Cairo University

SMART POWER GRID OPTIMAL DESIGN, ANALYSIS AND CONTROL INCLUDING DISPERSED RENEWABLE ENERGY GENERATION

By

Eng. Amal Abdel-Aal Hassan Mohamed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfilment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY
in
ELECTRICAL POWER & MACHINES ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis: Smart Power Grid Optimal Design, Analysis and Control Including Dispersed Renewable Energy Generation

Key Words: Distributed Renewable Energy Generation; Smart Grid; Multi-Objective Genetic Algorithm; Voltage Stability; PV and Wind Systems Control.

Summary:

This thesis presents an optimal design of a smart power grid based on distributed renewable energy generation, especially photovoltaic (PV) and wind turbines (WT). This includes optimal allocation and sizing to minimize the total power losses, minimize the total investment cost and improve the voltage stability. This thesis also proposes an advanced smart control for PV and WT systems aiming to track the maximum power, to control active and reactive power in order to deliver high power quality. Finally, dynamic modeling and simulation is presented to monitor the proposed systems and its mutual interactions to the tested power network.

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DEDICATION

This Thesis Is Dedicated To:

The Soul of My Beloved Father

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