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لم ترد بالأصل

Ain Shams University
Faculty of Engineering

Digital Relay Performance During Power Quality Disturbances

By

Mai Mohamed El Nady

B.Sc., In Electrical Power Engineering

A thesis Submitted for the Requirement of the Degree of Master of Science in Electrical Power Engineering

Supervised by

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Presented By

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Statement

This dissertation is submitted to Ain Shams University in partial fulfillment of the requirements for the degree of Master of Science in Electrical Engineering.

The work included in this thesis was carried out by the author in the department of Electrical Power and Machines, Ain Shams University.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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ABSTRACT

This thesis investigates the impact of power system disturbances on the performance of digital protective relays. The study relies on simulating the transients generated from the power system disturbances using Power Systems Computer-Aided Design software (PSCAD). The implementation of the digital relay algorithms and the evaluation study has been carried out using MATLAB. Four power system disturbances have been considered for this research: System frequency deviation, transformer energization, power factor capacitor bank switching and transmission line shunt capacitance switching. For each disturbance, the suitable power system configuration is selected. The operating conditions are adjusted in order to operate the protective relay under severe conditions close to its setting value. Four algorithms are used to perform the digital relay function; namely: Fourier full cycle, Fourier half cycle, approximate Walsh method and true root mean square algorithm.

For each considered case study, the power system disturbance is applied to the digital relay which is programmed using the four algorithms, one at a time. The relay response is estimated and then evaluated. A comparative study is accomplished to evaluate the reliability of different algorithms.

The study revealed that some of the disturbances have significant impact on digital relay performance leading to false

trip condition or at least START condition of relay algorithm, while, other disturbances have minor effect on the relay and are classified as non-fault conditions.
The results prove the significance of proper selection of digital relay algorithm to maintain the power system security.

Keywords: Digital protective relay, Power quality disturbance, System simulation, Overcurrent relay algorithm, Distance relay algorithm, PSCAD.