Z-SOURCE INVERTER (ZSI) BASED RECONFIGURABLE ARCHITECTURE FOR SOLAR PHOTO-VOLTAIC (PV) MICROGRID

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Degree of Master of Science

Department of Electrical Engineering

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DECLARATION

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ABSTRACT

The principal aim of this research is to identify and use the advantages of Z-source inverter and to develop a reconfigurable architecture for residential microgrid. The researcher has described the summary of the studies on Z-source inverter and reconfigurable systems. The distinctive feature of the proposed, reconfigurable, residential microgrid is the capability to reconfigure microgrid components to operate as a current source (current controlling mode) and a voltage source (voltage-frequency controlling mode) and a static synchronous compensator (STATCOM) (reactive power controlling mode) while replacing the traditional solar inverter from latest Z-source inverter. Where grid-connected, solar photovoltaic customers get uninterrupted power supply from their solar system even at a grid fault, and utility grids can use the same assets to improve the power quality and use their distribution network when it is idle at night. Then, it improves the utilization factor of solar photovoltaic system, power quality at the point of common coupling, and reliable power supply to the loads while increasing controllability of residential microgrid and taking part grid operations with utility grid request. Both the customer and the grid owner could get benefits. The proposed architecture is developed in MATLAB/Simulink platform and results are discussed to prove the proposed architecture.

Index Terms—*Reconfigurable architecture; Solar photovoltaic; Microgrids; Z-source inverte*r, STATCOM, *Power quality*, *Battery storage system*

ACKNOWLEDGMENTS

Foremost, I am deeply indebted to my supervisor Professor K.T.M.U. Hemapala and co-supervisor Dr. W.D. Prasad of the Department of Electrical Engineering, University of Moratuwa for their constant guidance, encouragement and support from the beginning to the end. It is my pleasure to acknowledge all the other academic staff members of the Department of Electrical Engineering of the University of Moratuwa for their valuable suggestions, comments and assistance which were beneficial to achieve the project objectives. I am grateful to the Department of Science and Technology (DST), Government of India and Ministry of Science, Technology and Research (MSTR), Government of Sri Lanka for the financial grants under Indo-Sri Lanka Joint Research program Grant (MSTR/TR/AGR/3/02/13) scheme and the Faculty of Graduate Studies for the given administrative support to conduct the research. I specially thank to our research team in university of Moratuwa Eng. Gayashan, Eng. Ranaweera, Eng. Lemasha, Eng. Bhagya, Eng. Sisitha, Eng. Malith, Eng. Kaushali, Eng. Yomal and all motivating and helping me to completer this successfully. I thank to the technical officers and other support staff for the assistance they have given to perform laboratory experiments. Moreover, I would like to extend my gratitude to my family for their encouragement, understanding and patience throughout my academic pursuit. Finally, I am grateful to my colleagues and friends for showing interest in my work and giving constructive ideas towards the success of the research.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AR	Array Reconfiguration
BESS	Battery Energy Storage System
BL	Bridge-Linked
CSI	Current Source Inverters
DG	Distributed Generations
DN	Distribution Network
DOD	Depth of Discharge
DSO	Distribution System Operators
EV	Electrical Vehicle
FACTS	Flexible AC Transmission System
GWO	Grey Wolf Optimization
HC	Hill Climbing
INC	Incremental Conductance
LTC	Load Tap Changers
LV	Low Voltage
LVR	Line Voltage Regulators
MAS	Multi-agent system
MCBC	Maximum constant boost control
MG	Microgrid
MPP	Maximum Power Point
MPPT	Maximum Power Point Tracker
MSVMBC	Modified space vector modulation boost
MV	Medium Voltage
P&O	Perturb and Observe
PCC	Point of Common Coupling
PSO	Partial Swarm Optimization
PWM	Pulse Width Modulation
qZSSRC	Quasi-Z-Source Series Resonant DC/DC Converter
RMS	Root Mean Square
RSC	Reconfigurable Solar Converter
SPV	Solar Photovoltaic

Abbreviation	**Description**
SB	State Based
SBC	Simple boost control
SCC	Short Circuit Current
SIDO	Single-Input Dual-Output
SPWM	Sine PWM
SP	Series-Parallel
ST	Shoot-Through
STATCOM	Static Synchronous Compensator
STC	Standard Test Condition
SVPWM	Space-vector PWM
TCT	Total Cross-Tied
TDD	Total Demand Distortion
THD	Total Harmonic Distortion
TSI	Two-Stage Inverter
UC	Ultra-Capacitor
UOF	Under/Over Frequency
UOV	Under/Over Voltage
VDR	Voltage-Doubler Rectifier
VFOC	Virtual Flux-Oriented Control
VOC	Voltage-Oriented Control
VSI	Voltage Source Inverter
ZSI	Z-Source Inverter
MBC	Maximum boost control

LIST OF APPENDICES