

IAF SPACE POWER SYMPOSIUM (C3)
Advanced Space Power Technologies (3)

Author: Dr. Xinsheng Wang
Beihang University, China, xswang@buaa.edu.cn

Mr. Meng Xie
Beijing University of Aeronautics and Astronautics (BUAA), China, xiemeng@buaa.edu.cn

Mr. Peizhao Sun
Beihang University (BUAA), China, sunpz@buaa.edu.cn

Mr. Jiaming Wang
Beihang University (BUAA), China, 441355785@qq.com

A NEW HARDWARE-IN-LOOP SIMULATION SYSTEM DESIGN FOR ELECTRICAL POWER
SYSTEM OF SMALL SATELLITE**Abstract**

The Electrical Power Subsystem (EPS) is the key subsystem of satellite platform that generates, stores, transforms, regulates, and distributes electrical energy. Powerful testbed can verify EPS specification and assess the satellite system function effectively. It will simulate the abnormal scenario to assess EPS performance and find the flaws in EPS. In this paper, sufficient studies have been done in the hardware-in-loop (HIL) simulation of satellite EPS. Firstly, Abundant technical surveys were made including the domestic and abroad small satellite EPS. Based on mathematical models, the HIL simulation system is established with the modular design philosophy. The HIL simulation system is composed of solar array simulator, storage battery simulator, prototype power controller, data acquisition component and related software developed by our own. The host computer calculates the light conditions by Satellite Tool Kit; the battery simulator establishes a battery pack model according to the preset battery charging and discharging value, and simulates the battery output characteristics; set the power consumption of the DC electronic load to simulate the operation of the components on the satellite; the data acquisition card is used to collect the telemetry data of the power system, and control the working status of the power system according to the instructions of the host computer simultaneously. The software includes the upper computer HIL simulation platform control interface, which achieves the functions of reading telemetry data and issuing remote control commands, setting different work modes to complete the energy balance analysis under each work mode. It is used to control the operation of the entire simulation platform through the development of the GUI graphical user interface based on Matlab environment. And it forms a complete HIL simulation system design of the electrical power subsystem. Based on the HIL simulation platform, the EPS energy balance analysis has been done for a small satellite project. The simulation and test results have shown that the EPS work procedure and state transfer performance is satisfied. Some potential technical flaws in EPS have been found and analyzed.