Abstract

In a photovoltaic system, an inverter is an essential interface to convert the direct power produced by solar cell into alternating power. However, the inherent instantaneous second harmonic power phenomenon of a PV system affects the Maximum Power Point Tracking (MPPT) and output current quality of the system. One most common solution is by connecting a large electrolytic capacitor to the DC link of PV inverters to reduce the effect of the instantaneous second harmonic power component. Yet, comparing with AC capacitors, the lifetime of an electrolytic capacitor is much shorter, and its reliability becomes much lower. Therefore, the major purpose of this thesis is to develop a PV inverter which contains an active power decoupling circuit to eliminate the instantaneous second harmonic power of the PV system effectively and to enable the use of an AC capacitor with lower capacitance value to substitute for the large DC link capacitor.

The contributions of this thesis may be summarized as follows. First, the distribution of the instantaneous second harmonic power of each element in the PV inverter adopted was analyzed and its influence on MPPT and output current quality of the PV module was also discussed. Second, based on the understanding of the first point which we have studied in depth, two simple power decoupling circuits were proposed to eliminate the second harmonic voltage ripple so that we can use an AC capacitor to replace traditional large electrolytic capacitor to enhance the reliability of the entire PV system. Third, a prototype is also constructed by using a TMS320F2812 DSP (developed by Texas Instrument Company) to verify the validity of the power decoupling circuit.

Keywords：PV inverter、instantaneous second harmonic power、power decoupling circuit.