Sensitivity Calculation of Relay Protection

Article Overview

The sensitivity of a relay is calculated as the ratio of the minimum fault current detectable by the relay to the rated current of the protected equipment, ensuring reliable operation under all fault conditions.

Understanding Relay Sensitivity

Relay sensitivity defines the minimum fault current or voltage that will cause the relay to operate. A highly sensitive relay can detect low-level faults, while a less sensitive relay may only respond to higher fault currents. Sensitivity is crucial for protecting equipment like transformers, feeders, and transmission lines without causing unnecessary trips during normal operation .

Steps to Calculate Relay Sensitivity

o Determine Maximum Load Current (ILmax) Calculate the maximum normal operating current of the protected equipment. This ensures the relay does not trip under normal load conditions .

o Calculate Minimum Fault Current (IFmin) Use fault analysis to determine the minimum short-circuit current that can occur at the relay location for different fault types (single line-to-ground, line-to-line, or three-phase faults). This can be done using symmetrical and asymmetrical fault calculations .

o Select Relay Pickup Setting (IPU) The pickup current is the minimum current at which the relay will operate. For overcurrent relays, it is often set as a multiple of the maximum load current: IPU = K x ILmax, where K is a safety factor (commonly 1.2-1.5) to avoid tripping during normal load fluctuations .

o Calculate Sensitivity Factor (S) The sensitivity factor is defined as: S = IFmin / IPU A sensitivity factor greater than 1 ensures the relay will operate for the minimum fault current. For transformer differential relays, the sensitivity is often expressed as a percentage of the rated current: Sensitivity (%) = (IFmin / Rated Current) x 100 .

o Verify CT and Relay Coordination Ensure that the current transformer (CT) ratio and burden do not limit the relay's ability to detect IFmin. Check that the CT does not saturate at maximum fault current and that the relay operates within its time-current characteristic .

o Adjust for Time-Delay and Backup Protection If the relay is part of a coordinated protection scheme, include time-dial settings and safety margins to ensure selectivity with upstream or downstream relays .

Practical Considerations

o For transformer differential protection, include inrush restraint and harmonic filtering to prevent false tripping.

o For distance or impedance relays, calculate the zone reach and impedance settings to cover the designated line segment without overreaching .

o Always verify the sensitivity under all operating conditions, including minimum fault currents, maximum

load currents, and potential CT saturation effects . By following these steps, engineers can ensure that the relay is sensitive enough to detect faults reliably while maintaining selectivity and avoiding unnecessary trips.

The scope of study involves calculating the settings for protective relays to achieve selectivity during faults ocurring in

Terminology in relay protection It"s not unusual to see graduates and engineers from other disciplines experience

The IIDG effect on the relay protection sensitivity was analysed and the relay protection sensitivity re-evaluation

The Inverse Time Over Current (TOC/IDMT) relay trip time calculator calculates the protection trip time

Among the various possible methods used to achieve correct relay co-ordination are those using either time or

Abstract--This paper describes several commonly applied line protection schemes, including distance schemes, directional

2.2 115/13.8KV Transformer LV Restircted Earth Fault Protection Relay Setting Circuit Ref : Aux.

The relay protection sensitivity evaluation was integrated into the proposed model and the particle swarm optimization

The document discusses relay setting principles for transmission line protection. It begins by outlining the four key characteristics of

The paper discusses the conditions for setting the overcurrent protection and how they determine the sensitivity and selectivity of

The overcurrent relay protection is the most commonly used against line to line faults in medium voltage power lines. The main

Sensitivity Sensitivity refers to the characteristic of the relay to act when the actual fault conditions occur. Sensitivity is usually

Transformer Protection Application Guide This guide focuses primarily on application of protective relays for the protection of power

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Traditionally, protective relays were electromechanical devices utilizing induction disk, coils, contacts, and solenoid elements to

Based on simple examples of the generator-transformer unit protection from symmetrical short circuits, it was shown that the

Relay 8 backs up relays 6 and 7, and should be co-ordinated with the slowest of these two relays. Relay 7 has an instantaneous

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