ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Optimal Allocation of TCSC Devices to Optimize Total Transmission Capacity using Genetic Algorithm

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Abstract
Improving of Available Transfer Capability (ATC) is an important issue in the current de-regulated environment of power systems. The Available Transfer Capability (ATC) of a transmission network is the unutilized transfer capabilities of a transmission network for the transfer of power for further commercial activity, over and above already committed usage. Power transactions between a specific seller bus/area and a buyer bus/area can be committed only when sufficient ATC is available. Transmission system operators (TSOs) are encouraged to use the existing facilities more effectively to enhance the ATC margin. ATC can be limited usually by heavily loaded circuits and buses with relatively low voltages. It is well known that FACTS technology can control voltage magnitude, phase angle and circuit reactance. Using these devices may redistribute the load flow, regulating bus voltages.

Therefore, it is worthwhile to investigate the impact of FACTS controllers on the ATC. In this thesis focuses on the evaluation of the impact of TCSC as FACTS device on ATC and its enhancement during with and without line outage cases. In a competitive (deregulated) power market, optimal the location of these devices and their control can significantly affect the operation of the system and will be very important for ISO. Genetic Algorithm is used as the optimization tool to determine the location as well as the parameters of TCSC simultaneously.

In this thesis, the use of TCSC to maximize Available Transfer Capability (ATC) generally defined as the maximum power transfer transaction between a specific power-seller and a power-buyer in a network during normal and contingency cases.

Keywords-Active: FACTS, TCSC, ATC, GA

I .INTRODUCTION

The aim of electric industry restructuring is to promote competitive markets for electric power trading. Under new environment, the main consequence of the nondiscriminatory open-access requirement is the substantial increase in power transfers. The Available Transfer Capability (ATC) of a transmission network is the unutilized transfer capabilities of a transmission network for the transfer of power for further commercial activity, over and above already committed usage. Adequate available transfer capacity (AATC) is needed to ensure all economic transactions, while sufficient ATC is needed to facilitate electricity market liquidity. It is necessary to maintain economical and secure operation over a wide range of system operating conditions and constraints. However, tight restrictions in the construction of new facilities due to the economic, environmental, and social problems, reduces the operational alternatives. It may sometimes lead to a situation that the existing transmission facilities are intensively used. Maximum use of existing transmission assets will be more profitable for transmission system owners; and customers will receive better services with reduced prices. Various ATC boosting approaches have been experienced via adjusting generators' terminal

Cite this article as: D. Roop Chand & Mr B. Anand Swaroop, "Road Accident Investigation in Highway", International Journal & Magazine of Engineering, Technology, Management and Research, Volume 6 Issue 11, 2019, Page 10-18.