CONFIGURING A POWER SYSTEM STABILIZER FOR IMPROVED DYNEMIC PERFORMANCE A CASE STUDY FOR LAKVIJAYA POWER STATION

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Degree of Master of Science

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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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Dr. W. D Prasad

ABSTRACT

The concept of Power System Stabilizer (PSS) is widely accepted worldwide as a supplementary excitation control method to improve the dynamic performance of power systems. This work presents the implementation of a PSS by proposing a robust tuning procedure for the inbuilt PSS functions in UNITROL 5000 excitation controllers, focusing on the ST1A type static excitation system. Additionally, this research serves as a case study for the Sri Lankan power system centered around the Lakvijaya Power Station in Sri Lanka, which is the largest coal power plant in the country. The proposed tuning procedure demonstrates how the conventional Frequency Response-Based Method and a Model Based Method incorporated with an optimization technique, can be used in a cascaded format to significantly enhance the dynamic response of the power system. The optimization technique has been completely automated on the Python coding platform, which employs an Eigenvalues-based approach to optimize in the presence of comprehensive dynamic data of the Sri Lankan power system up to the 33kV voltage level.

Keywords: *Power System Stabilizer, Simulated Annealing, Frequency Response Based Method, UNITROL 5000, Python*

DEDICATION

I dedicate my M.Sc. research dissertation to my beloved parents and my wife for their support given through thick and thin.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

Abbreviation	Description
PSS	Power System Stabilizer
AVR	Automatic Voltage Regulator
LVPS	Lakvijaya Power Station
CEB	Ceylon Electricity Board
RTF	Ramp Tracking Filter
IEEE	Institute of Electrical and Electronics Engineers
WECC	Western Electricity Coordination Council
MOR	Model Order Reduction
BT	Balanced Truncation
GA	Genetic Algorithm
PSO	Particle Swarm Optimization
SA	Simulated Annealing
FACTS	Flexible AC Transmission System
HVDC	High Voltage Direct Current
UFLS	Under Frequency Load Shedding
API	Application Programming Interface
GUI	Graphical User Interface
OPC	Over-Speed Protection Control
FCB	Fast Cut Back
TGR	Transient Gain Reduction