

DESIGN OF AN ADAPTIVE OVERCURRENT PROTECTION SYSTEM FOR MICROGRIDS

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Name of the supervisor: Prof. K T M U Hemapala

Signature of the supervisor:

Date

ABSTRACT

Microgrids have been popularized in the past decade due to their ability to add distributed generation into the classic distribution systems. Protection problems are among several other problems that need solutions in order to extract the full capability of these novel networks. This research follows the branches of two major solutions, namely Adaptive protection, and Protection Optimization.

Adaptive protection implementation with a novel concept of clustering is studied and protection setting optimization is done using a novel hybrid nature-inspired algorithm. Two test system models are used to test the performance of the proposing method as final outcome being the operating time of relays due to different faults.

The selected algorithm proven to be effective than most other algorithms and the clustering approach for adaptive protection was able to reduce the number of adaptive groups.

Keywords— Adaptive Protection, Microgrid Protection, Protection Optimization, Directional Overcurrent Protection, Nature Inspired Optimization Algorithm, k-means Clustering

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LIST OF ABBREVIATIONS

CT	Current Transformer
CTI	Coordination Time Interval
DER	Distributed Energy Resources
DFIG	Doubly-Fed Induction Generators
DG	Distributed Generation
DOCR	Directional Overcurrent Relays
ECDG	Electronically Coupled Distributed Generation
ESS	Energy Storage Systems
IIDG	Inverter Interfaced Distributed Generation
VSC	Voltage Source Converter
LOG	Loss of Grid
LOM	Loss of Mains
MINLP	Mixed-Integer Non-Linear Programming
NIA	Nature-Inspired Algorithms
PCC	Point of Common Coupling
PS	Pickup Setting
SG	Synchronous Generator
SSC	Symmetrical Short Circuit
TDS	Time Dial Setting
WCMFO	Water Cycle - Moth Flame Optimization