CERTIFICATE

It is certified that the project entitled "**LOAD FLOW STUDY OF POWER SYSTEM with UNIFIED POWER FLOW CONTROLLER**" being submitted by **Pramod kumar Rajora,** M.Tech in Power System and Apparatus, **Delhi College Of Engineering, Delhi University,** is a record of original bonafide work carried out by him under my guidance and supervision. The results in this project have not been submitted to any other university or institute.

I wish him success in all his Endeavour's **.**

Dr. NARENDRA KUMAR

Professor & Head of

Dept. of Electrical Engineering

Delhi College of Engineering

ACKNOWLEDGEMENT

It gives me immense pleasure in expressing my deep sense of gratitude and thankfulness to Dr. Narendra Kumar (Professor & Head of Electrical Engineering Department) for his invaluable guidance, continual encouragement and support at every stage of this work project.

I would also like to express my sincere thanks to Mr. Ram Bhagat , Mr. J. N. Rai and other faculty members of Electrical Engineering Department, Delhi College of Engineering**,** Delhi University. Finally I acknowledge my deep gratitude to my loving family & my friends, who always gave moral support and continuously encourage my academic endeavor.

Pramod Kumar Rajora

(University Roll No.-14023)

M.E. (Power System and Apparatus)

Delhi College of Engineering

Delhi University

LIST OF SYMBOLS

P_P	-	real power component for any bus p
Q_P	-	reactive power component for any bus p
Y	-	bus admittance matrix
J	-	jacobian matrix
e_P	-	real part of voltage at any bus p
f_P	-	imaginary part of voltage at any bus p
δ	-	load angle
PEx	-	power exchange
V_{sp}	-	specified voltage
R	-	transmission line resistance
X	-	transmission line reactance
G	-	transmission line conductance
B	-	transmission line susceptance
V_M	-	nodal voltage magnitude
V_A	-	nodal voltage phase angle
$Q_{\max}$	-	generator reactive power upper limit
$Q_{\min}$	-	generator reactive power lower limit
P_{GEN}	-	scheduled active power contributed by the generator
Q_{GEN}	-	scheduled reactive power contributed by the generator
P_{LOAD}	-	scheduled active power consumed at the bus
Q_{LOAD}	-	scheduled reactive power consumed at the bus

Abstract

of

LOAD FLOW STUDY OF POWER SYSTEM WITH UNIFIED POWER FLOW CONTROLLER

by

Pramod Kumar Rajora

The demand of the electrical energy is ever increasing and it is desired to use the existing transmission network to its thermal stability limits. The transmission capacity can be increased by the compensation at appropriate locations and it is a large interconnected network that requires a careful design to maintain the system with continuous power flow operation without any limitations. Flexible Alternating Current Transmission System (FACTS) is an application of a power electronics device to control the power flow and to improve the system stability of a power system. Unified Power Flow Controller (UPFC) is a versatile device in the FACTS family of controllers which has the ability to simultaneously control all the transmission parameters of power systems i.e. voltage, impedance and phase angle which determines the power flow of a transmission line.

This project proposes a case study to control the power flow of a power system with UPFC. In this study, I am considering a standard 5-bus network and IEEE-30 bus network, for the analysis. Power flow equations are solved using Newton Raphson's algorithm and the simulations of the algorithm are done in MATLAB 7.6.0. The results of the network with and without UPFC are compared in terms of active and reactive power flow in the transmission line at the bus to analyze the performance of UPFC.

Software used MAT LAB 7.6.0

CONTENTS

LOAD FLOW STUDY OF POWER SYSTEM WITH UNIFIED POWER FLOW CONTROLLER

A DISSERTATION SUBMITTED TO THE UNIVERSITY OF DELHI FOR THE AWARD OF DEGREE OF

MASTER OF ENGINEERING

IN

(POWER APPARATUS & SYSTEM)

Submitted by

PRAMOD KUMAR RAJORA

(University Roll No. 14023)

Under the supervision of

DR. NARENDRA KUMAR

(Prof. & Head of Department of ELECTRICAL ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

DELHI COLLEGE OF ENGINEERING

BAWANA ROAD, DELHI-110042

2009 – 2012