ABSTRACT

Over the past ten years, the paradigm has shifted from conventional power generation to renewable generation. Large integration of these renewable energy sources (RES) into the power system poses challenges to system operators, leading them to put stringent requirements for their grid connection. Displacement of synchronous generators by RES reduces system inertia and consequently decreases the system damping capability of electromechanical oscillations. Poorly damped inter area oscillations reduce the transmission line's capacities and may damage power system components. Hence, future grid codes will require wind and solar power plants to provide damping to the system. Several papers have proposed adding an auxiliary damping controller to the wind turbine control algorithm to damp the low-frequency oscillations (LFOs) by modulating active or reactive power. However, these studies have not mentioned if small power plants can damp LFOs in a multi-machine system. Therefore, this paper investigates the influence of reactive power capacity on the damping of LFOs and its effects on optimal controller parameters using a simplified SVC model connected at the midpoint of the tie line of a two-area test system. A local feedback signal is selected as the input signal to the SVC damping controller. Controller parameters are optimized using the particle swarm optimization algorithm. Time-domain simulations performed in Power Factory software demonstrate the damping behavior of the controller at different SVC ratings. The results show a minimum reactive power capacity is required for effective damping of power system oscillations.