Three Phase Grid Connected Photovoltaic System with Active and Reactive Power Control Using "Instantaneous Reactive Power Theory"

Extended abstract:

In this paper presented a brief overview of the control strategies of photovoltaic system (P/V) and analyzed the advantages and disadvantages of each strategy. A photovoltaic system, with maximum power point tracking (MPPT), connected to a three phase grid is proposed. The connection of photovoltaic system on the grid takes place in one stage using two level voltage source inverter (VSI). For a better utilization of the photovoltaic system all 24 hours of the day, the control strategy applied is based on p-q theory. This theory creates the reference currents of the inverter based on the calculation of the active and reactive power and the active power from the P/V system. According to this strategy during sunlight the system supply the grid with active power and at the same time compensates the reactive power of the load. In case there is no sunlight (during the night for instance), the inverter only compensates the reactive power of the load. On a practical level, such a system is extremely useful because it improves the power factor of the power system. In this paper the use of p-q theory to supply the grid with active power and compensate the reactive power of the load is investigated. The proposed electrical power system was simulated on the computer. The simulation was done with the software package Matlab/Simulink. During simulation studied the behavior of the electrical power system when the solar radiation is constant. Also studied the transient behavior of electrical power system when the solar radiation increases and when the solar radiation becomes zero. During the simulations numerous waveforms which correspond to the currents and the active and reactive power of electrical power system were recorded. The advantage of this control strategy is that the photovoltaic system is operated the whole day. Furthermore, the p-q theory uses simple algebraic calculations without demanding the use of PLL to synchronize the inverter with the grid.