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INVESTIGATION OF MULTIPLE TECHNIQUES FOR CUBESAT POWER GENERATION COMPUTATION

Abstract

CubeSats are miniature satellites that rely on solar energy as the main source of power. In space, power generation of a CubeSat is primarily limited by the area of the installed solar panels and the duration of the eclipse periods. To ensure the success of any space mission, it is essential to develop an accurate computational model capable of estimating the CubeSat power generation under various conditions. In this work, two different approaches were considered for power generation calculation and were validated by comparing the obtained results with those using existing tools such as the commercially available Systems Tool Kit (STK) software. They were also validated by comparison with the house-keeping data from MYSAT-1, a 1U CubeSat developed at Khalifa University. The first computational approach is a standalone MATLAB application (CubeSat Wizard), whereas the second approach uses the output results from the General Mission Analysis Tool (GMAT) and then computes the power generation using another in-house developed MATLAB code. The prior approach assumes that the orbital changes within one day are negligible and the calculations of the CubeSat orbital position are based on the angle from the orbit noon. On the other side, the later approach uses the true anomaly angle and makes no assumptions on orbits during each day. The results were successfully validated as there was a matching trend with the STK results within an acceptable range of error. Similar trends were also observed while validating the results using the house-keeping data from MYSAT-1. Comparing the results of the two computational tools suggest that the considered assumptions in the former approach are valid for the case under consideration. In addition, using the CubeSat Wizard reduces the computational efforts significantly.