

Abstract

Voltage instability has been a major concern in power systems, especially in planning and operation, as there have been several major power interruptions associated with this phenomenon, in the recent past. Voltage instability due to the lack of the ability to foresee the impact of contingencies is one of the main reasons for the worst North American power interruptions on August 14th, 2003. Hence, electric power utilities around the world have been devoting a great deal of efforts in voltage stability assessment and margin enhancement.

Major contributory factors to voltage instability are power system configuration, generation pattern and load pattern. Power system network can be modified to alleviate voltage instability by adding reactive power sources i.e. shunt capacitors and/or Flexible AC Transmission System (FACTS) devices at the appropriate locations. There are various types of FACTS devices, namely Static Var Compensator (SVC), Static Synchronous Compensator (STATCOM), Thyristor-Controlled Series Capacitor (TCSC), Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC). Each of these FACTS devices, however, has its own characteristics and limitations. Adequate representations of FACTS devices have a great impact on voltage stability margin. Moreover, appropriate type, placement and correct size of the devices are important and become necessary for power system, especially in a de-regulated environment, to achieve maximum loading margin and other benefits.

Based on the above observation, attention is drawn in this research to study the influence of FACTS devices on static voltage stability margin. The work investigates and compares various types of FACTS devices in terms of static voltage stability margin. Appropriate model is used to represent AC and DC characteristics and limitations of FACTS devices. New placement and sizing techniques of these devices are also proposed to provide a higher voltage stability margin.

The IEEE test system is used for testing and validating all the proposed methodologies. Moreover, a new idea on voltage setting of existing FACTS devices is also proposed to provide the highest margin in the test systems.