OPTIMAL POWER FLOW (OPF) FOR UNIFIED POWER FLOW CONTROLLER (UPFC) IN FLEXIBLE AC TRANSMISSION SYSTEM (FACTS) USING EVOLUTIONARY PROGRAMMING

This project report is presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Honors.)
UNIVERSITI TEKNOLOGI MARA

AMZAR B ZUBIR

B. ENG (Honors.) ELECTRICAL
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR DARUL EHSAN
MALAYSIA

NOVEMBER 2005

ACKNOLEDGEMENT

In the name of ALLAH S.W.T, The most Beneficent, The most Merciful. It is with the deepest sense of the Al-Mighty Allah that gives me the strength and ability to complete this project. All good aspirations, devotions and prayers are due to ALLAH whose blessing and guidance have helped me throughout the entire project.

I would like to acknowledge and express my sincere gratitude towards my supervisor P.M Dr. Titik Khawa Abdul Rahman for her concern, valuable time of consultation and advice, guidance and patience in supervising my project from the beginning until the completion of this project thesis.

My heartiest goes to Cik Rafidah for her dedication in advice and willingly gives her ideas and suggestions for completing my project especially in how to use MATLAB software.

Last but not least, my special thanks to all my friends, i

for the valuable help and motivation given in completing this project. Most of all to my beloved family, especially my mother and my father who are dearest person in my life and greatest source of inspiration, thank you for the endless love and encouragement they have given and for being so understanding.

ABSTRACT

This project report presents an application of Evolutionary Programming (EP) for solving Optimal Power Flow (OPF) problem by means of series compensation scheme of Flexible AC Transmission Systems (FACTS) in a power system. The main idea is to identify the series capacitors value so that the total losses in the system are minimized and the voltage profile is maintained at the acceptable level. The proposed method has been tested on the IEEE 30 bus Reliability Test systems. The results shows that the proposed technique has able to identify the suitable values of the series capacitor that minimize the total losses in the system while maintaining the voltage level at the suitable value.

Keyword:

Evolutionary Programming (EP), Optimal Power flow (OPF), Flexible AC Transmission System (FACTS), Unified Power Flow Controller (UPFC)

TABLE OF CONTENTS

CHAPTER DESCRIPTION	PAGE
DECLARATION	i
ACKNOWLEDGEMENT	ii
ABSTRACT	iii
TABLE OF CONTENTS	iv
LIST OF FIGURE	viii
LIST OF TABLES	ix
SYMBOLS AND ABBREVIATIONS	x
CHAPTER 1	
INTRODUCTION	
1.1 Background	1
1.2 Aim of the Project	2
1.3 Organization of the Thesis	2
CHAPTER 2	
POWER FLOW ANALYSIS	
2.1.1 Introduction	4
2.2 Power Flow Solution	4
2.2.1 Slack Bus	5
2.2.2 Load Buses	5
2.2.3 Generator Buses	5
2.3 Power Flow Program	5
2.3.1 Lfybus	6
2.3.2 Busout	6
2.3.3 Lineflow	6
2.3.4 Lfnewton	6
2.4 Newton Raphson Method	6

2.5 Data Preparation 10
2.5.1 Bus Data File-Bus Data 10
2.5.2 Line Data File-Line Data 11

CHAPTER 3 13
FLEXIBLE AC TRANSMISSION SYSTEM (FACTS) 13
3.1 Introduction 13
3.2 Unified Power Flow Controller (UPFC) 14
3.3 Review of Series compensator 14
3.3.1 Types of Reactive Power Compensation 16
3.3.1.1 Parallel/Shunt Compensation 16
3.3.1.2 Series Compensation 17
3.3.2 Series Compensation of Transmission System 18
3.3.3 Modeling of Series Compensator 18

CHAPTER 4 20
METHODOLOGY 20
MATLAB PROGRAMMING 20
4.1 Introduction 20
4.2 The Matlab System 20
4.2.1 Development Environment Library. 20
4.2.2 The MATLAB Mathematical Function 22
4.2.3 The MATLAB Language. 23
4.2.4 Handle Graphics. 23
4.2.5 The MATLAB Application Program Interface (API). 23
4.3 Flow Control 24
4.3.1 if statement 24
4.3.2 switch and case 24
4.3.3 for 24
4.3.4 while 25