

Article Overview

The impedance relay operates by measuring the ratio of voltage to current to detect faults within a specified distance, and its characteristic experiment demonstrates this relationship in a controlled setup.

Principle of Impedance Relay

An impedance relay is a type of distance relay that protects transmission lines by calculating the impedance (V/I ratio) between the relay location and the fault point. It operates when the measured impedance falls below a preset value, corresponding to the reach of the relay, ensuring that only faults within the protected zone trigger a trip. The relay combines a voltage coil connected through a potential transformer and a current coil connected via a current transformer. The voltage element produces a restraining torque, while the current element produces an operating torque, making it a voltage-restrained overcurrent relay.

Operating Characteristic

The operating characteristic of an impedance relay is typically represented on a voltage-current (V-I) diagram. The relay picks up for any combination of voltage and current above the characteristic curve in the positive-torque region, or equivalently, for any impedance below the set value. At low currents, the control spring may cause a slight bend in the characteristic, but for practical purposes, the relay can be considered to operate at a constant impedance threshold.

Experimental Setup

In a laboratory experiment, the following steps are generally followed :

- o Circuit Connections: Connect the voltage and current coils of the relay to the test line through appropriate potential and current transformers.
- o Safety Checks: Verify all connections, ensure proper ratings of instruments, and maintain safe distance from live circuits.
- o Fault Simulation: Apply different combinations of voltage and current to simulate faults at various distances along the line.
- o Observation: Record the relay operation, noting the points where the relay picks up, and plot the V-I characteristic curve.
- o Analysis: Compare the experimental curve with theoretical expectations to understand the relay's reach and sensitivity.

Distance Protection Application

Impedance relays are widely used in distance protection schemes for transmission lines. They can be configured in multiple zones:

- o Zone 1: Covers 80-90% of the line length for instantaneous tripping.
- o Zone 2: Extends beyond the line with a time delay for backup protection.
- o Zone 3: Provides further backup for adjacent lines . The relay calculates the line impedance angle, which depends on line parameters, and trips only for faults within the defined zone, ensuring selective and reliable protection .

Key Takeaways

- o Impedance relays are distance-based protective devices that respond to the V/I ratio.
- o The experiment demonstrates the relay's operating characteristic, showing how it responds to faults at different points along a line.
- o Proper safety protocols and accurate measurement are essential for reliable results in the laboratory . This experiment helps students and engineers understand the fundamental operation of distance relays, their characteristic curves, and their practical application in power system protection.

A relay that operates or picks up when its current exceeds a predetermined value (setting value) is called Over-current

A. STUDY OF IDMT OVER CURRENT RELAY TITLE: Study of IDMT over current relay. OBJECTIVE: To study the characteristics of

Distance relay Impedance Relay The impedance relay has a circular characteristic centered

This report is discussing the distance protection relay fundamentals of measuring distance to fault based on electrical signals from

Almost all modern distance protection relays are designed and manufactured with dynamic impedance characteristics. Dynamic

This paper describes the relay testing method and the result for detecting availability of protective relays under high impedance faults

The operating time of these relays is constant, irrespective of the fault location within the protected zone. The

Earth fault protection can be provided with normal over current relays, if the minimum earth fault current is

sufficient in magnitude.

In this experiment, the MIB202 is micro-controller based Numerical Biased Differential Protection Relay within build Current

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Experiment No.: - 04 Objective: - To study the distance protection scheme for the transmission line with a numerical distance relay.

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The experimental results show that this method can effectively analyze the operation characteristics of power system

Distance Protection Impedance Relay: Distance Protection Impedance Relay - It has already been pointed out that the impedance is

Key learnings: Impedance Relay Definition: An impedance relay, also known as a distance relay, is defined as a

This paper introduces the concept of relay protection of hidden faults, its characteristics, and then analyzes the

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