AN EFFICIENT PV-GRID CONNECTED SYSTEM

By

Ammar Samir Abdul Qader Morsy

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
In
Electrical Power and Machines Engineering

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Under the Supervision of

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Title of Thesis:

AN EFFICIENT PV-GRID CONNECTED SYSTEM

Key Words:
Distributed Generation System; Genetic Algorithm; Photovoltaic; space vector modulation; Voltage source converter.

Summary:

In this work, a complete model for the integration between the Photovoltaic Distributed Generation System (PV-DGS) and the utility grid is simulated by MATLAB / SIMULINK. The aims of this study are to provide active power of a given feeder and to improve the output power quality from the PV-DGS unit. The voltage source converter is controlled to allow the system to operate in different modes. These modes are the unity output power factor and the reactive power compensation. Different control techniques are applied including the conventional PI controller as well as the intelligent optimization tuning.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Ammar Samir Abdul Qader Morsy   Date: 18/9/2018

Signature:

Dedication

I would like to dedicate this thesis to my parents, my uncle "Saleem", my sister, and my little brother for their endless love, support, and encouragement.

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Nomenclature

(A) - List of symbols;

D	Duty cycle of the boost converter
dq0	Park Representation Frame
J_{SC}	Short Circuit Current Density
J_{Ph}	Photo-Generation Current Density
J_{gen}	Thermal-Generation Current Density
J_{rec}	Recombination Current Density
J_0	Diode Saturation Current Density
J	Net Current Density
K_b	Boltzmann constant [1.38065*10^{-23} J/K]
q	Charge of electron [1.60217*10^{-19} coulombs (C)]
T_s	Sampling Period of the given circular locus.
U_0	Zero Sequence Components
V_{OC}	Open Circuit Voltage
αβ0	Clarke Representation Frame
δ_A	Initial Shift of the voltage

(B) - List of abbreviations;

ANFIS	Adaptive Neuro Fuzzy Inference System
ANN	Artificial Neural Network
GA	Genetic-Algorithm Optimization Technique
IAE	Integral of Absolute Error
ISE	Integral of Square Error
ITAE	Integral of Time Multiplied by Absolute Error
ITSE	Integral of Time Multiplied by Square Error
MOSFET	Metal Oxide Semiconductor Field Effect Transistor.
MPP	Photovoltaic Maximum Power operating point
MPPT	Maximum Power Point Tracking
MSE	Mean of the Square Error
PCC	Point of Common Coupling
PI	Proportional-Integral action "Controller"

P&O	Perturb and Observe Algorithm
PV-DGS	Photovoltaic Distributed Generation System
PWM	Pulse Width Modulation
STATCOM	Static Synchronous Compensator
STC	Standard Test Condition
SVM	Space Vector Modulation Technique
THD	Total Harmonic Distortion
VSC	Voltage Source Converter
ZN	Ziegler–Nichols Tuning Method