UNIFIED POWER FLOW CONTROLLER AS POWER SYSTEM STABILIZER

A dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfilment of the requirements for the
degree of Master of Science

by

WARUSAPPERUMA KANKANAMALAGE MAHESH
PRASANNA WARUSAPPERUMA

Supervised by: Prof. J.R.Lucas
Dr. P.S.N. De Silva

Department of Electrical Engineering
University of Moratuwa, Sri Lanka

January 2009

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

.....

W.K.M.P. Warusapperuma

Date: 30th January 2009

We/I endorse the declaration by the candidate.

UOM Verified Signature

.....

Prof. J.R.Lucas

UOM Verified Signature

.....

Dr. P.S.N. De Silva

Table of Contents

Abstract

The FACTS device - Unified Power Flow Controller (UPFC) and its performance is studied under transient condition in the usage as a power system stabilizer. This device creates an impact on power system stability with its unique capability to control real and reactive power flows simultaneously on a transmission line and regulate voltage at the bus connected. These features become significant as the UPFC can allow loading of the transmission lines up to their thermal limits by regulating the power flow through desired paths. This gives the power system operators the desired flexibility in satisfying the deregulated power system imposed requirements.

The new technology associated with the UPFC and its structure is studied. The theoretical analysis is done in verifying its capability for stability enhancement. A practical system is modelled to verify the theoretical analysis in MATLAB/SIMULINK platform.

Theoretical and practical verification reveals the function of UPFC in power system stabilisation. The parameters associated with the UPFC are studied for optimum stability criterion.

Acknowledgement

Thanks are due first to my supervisors, Professor J.R.Lucas and Dr. P.S.N.De Silva for their great insights, perspectives, guidance and sense of humour. My sincere thanks go to the officers in Post Graduate Office, faculty of Engineering, University of Moratuwa, Sri Lanka for helping in numerous ways to clarify the things related to my academic works in time with excellent cooperation and guidance. Sincere gratitude is also extended to the people who serve in the office of Department of Electrical Engineering.

I would also like to extend my sincere gratitude to M/s Maga Engineering (Pte) Ltd. for sponsoring me for the first year work of my MSc course and providing required duty leave.

Lastly, I should thank my parents, many individuals, friends and colleagues who have not been mentioned here personally in making this educational process a success. May be I could not have made it without your support.

List of Figures

List of Tables

Table **Page**