

MODELING AND SIMULATION OF TCSC IN POWER SYSTEM LOAD FLOW ANALYSIS

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ABSTRACT

With the current trend towards restructuring and deregulation in the power industry, burden over the power systems has been raised owing to the open access policies. Under the open access regime, all the buyers wish to avail the power from cheaper generation sources without even compromising with the operational as well as thermal stability constraints of the transmission corridors. This trend in the electricity market, has lead to overloaded (network congestion), inefficient, insecure and unreliable operation of the power system network. Owing to certain restrictions including environmental factors, right-of-way, cost involved, limited conventional sources of energy etc, the process of extending the transmission utilities cannot be done at large scale. Fortunately, the introduction of revolutionary Flexible AC Transmission Systems (FACTS) devices in the power industry has generated a solution to the undesirable operating conditions of the power system. These devices facilitate the economic, reliable, flexible and secure operation of network by controlling certain variables that regulate power flowing into the network.

As the load demand varies, the demand for the reactive power is also varied. If this demand is not met, it yields unacceptable voltage profile at the buses and ultimately leads to voltage instability which in turn effects not only the operation of various electrical equipments but also results in transmission losses. In this research work, Thyristor Controlled Series Compensator (TCSC) has been modeled in the Newton Raphson load flow algorithm and simulations have been carried out to provide integrated solution for the voltage profile improvement, reduction of real and reactive power losses as well as the control over the active power flowing in the lines by modification of effective reactance of the line by TCSC. The simulation results have been carried out on the IEEE-14 bus system in the MATLAB environment. The optimal results for improved voltage profile when TCSC connected in line 4-5, reduced losses (real and reactive power losses) with TCSC connected in line 1-5 and real power flow regulation in the transmission line 1-2 when TCSC connected in line 1-2 and 1-5 have been achieved. It has been concluded that the integrated solution is obtained for voltage profile improvement, loss reduction and regulation of power flow on installing TCSC in line 1-5.