Relay protection is unaffected by system oscillations



Overview

System Oscillation Relay Protection The S-PRO relay detects these sub harmonic oscillations and allows the utility to monitor and protect the power system.

Key Takeaways

Relay protection is not inherently unaffected by oscillations; specialized relays are required to detect and respond accurately to oscillatory conditions. Impact of Oscillations on Relay ProtectionProtective relays are designed to detect abnormal conditions such as overcurrent, overvoltage, or frequency deviations and to trip circuit breakers to isolate faults quickly, maintaining system stability and safety. However, oscillations in the power system, including sub-synchronous oscillations (SSO) or transient harmonics, can influence relay measurements and potentially affect their operation.

Standard overcurrent or impedance relays rely on phasor estimation of sinusoidal signals, which assumes relatively steady-state conditions. Oscillatory signals can distort these measurements, leading to delayed or incorrect tripping if the relay is not designed to handle such phenomena.

Specialized Relays for Oscillatory Conditions

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To address oscillations, particularly SSO, specialized relays have been developed. These relays extract sub-synchronous frequency components from system currents and voltages using advanced signal processing techniques such as Fast Fourier Transform (FFT), Discrete Fourier Transform (DFT), wavelet transforms, or artificial neural networks. Unlike conventional relays, SSO relays are designed to operate reliably even when oscillations are slow-developing or involve multiple frequency components.

They incorporate longer operating times and filtering to avoid false trips from transient events or lower-order harmonics.

Practical Considerations

Conventional relays may not respond correctly to fast-developing oscillations or sub-synchronous components because accurate phasor estimation requires a finite data window, which can delay detection. Numerical and microprocessor-based relays can combine multiple protection functions and include algorithms to distinguish between genuine faults and oscillatory transients, improving reliability under oscillatory conditions. Relay coordination and settings must consider the presence of oscillations to ensure selectivity and speed, preventing unnecessary tripping while maintaining protection integrity.

Conclusion

Relay protection is not automatically immune to oscillations. While conventional relays may be affected by oscillatory signals, modern numerical relays and specialized SSO relays are designed to detect and respond accurately to oscillations, ensuring dependable protection of power system components. Proper relay selection, coordination, and signal processing are essential to maintain protection performance in systems prone to oscillatory phenomena.

Article Content

System Oscillation Relay Protection

The S-PRO relay detects these sub harmonic oscillations and allows the utility to monitor and protect the power system by isolating the healthy grid from sub-harmonic generation sources.

Protection Against Sub-Synchronous Oscillations, A Relay Model

Since regular power system protection relays are designed to operate based only on fundamental frequency components, they are generally oblivious to SSO conditions. Specially designed relaying

Performance of protection relays during stable and unstable power

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This work will characterise and evaluate the impact of stable and unstable power swings on a wide range of protection functions in protection relays.

Power System Protective Relays: Principles & Practices

Protective relays and devices have been developed over 100 years ago to provide “last line” of defense for the electrical systems. They are intended to quickly identify a fault and isolate it so the balance of

Performance of Protection Relays During Stable and ...

The aim of this paper is to explain which relay systems are most prone to operate during stressed system conditions, and why relay systems operate, to share experiences and lessons...

Relay Element Performance During Power System Frequency

Many microprocessor relays employ frequency tracking algorithms to ensure that system frequency changes have minimal impacts on relay phasor measurement and pro-tection elements.

Protection against sub-synchronous oscillations, a relay model

In addition, performance of the developed relay model is compared against a commercial (physical) SSO relay. Obtained results demonstrate the effectiveness of the implemented relay

Microsoft Word

Abstract— Use of micro-possessor based sub harmonic protection relays to provide the protection against the Sub Synchronous Oscillations (SSO) conditions occurring in a power system has

Relay Performance During Major System Disturbances

The aim of this paper is to explain which relay systems are most prone to operate during stressed system conditions, and why relay systems operate, to share experiences and lessons

Performance of Protection Relays During Stable and Unstable Power

This basic relationship between the period and magnitude of the oscillation in voltage magnitude is critical to understanding how power swings impact protection relay functions.

Types of System Oscillations and Their Detection

This paper first identifies a set of ranges of sub-synchronous oscillations, introduces a new high-performance measurement technique for these oscillations, and identifies possible mitigation

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Design Of Subsynchronous Resonance Protection And Reduction Of ...

Key words: SSR, TCSC, SVR, Protective Relays, Schematic Diagram I. INTRODUCTION Sub synchronous Resonance (SSR) is a condition that can exist on a power system where the network

Study of relay behaviour under system oscillations and out of step ...

As far as these relays now are concerned they add complexity to the system and furthermore they can not distinguish between power oscillations, during which they must not trip and out-of-step conditions

Series Compensated Tx. Line Parameters

Protection Against Sub-Synchronous Oscillations, A Relay Model Dinesh Rangana Gurusinghe, Sachintha Kariyawasam, and Dean S. Ouellette3 RTDS Technologies Inc., Winnipeg, Canada

Relay Element Performance During Power System Frequency

Abstract—Many voltage and current protection elements in microprocessor relays use the fundamental frequency component of current and voltage. Distance relays also calculate apparent fault

System protection behavior and settings during system ...

As a result, the high current during dynamic loading or system oscillations may create sufficient zero sequence current that will lead to the operation of a backup ground overcurrent element of a

The basics of power system protection that every

Introduction to relay protection Protection is the branch of electric power engineering concerned with the principles of design and operation of

Intelligent strategies for microgrid protection: A comprehensive review

The online protection system employs the coordination of different agents and a SCADA system to localize and clear faults. The offline protection system primarily serves as a backup to the

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