Chapter 5
Flexible AC Transmission Systems (FACTS) Controller in Power Transmission

ABSTRACT

Secure and reliable operation of the power system is a critical issue for large, complicated, and interconnected power system networks. Security constraints such as thermal limits of transmission lines and bus voltage limits must be satisfied under any operating point in order to deliver reliable power to the consumers. One of the best alternative solutions of improvement of the security of power system is the use of flexible AC transmission systems (FACTS) devices. FACTS devices can be used to limit the power flow on the overloaded line and to increase the use of alternative paths to improve power transmission capacity. This chapter briefly describes all three categories of FACTS devices, namely shunt controllers (static synchronous compensator, static var compensator, thyristor-controlled reactor, thyristor switched reactor, thyristor switched capacitor), series controllers (static synchronous series compensator, thyristor controlled series capacitor, thyristor-controlled series reactor), and combined series-shunt controllers (unified power flow controller).

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INTRODUCTION

The Flexible AC transmission system provides voltage support at critical buses in the system and regulates power flow in critical lines. It is defined as a power electronic based system and other static equipment that provide control of one or more AC transmission system parameter. The objective of power system operation is the electric power supply from supply end to load end stably and most economically, so that the frequency and voltage at any point of the network which remain constant while the voltage waveform at any bus is free from harmonics and the phases are balanced. However, in order to achieve optimum performance of the power system it is required to control the reactive power flow in the network and is possible by applying reactive power management at the different nodes in the power systems. The reactive power of load is to achieve its optimum performance is called load compensation while the reactive power compensation of the transmission network is called line compensation. The rapid growth of electrical energy consumption with demand for cost-effective energy has led to the development of generation. Modern power systems are designed to operate efficiently to supply power on demand to various load centres with high reliability. The generating stations are located at distant locations for economic and safety reasons. There is ac system interconnection the security can be adversely affected as the disturbances are initiated in a particular area and propagate over the entire system resulting in major blackouts caused by cascading outages. The purpose of the transmission network is to pool up the power plants and load centres in order to minimize the total power generation capacity and fuel cost. A power delivery system made up of radial lines from individual. Generators which are local without being part of a grid system, many more generation resources are needed to serve the load with the same reliability, and the cost of electricity would be too much higher. Transmission is often an alternative to a new generation resource. If transmission capability is less it means that more generation resources would be required inspite of taking into account of whether the system is made up of large or small power plants. The cost of transmission lines and losses, as well as difficulties in building new transmission lines, would often limit the available transmission capacity. The power systems of today and large, are controlled mechanically. There is a widespread use of microelectronics, computers and high-speed communications for control and protection of transmission systems; however,