

Switched Capacitor Energy Buffer System

Technology #20268

Applications

- Photovoltaic (PV) system
- PV energy extraction
- Solar cells

Problem Addressed

Asymmetric PV strings can result from temperature variation, dirt, panel aging, or panel orientation. These asymmetries negatively impact tracking efficiency. To maximize energy extraction, distributed power conversion is employed to enable per-panel or sub-panel maximum-power-point-tracking (MPPT). There are three common architectures deployed in residential and commercial PV installations for delivering power to the grid: string inverters, micro-inverters, and DC-DC series power supplies working with a string inverter. Each of these systems has limitations. For example, they are typically constructed with magnetic components which are possibly obtained on a per-panel basis and increase manufacturing costs. High frequency switching complicates electromagnetic interface created by distributed converters.

Technology

The invented solar panel is a series of connected solar cells coupled in a layout that substantially reduces the amount of mismatch caused by an imbalance in solar irradiance between the sub-module strings. Within the system lies a switched-capacitor DC-DC converter with a plurality of conversion levels. A conversion level is selected to provide the maximum power current of the solar cell in order for the converter to increase overall array tracking efficiency. Also included is a grid-tie inverter for coupling a PV array to a power grid. The inverter ensures the system operates stably by relying on feedforward rather than feedback processes.

Advantages

- Increased efficiency in overall array tracking
- Achieves high energy utilization and highly effective energy density
- Reduced manufacturing cost

Related Technologies

This technology is related to MIT Case No. [14953 - Switched Capacitor Energy Buffer Architecture](#)

Categories For This Invention:

[Electronics & Circuits](#)

Power Conversion
Energy
Energy Efficiency
Solar
Photovoltaics
PV Electronics

Intellectual Property:

Systems approach to photovoltaic energy extraction
Issued US Patent
9,407,164

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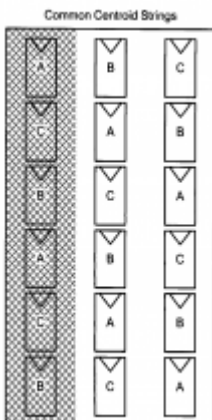
Publications:

Stacked Switched Capacitor Energy Buffer Architecture
2012 Twenty-Seventh Annual IEEE Applied Power Electronics Conference and Exposition (APEC)
5-9 Feb. 2012

External Links:

Power Electronics Research Group
<http://www.rle.mit.edu/per>
Laborator for Electromagnetic and Electronic Systems
<http://www.rle.mit.edu/lees>

Image Gallery:



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