

A Grid Synchronization Method Based On Adaptive Notch Filter for SPV System with Modified MPPT

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Abstract : This paper presents a grid synchronization technique based on adaptive notch filter for SPV (Solar Photovoltaic) system along with MPPT (Maximum Power Point Tracking) techniques. An efficient grid synchronization technique offers proficient detection of various components of grid signal like phase and frequency. It also acts as a barrier for harmonics and other disturbances in grid signal. A reference phase signal synchronized with the grid voltage is provided by the grid synchronization technique to standardize the system with grid codes and power quality standards. Hence, grid synchronization unit plays important role for grid connected SPV systems. As the output of the PV array is fluctuating in nature with the meteorological parameters like irradiance, temperature, wind etc. In order to maintain a constant DC voltage at VSC (Voltage Source Converter) input, MPPT control is required to track the maximum power point from PV array. In this work, a variable step size P & O (Perturb and Observe) MPPT technique with DC/DC boost converter has been used at first stage of the system. This algorithm divides the dP_{pv}/dV_{pv} curve of PV panel into three separate zones i.e. zone 0, zone 1 and zone 2. A fine value of tracking step size is used in zone 0 while zone 1 and zone 2 requires a large value of step size in order to obtain a high tracking speed. Further, adaptive notch filter based control technique is proposed for VSC in PV generation system. Adaptive notch filter (ANF) approach is used to synchronize the interfaced PV system with grid to maintain the amplitude, phase and frequency parameters as well as power quality improvement. This technique offers the compensation of harmonics current and reactive power with both linear and nonlinear loads. To maintain constant DC link voltage a PI controller is also implemented and presented in this paper. The complete system has been designed, developed and simulated using SimPower System and Simulink toolbox of MATLAB. The performance analysis of three phase grid connected solar photovoltaic system has been carried out on the basis of various parameters like PV output power, PV voltage, PV current, DC link voltage, PCC (Point of Common Coupling) voltage, grid voltage, grid current, voltage source converter current, power supplied by the voltage source converter etc. The results obtained from the proposed system are found satisfactory.

Keywords : solar photovoltaic systems, MPPT, voltage source converter, grid synchronization technique

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