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A STUDY ON THE APPLICABILITY TO SPACECRAFTS OF DC-DC CONVERTER INTEGRATING
VOLTAGE EQUALIZER FOR SOLAR CELLS UNDER PARTIAL SHADING

Abstract

The generated power from a solar array on spacecrafts such as micro satellites without solar tracking function or such as a planetary surface exploration rover with protruding objects such as communication antennas may be significantly reduced due to the shade on the surface of a solar array by the protruding objects. If the shade occurs in a part of a solar array composed of solar cells connected in series, the current generated by the shaded solar cell decreases, and other cells can only supply the reduced current. As a result, the power generated by a solar array is significantly reduced. When a bypass diode is attached to a solar cell, a reduction in the generated power of the solar array can be suppressed, but a voltage drop occurs. As described above, the shade on the surface of a solar array not only reduces the generated power but also distorts the P-V characteristics of the solar cell, and it may generate two or more power peak points of the P-V characteristics. As a result, it becomes a cause that the maximum power point tracking(MPPT) control becomes difficult. In this paper, we show a circuit which is DC-DC Converter integrating voltage equalizer for solar cells under partial shading which maximizing the generated power as much as possible when the shade occurs, and which has only one maximum power point. And we propose a method to simplify MPPT control by adopting the circuit to spacecrafts which has the battery bus.