

**LOSS MINIMIZATION WITH SVC INSTALLATION USING THE
FIREFLY ALGORITHM METHOD**

Project report is presented in partial fulfillment for the award of the
Bachelor of Engineering (Hons) Electrical
Universiti Teknologi MARA (UiTM)



SYAZANA BINTI ABDUL HALIM
Faculty of Electrical Engineering
Universiti Teknologi MARA
40450 Shah Alam, Selangor, Malaysia

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim. In the name of Allah, The Most Gracious, The Most Merciful. Praised be to Prophet Muhammad S.A.W, his companions and those who are on the path as what he preached upon. My everlasting thanks to Allah for granting me patience and hope to complete my final year project and my thesis this semester.

My utmost appreciation and gratefulness to my Project Supervisor, Assoc. Prof. Dr. Ismail bin Musirin for the untiring efforts in providing guidance, encouragement and invaluable advices has helped me tremendously in completing this project. Not to forget, to my other lecturers who has helped me a lot in understanding and completing this project.

I would like to express my sincere appreciation and gratitude to my parents, Abdul Halim b. A. Karim and and all my family members for their continuous “doa” and encouragement in making sure that I will stay strong and I will go through this big challenge to complete this project with patience.

My special thanks and deepest appreciation to all my friends who are always by my side through my ups and downs in struggling to complete this project. Their kind help, positive words and moral supports will always be remembered and appreciated. May Allah grant them with happiness in life and be blessed forever.

Thank you.

ABSTRACT

The problem of losses in power transmission lines these days has been one of the popular topics in the power system field. This problem needs to be overcome due to the increasing of power demands nowadays. This problem may lead to voltage instability. Highly loaded increases may lead to voltage instability. The voltage collapse minimizes the voltage magnitudes on which cause the system to be unable to distribute enough power according to the demands. Due to this phenomenon, losses in power generation especially highly loaded lines are very concerned.

This thesis presents the Firefly Algorithm (FA) Method in minimizing loss in the transmission lines in power systems. This algorithm method is idealized by some of the characteristics of fireflies. The improvement of the voltage stability will be proved by determining the best size of Static Var Compensator (SVC) to be injected through the bus system. This study will involve MATLAB programming simulation to solve the analytical mathematic modeling showing the method proposed in this paper. A 30-bus IEEE Reliability Test System (RTS) is utilized as the test specimen. Results obtained from the experiment indicated that the proposed FA to optimize the sizing and location for SVC installation managed to minimize the loss.

TABLE OF CONTENTS

CHAPTER	DESCRIPTION	PAGE
	Declaration	i
	Acknowledgement	ii
	Abstract	iii
	Table of Contents	iv
	List of Figures	vii
	List of Tables	viii
1	INTRODUCTION	
	1.1 Overview	1
	1.2 Problem Statement	2
	1.3 Objectives of the Study	2
	1.4 Scope of Work	3
	1.5 Outline of the Thesis	3
2	LITERATURE REVIEW	5
	2.1 Introduction	5
	2.2 Loss Minimization in Power System	
	2.2.1 Loss in Power System	5
	2.2.2 Loss Minimization	5
	2.2.3 Voltage Stability	6
	2.3 FACTS Devices	
	2.3.1 Static Var Compensator (SVC)	7
	2.3.2 STATCOM	7
	2.3.3 Thyristor Controlled Series Compensator (TCSC)	8
	2.4 Modern Heuristic Optimization Techniques	
	2.4.1 Particle Swarm Optimization Techniques (PSO)	9
	2.4.2 Ant Colony Search Algorithm (ACS)	10

CHAPTER 1

INTRODUCTION

1.1 Overview

The problem of high losses in power transmission lines nowadays has been one of the popular topics in the power system field. This problem needs to be overcome due to the increase of power demands nowadays. This problem may lead to voltage instability. This thesis is focusing on improving the power transmission losses with the installation of a Static VAR Compensator (SVC), one of the Flexible AC Transmission Systems (FACTS) devices.

It is important to minimize the losses at the same time stabilizing the voltage. There are a few methods implemented by past many researches on how to minimize the losses. This thesis introduces one of the new methods in optimization, termed as Firefly Algorithm. This method is invented by a Senior Research Scientist, Xin-She Yang [1]. This algorithm is used to determine the optimal sizes of SVC to be installed in order to minimize the transmission loss in power system.

This method is tested on the 30-Bus IEEE Reliability Test System (RTS) on Bus No. 26. Bus No. 26 is chosen since it is the weakest bus in the system [2]. Hence, the total transmission loss before the installation of SVC at bus 26 will be