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A Singe-Phase PV Inverter with Reduce-Sized Passive Components and Improved Energy Yield

Solar photovoltaic (PV) power generation systems require electrical inverters to convert direct current (DC) into alternating current (AC), the standard type of electricity supplied by utilities. Inverters make up a large portion of capital costs because they must be replaced periodically over the lifetime of a solar system. The mean time before failures (MTBF) is about 3 -5 years for most PV inverters, while the expected lifetime of PV cells is 20 years or more. Reductions in inverter costs as well as extended lifetimes would significantly reduce overall system costs. The market for PV has grown significantly, and a study by IMC Research predicts that revenue from solar inverters will exceed \$2 billion by 2010.

Researchers at Arizona State University have developed a single-phase current-source inverter that could be used for residential solar and other smaller sized PV applications. While single-phase current source inverters are known, they have low-frequency pulsation (or ripple) problems, leading to large oscillations around the maximum power point, reducing efficiency. The circuit topology proposed overcomes this, minimizing the ripple. By using a current source inverter, the electrolytic capacitor associated with voltage-source inverters, which is the main failure mechanism for inverters, is removed. The topology also allows reduced dc link inductor sizes, and offers better energy yield. This design is not well suited to power plants, which would require more costly and complex multi-phase inverters.

Potential Applications

- Residential PV systems
- Compact or standalone solar systems

Benefits and Advantages

- Improved reliability and longer mean time before failures (MTBF) ? eliminates electrolytic capacitor, which has a limited lifetime.
- Better efficiency ? less ripple allows more accurate tracking of maximum power point.
- Reduced cost of ownership ? fewer failed components need to be replaced in the field.
- Improved performance ? Small, simple system improves energy yield.

