Optimal location and signal selection of UPFC device for damping oscillation

Abstract:

Unified power flow controller (UPFC) is used for controlling the real and reactive power in transmission line and bus voltage simultaneously and independently. An additional task of UPFC is to increase transmission capacity as result of power oscillation damping. The effectiveness of this controller depends on its optimal location and proper signal selection in the power system network. A residue factor has been proposed to find the optimal location of the UPFC controllers and eigenvalue analyses are used to assess the most appropriate input signals (stabilizing signal) for supplementary damping control of UPFC to damp out the inter-area mode of oscillations. The proposed residue factor is based on the relative participation of the parameters of UPFC controller to the critical mode. A simple approach of computing the residue factor has been proposed, which combines the linearized differential algebraic equation model of the power system and the UPFC output equations. While for signal selection a right-half plane zeros (RHP zeros) and Hankel singular value (HSV) is used as tools to select the most receptive signal to a mode of the inter-area oscillation. The placements of UPFC controllers have been obtained for the base case and for the dynamic critical contingences. The effectiveness of the proposed method of placement and selection of signals are demonstrated on practical network of TNB 25 bus system of south Malaysian network and New England 39 bus system.