Z-Source Inverters for Advanced Power Conditioning of Alternate Energy Systems

Abstract—Alternate energy sources such as solar, fuel cell, and wind have a wide voltage change range due to the nature of the sources. Photovoltaic cell’s voltage varies with temperature and irradiation. Fuel cell stack voltage drops greatly with current. And wind generator voltage varies with wind speed and control. The traditional voltage source inverter that has been the power conversion technology for these energy sources cannot cope with this wide voltage change nature and often requires additional voltage boost by additional dc/dc converter. The Z-source inverters can solve this problem. This single stage power conversion technology provides a great alternative with lower cost, higher reliability, and higher efficiency. System configurations, features and results are shown for advanced power conditioning of alternate energy systems.

Quasi-Z-Source Inverter for Power Conditioning of Photovoltaic Systems

Features:
- Single power stage for buck and boost, power inversion, and maximum power point tracking;
- Minimum number of switching devices;
- More reliable and lower cost; High immunity to EMI noise and high efficiency.

Quasi-Z-Source Inverter of Fuel Cell Battery Based Distributed Power Generation

Features:
- One single inverter stage to interface FC and battery, boost voltage, and perform energy management;
- Production of desired ac voltage for a wide FC voltage range (1:2);
- Minimum number of switching devices;
- Constant current from FC and independent battery SOC control;
- High efficiency;
- High reliability and low cost.

Z-Source Inverter for Wind Power Generation Systems

Features:
- Single active power stage to perform voltage boost and maximum power point tracking;
- Production of desired output voltage and MPPT for a wide range of wind speed;
- Minimum components count; Reliable, low cast, and high efficient.