

# **OPTIMAL SIZING OF TCSC USING ANT COLONY OPTIMIZATION (ACO) TECHNIQUE FOR LOSS MINIMIZATION**

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## ABSTRACT

Power transmission loss of grid can be improved by upgrading or adding of new transmission circuit. TCSC offer a strong alternative for optimizing the transmission over power link, existing as well as new, by means intended for the control of power flow, improvement of stability, voltage profile management, power factor correction, and power losses.

This thesis presents optimal sizing of Thyristor Controlled Series Capacitor (TCSC) using Ant Colony Optimization (ACO) technique for loss minimization in power system.

The study involved the development of optimization engine to implement the TCSC installation. So that cost can be minimized. TCSCs are the control variables in this scheme. Prior to optimizing the TCSCs, size, tests were conducted on the IEEE 57-bus reliability test system, producing promising result.

Keywords: - Thyristor Controlled Series Capacitor (TCSC), Ant Colony Optimization (ACO), 57-bus system.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background Study

In recent years, with the deregulation of the electricity market, the traditional concepts and practices of power systems have changed. Better utilization of the existing power system to increase power transfer capability by installing FACTs (Flexible AC Transmission Systems) devices becomes imperative [1]. The problem of voltage collapse in power system is now becoming one of the most important predicaments to resolve, as several major blackouts throughout the world have been directly associated to this phenomenon [3].

TCSC is a type of the FACTs devices. Other devices of FACTs devices are TCPST (Thyristor Controlled Phase Shifting Transformer), UPFC (Unified Power Flow Controller) and SVC (Static Var Compensator). The parameter and variable of the transmission line, for example line impedance, terminal voltage, and voltage angles can be controlled by FACTs devices in a fast effective way. The benefit brought about by FACTs includes improvement of system dynamic behavior and thus enhancement in system reliability [3]. However, their main function is to control power flow provided that they are placed at optimal location. FACTs devices are capability of increasing the loadability.

TCSC can be used to improve stability limits and increase transfer capabilities in power system network. The transmitted power through a line is inversely proportional to the transfer impedance. For example, considering other parameters constants, 50 % series compensation approximately doubles the steady-state transmitted power, whereas 75 % series compensation would increase the transferred power to about four times the original value [1].

In this study, TCSC is used to minimize loss in power system which required optimization process. Thus, Ant Colony Optimization (ACO) is proposed to as the