Design of High-Performance Power Subsystem for Nanosat

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Abstract — In the paper the COTS – technology application under the nano - satellite power subsystem development with applying the maximum power selection method is described.

I. INTRODUCTION

The basic tendency of nano-satellite serial production and launching is stable and evident. The modern NASA ideas concerning the new generation of micro-, nano- and femto- satellites development on the base of miniature and chip light units and devices with low power usage was support as by ESA, as by majority of national agencies and public organization of the world. The number of universities and other scientific organization associate oneself with nano satellites development and launching [8] under protectorate of national space agencies respectively.

II. MAIN PART

In this paper the electrical power subsystem (EPS) for the low-orbit nano-satellite development with the Earth ionosphere electromagnetic sensing is considered. Power subsystem is developed on the basis of high reliable, non radiation resistant industrial components (COTS)[1,2].

The electronic power subsystem consist from four photo electronic batteries for electron energy generation on the basis of silicon monocrystal, four Li-Ion battery for storage or nano satellite powering on the shady side as well as for charging and protection systems [5-7].

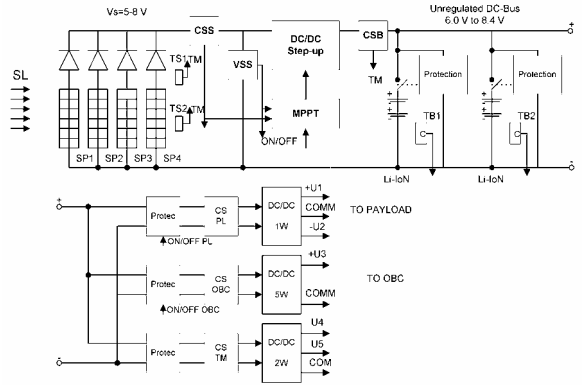

Fig. 1. Electrical power subsystem functional scheme

The required voltages forming for other subsystems is performed by DC/DC converters. EPS functioning control (current, voltage, temperature sensors – over 16 parameters) is performed by telemeter module on the microcontroller and multichannel ADC basis.

For maximal efficacy of EPS performance the Maximum Power Point Tracker (MPPT) is used – Fig.1.

For hazard reducing under the elements selection the special components, designs for the space purposes are used.

III. CONCLUSIONS

EPS for the nano-satellite LISA is utilizing an innovate, robust power system which will allow the other subsystem and payload to operate at optimal levels. Included in the system are solar cells. Lithium-Ion batteries and various regulation and distribution components individually chosen for their reliability and ability to fit with the constrains. Introduction of VMPPT increases the output power of PV generators. The percentage of power increase depends on operating conditions (isolation, temperature, degradation and load levels).

The proposed VMPPT technique is very simple since it requires only the measured open circuit voltage. The cell open circuit voltage can be measured using a micro-system. The same micro-system can be used for switching of DC/DC converters (buck or boost mode) and controlling the operating point on the panel V-I characteristics. The effect of MPPT is especially appreciable when generated electrical energy is less than the demands level (e.g. at EOL, High power demand phases, high temperature conditions.) The main advantage of the proposed microprocessor-based VMPPT method as compared to the current-based MPPT [9] is the elimination of the reference cells which results in a "simpler" and "more efficient" system.

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