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Impact of Inverter-Based Resources with Dynamic Reactive Current Control on Protection Relay under Three-Phase to Ground Fault

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Abstract
In recent years, the introduction of Inverter-Based Resources (IBRs), such as solar and wind power generation, has progressed. Current power systems rely on Synchronous Generators (SGs) to maintain power system stability. As more IBRs are integrated, the number of conventional SGs decreases, potentially leading to instability in the power system. To expand the introduction of IBRs while maintaining power system stability, new control functions have been added to IBRs. One of these control functions is a dynamic reactive current control, which provides reactive current to maintain the voltage during system faults. However, conventional protection relays are designed based on the fault current of SGs. Therefore, it is necessary to clarify the impact of IBRs with dynamic reactive current control on protective relays.
This study investigates how the fault current of IBRs affect conventional protection relay, specifically distance relays, which are widely used in Japan. We measured the fault current of commercially available IBR with dynamic reactive current control function using a test system of CRIEPI's power system simulator. Based on the analysis of the measurement data, we confirmed that the impedance calculated by the distance relay changes when the IBR's pre-fault current output changes. This result indicates that IBRs with dynamic reactive current control may complicate the setting of distance relays.