Poster Session (P)
Poster Lunch (1)

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A SIMPLIFIED SERIES-PARALLEL STRUCTURE AND CONTROL STRATEGY FOR THE REGULATED PEAK POWER TRACKING SYSTEM

Abstract

Maximum power point tracking (MPPT) technology controls the output voltage of the solar array around the maximum power point, thus maximizing the use of solar array output power, to meet the demand of instantaneous high-power, lightweight and long-life of the spacecraft. Different from direct energy transfer (DET) methodMPPT method increases the difficulty of bus regulating. The technology not only faces with the problem of accurate and stable MPPT and improving system efficiency, but also to resolve the unified control of MPPT, battery charge and discharge and bus regulation. 1. Overview Based on a 1kW MPPT system module, this paper puts forward an efficient MPPT technology and engaged deep research on its topology, unified control, stability, MPPT algorithm and so on. Finally, the experimental results demonstrate excellent behaviors of the present MPPT system. The 1kW MPPT module consists of a 3 DC/DC low ripple buck regulator SAR, a BCR and a BDR. The 3 MPPT electronics includes majority voter operating in 2 out of 3 redundancy, each electronic device is 500W, have one failure tolerant against bus shortage and permanent solar array shortage and bus regulation has the priority against the MPPT. 2. Unified control and stability The paper proposes a three-domain control method of the proposed MPPT system. The control method ensures each module in the system accurately and stably running. Investigate the small signal model of the system and the system large-signal behavior which provide theoretical basis for the reliability of the MPPT technology. The system has four operating modes and in different mode, modules are controlled by different control loops and directed by two main error amplifies MEA and BEA. 3. MPPT algorithm Any perturbation around the maximum power point has the same relative change in voltage and current. Based on this inherent property of solar array, MPPT mechanism is very simple and doesn't require any calculation of power, so no software nor FPGA involve and have one failure tolerant. 4. Experimental results Finally, a 1kW MPPT system has been implemented. Experiment shows that the MPPT tracking is a 70 Hz perturbation, less than 5