Large- and Small-Signal Stability Performance of a Power System Incorporated with PV Generator

M. S. Widyan

Abstract

The large- and small-signal stability analysis of a power system incorporated with photovoltaic (PV) generator is investigated in this paper. The PV generator is designed such that the power delivered at maximum power point (MPP) at full solar illumination is about 0.65 pu. The study is carried out at different solar illuminations and compared with the case of no PV generation. A DC–DC buck–boost switch mode converter is used at the terminals of the PV array to keep the constant injected voltage at different realistic solar illuminations. The dynamic response of the delta angle of the PV generating bus is extracted. The results show that injecting power from PV panels improves the dynamic stability of the power system. Additionally, the higher the solar illumination is, the better the response of the system as both the overshoot and the pre-fault steady-state value of the delta angle of the synchronous generator are reduced. For the small-signal stability, Jacobian matrix and eigenvalues of the linearized model around the operating point are obtained. Time domain simulations based on the nonlinear dynamical model after successive step changes in the input mechanical power of the synchronous generator have been addressed. All of the numerical simulations are executed via MATLAB TM software environment by building the code required.