Distribution network relay protection longitudinal differential



Overview

Zero-sequence longitudinal differential protection of transmission. This paper explains a new, earth fault-sensitive algorithm for the longitudinal diffe.

Key Takeaways

Longitudinal differential protection provides fast, selective fault detection by comparing currents at both ends of a line, ensuring reliable disconnection of the faulted section.

Operating Principle

Longitudinal differential protection works by comparing the vector sum of currents measured at the two ends of a protected line. Under normal conditions, the sum of these currents is zero. When a fault occurs within the protected zone, the vector sum deviates from zero, triggering the relay to trip and isolate the faulted section quickly.

This principle ensures high sensitivity and selectivity, minimizing the impact on the rest of the network.

Implementation Methods

Pilot Wire-

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Based ProtectionTraditionally, pilot wires connect secondary current transformers at both ends of the line. This method is effective for short lines (a few tens of kilometers) but has limitations due to the physical presence of the pilot wire and susceptibility to line length constraints. Optical Protection Ground Wires (OPGW)Modern systems often use OPGWs, which combine grounding and optical communication.

OPG

Ws eliminate the line-length limitation of pilot wires and allow high-speed, reliable communication between relays at opposite ends of the line. This enables the implementation of digital differential protection algorithms, improving fault detection and reducing false trips. Adaptations for Distribution Networks with IIDGIn distribution networks connected to inverter-interfaced distributed generation (IIDG), fault currents can be complex and asymmetric.

Traditional longitudinal differential schemes may fail to distinguish between internal and external faults. A combined main and auxiliary protection scheme has been proposed, where auxiliary protection activates only when the main protection cannot correctly identify the fault, reducing cost while maintaining reliability.

Advanced Algorithms

Modern longitudinal differential relays incorporate algorithms that monitor current direction rather than relying solely on stabilization currents. This approach mitigates issues caused by current transformer saturation and ensures prompt tripping for faults within the protected zone. Minimum tripping currents are typically set to 20–50% of the rated transformer current to balance sensitivity and stability.

Advantages

Fast and selective fault detectionHigh sensitivity to internal faultsReduced impact on healthy network sectionsAdaptable to modern digital communication systemsLimitationsPilot wire schemes are limited to short linesRequires accurate current transformer measurementsComplexity increases with distributed generation and long linesSummaryLongitudinal differential protection is a critical relay scheme for both transmission and distribution networks. By comparing currents at both ends of a line, it ensures rapid isolation of faults. Modern implementations using OPGWs and advanced algorithms enhance reliability, especially in networks with distributed generation, while traditional pilot wire methods remain suitable for short lines.

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Article Content

Zero-sequence longitudinal differential protection of transmission ...

This paper explains a new, earth fault-sensitive algorithm for the longitudinal differential protection of transmission lines. The sensitivity of longitudinal differential protection in radial networks

An algorithm for longitudinal differential protection of transmission ...

The paper presented an algorithm for longitudinal differential protection of transmission lines. An electric power model was formed and various algorithms were tested.

Zero-sequence longitudinal differential protection of transmission lines

Radial networks often feature long transmission lines which connect distribution plants with consumers in remote locations. By establishing communication between the relays on the opposite ends of a line

A Dual-Channel Deep Network–Based Longitudinal Protection

In this paper, a two-channel deep network–based longitudinal protection method for distribution networks is proposed, and the effectiveness and rationality of the proposed evaluation

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Traditional overcurrent and differential protection methods cannot respond accurately due to the effects of unknown renewable energy sources. Therefore, a longitudinal protection method

Longitudinal Differential Protection of Power Systems Transmission ...

The longitudinal diferential protection principle is based on the comparison of the currents located at the beginning and at the end of the line, resulting in a quick, sensitive and simple protection concept that

An algorithm for longitudinal differential protection of transmission ...

Different types of faults have been simulated, both within and outside of the protected zone, and the paper demonstrates how the relay trips when the algorithm in question is used.

A Dual-Channel Deep Network–Based Longitudinal Protection

To address the challenges of balancing model efficiency with accuracy and improving the discrimination accuracy between internal and external faults, this paper proposes a dual-channel

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The present invention comprises a longitudinal differential protective relay for protection and supervision of power line zones in a distribution system. The protective relays are located at each end of the

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Abstract This paper describes a new algorithm for longitudinal differential protection of transmission lines. Classic stabilization is an unreliable method for avoiding unnecessary relay tripping in case of

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The distributed power supply is gradually connected to the distribution network, the original single power source radiant network pattern of the distribution network no longer exists. The

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Analogue longitudinal differential protection is used for shorter, single-circuit transmission lines in double-fed networks. If optical ground wires (OPGW) are used, the length of the line ceases

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Differential protection | Protection of Electricity Distribution Networks

Differential protection functions when the vector difference of two or more similar electrical magnitudes exceeds a predetermined value. Almost any type of relay can function as differential

Three basic principles of differential protection you

Generators, motors, transformers & lines The three basic principles of differential protection explained in this article, which has been known for

Hybrid Multi-Infeed Receiver Line Longitudinal Protection Scheme

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Hence, research is necessary for the relay protection of the receiving end AC system. Currently, the protection methods for AC transmission lines primarily rely on traditional relay

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The voltage connection is required for all functions that work on the basis of power or voltage values, e.g. ground fault differential protection in resonant-grounded/isolated systems, directional overcurrent

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