MIDPOINT SITING OF THYRISTOR-CONTROLLED SERIES COMPENSATOR ON A TRANSMISSION LINE FOR AVAILABLE TRANSFER CAPABILITY IMPROVEMENT

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ABSTRACT

This thesis presents the thyristor-controlled series compensator (TCSC) located at the midpoint siting of transmission line in order to improve the available transfer capability (ATC) for the particular transfer case. By locating the TCSC at the midpoint of transmission line, this will halved the reactance of transmission line. Hence, optimum value of ATC can be improved by varying the value of transmission reactance. The TCSC is defined as capacitive reactance bank, which consists of thyristor-controlled reactor (TCR), which is paralleled with fixed capacitor. The value of the reactance is varied in which it is the way to improve the ATC.

The objective of this thesis is to compare the ATCs with and without considering the TCSC. This thesis shows that the implementation of TCSC that varies the value of transmission line reactance hence improving the ATC. The effectiveness of TCSC in improving the ATC was verified on the IEEE 9-bus Reliability Test System (RTS) and the ATC results are presented.

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CHAPTER 1

INTRODUCTION

1.1 Background

The 20th century has seen the age of electronics and computers, centered on electrical technology. Thus, there will be an increasing use of electrical engineering technology. Due to that, the demand on the electricity is increasing day by day. An electrical power system can be seen as an interconnection of generating sources and customer loads through a network of transmission lines, transformers, and ancillary equipment. Its structure has many variations that are resulted economic, political, engineering, and environmental decisions. Based on their structure, power systems can be broadly classified into meshed and longitudinal systems. Meshed systems can be found in regions with a high population density and where it is possible to build power stations close to load demand centers. Longitudinal systems are found in regions where large amounts of power have to be transmitted over long distances from power stations to load demand centers.

The power flows throughout the network are distributed as a function of transmission line impedance whereby a transmission line with low impedance enables larger power flows through it than a transmission line with high impedance. Hence, a flexible AC transmission system (FACTS) device is required to vary the impedance of transmission line so that the power transfer can be fully optimized.

FACTS device is defined by the IEEE as a power electronic based system and other static equipment that provide control of one or more ac transmission system parameters to enhance controllability and increase power transfer capability [1]. FACTS device is one of an effective device that used to control and increase the power transfer capability from sending bus to receiving bus. Recently, there are many types of FACTS device that have been developed such as thyristor-controlled series compensator (TCSC), static var capacitor (SVC), unified power flow compensator (UPFC). The FACTS devices are also used to minimize the transmission losses. This FACTS device can be located at any point of the transmission line for ATC