines and likes are better handled in this new protection and control dispensation.

Future works for completing this review may discuss various parts of adaptive protection schemes, such as digital relays, communication capabilities, and supervisory software. Moreover, discussing PMUs and communication platforms as well as implementing them in the control and protection of microgrids, especially in islanded mode, might be a hot topic. The structure of future protection systems will consist of adaptive protection and intelligent protection, which will work based on communication with modern digital protective relays using PMU and IDM. The main concern in this regard is the time delay of communication links that plays an important role in future protection designs, especially in microgrids. Moreover, the expansion of adaptive systems with a communication platform increases the risk of cyber-attacks. A protection

system must be sufficiently secure against cyber-attacks to prevent blackouts. Therefore, further research specifically on cyber-security is necessary. Fault detection in an inverter-based microgrid in islanded mode with/without a communication scheme is an interesting subject for future studies.

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