

Predictive Control of a Grid Connected PV Systems Incorporating Active Power Filter Functionalities

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Abstract : This paper presents a multifunction operation of a double stage grid connected photovoltaic system, with insertion of the active power filter (APF) functionalities. This system is used to compensate the reactive power, suppress harmonics currents, supply the nonlinear loads and inject the active power into the grid. Our work is focused on the grid side, a perturbation and observation control is used to reach the maximum power point tracking (MPPT) regardless of solar radiation. On the grid side, a modified instantaneous active and reactive power algorithm (P-Q) based on a multi-variable filter (MVF) is used in order to identify the harmonics currents reference under distorted source voltage condition, also a modified predictive current control (PCC) algorithm is used to control the source voltage inverter in order to ensure compensation of reactive power and harmonic currents, feed the non-linear load and inject the surplus generated power into the grid. In Matlab/Simulink software, the proposed control scheme is investigated under load change and radiation change conditions. Simulation results show that the proposed PCC of the APF guarantees a flexible settlement of real power amounts exchanges with the grid with a high power factor operation. Furthermore, the grid current recovers its sinusoidal waveform with a total harmonic distortion (THD) meeting the IEEE-519 standard.

Keywords : Photovoltaic system (PV), active power filter (APF), Predictive current control (PCC), active and reactive power theory (P-Q), multivariable filter (MVF), total harmonic distortion (THD)