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UPFC Device: Optimal Location and Parameter Settingto Reduce Losses in Electric-Power Systems Using a Genetic-algorithm Method

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Abstract: Ensuring the secure operation of power systems has become an important and critical matter during the present time, along with the development of large, complex and load-increasing systems. Security constraints such as the thermal limits of transmission lines and bus-voltage limits must be satisfed under all of a system's operational conditions. An alternative solution to improve the security of a power system is the employment of Flexible Alternating-Current Transmission Systems (FACTS). FACTS devices can reduce the flows of heavily loaded lines, maintain the bus voltages at desired levels, and improve the stability of a power network. The Unifed Power Flow Controller (UPFC) is a versatile FACTS device that can independently or simultaneously control the active power, the reactive power and the bus voltage; however, to achieve such functionality, it is very important to determine the optimal location of the UPFC device, with the appropriate parameter setting, in the power system. In this paper, a genetic algorithm (GA) method is applied to determine the optimal location of the UPFC device in a network for the enhancement of the power-system loadability and the minimization of the active power loss in the transmission line. To verify our approach, simulations were performed on the IEEE 14 Bus, 30 Bus, and 57 Bus test systems. The proposed work was implemented in the MATLAB platform.

Keywords : FACTS, UPFC, GA, loadability, Matlab