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Author: Mr. Harshit Saini
SRM Institute of Science and Technology, India, hs09v2@gmail.com

Ms. Srishti Rawal
SRM Institute of Science and Technology, India, isrishtirawal@gmail.com
Mr. Karan Joseph
SRM Institute of Science and Technology, India, karanjoseph27122000@gmail.com

HARDWARE-IN-THE-LOOP SIMULATION FOR VERIFICATION OF SRMSAT-3

Abstract

The current ground testing trend has evolved, which delivers more actual data using computer modelling and simulations. Such data is adequate and very similar to the actual flight results. Moreover, it needs fewer components and is much cheaper than traditional entire prototype testing. Designing a nanosatellite requires absolute precision for healthy and efficient functioning, keeping in mind the design has to be economical due to mass and size constraints. The spacecraft's Electrical Power System (EPS) must generate, store, condition, and distribute energy using efficient solar arrays and battery units to meet the estimated power budget. After studying the whole mission, the maximum power consumption is by Attitude Determination and Control System (ADCS), Propulsion System, Autonomous Guidance and Navigation, and Inter-satellite Communication Link. The evaluation of the collected data is of the utmost importance to avoid power failures. Therefore, it calls for a method that can verify the hardware and power demand of the satellite.

Mission SRMSAT-3 intends to Autonomously dock a Chaser satellite with the Target satellite in the near-earth circular orbit at approximately 500 km altitude. This Low Earth Orbit (LEO) mission uses Hardware-in-the-Loop (HiL) simulations for ground testing. Such complex missions tend to fail in orbit due to a lack of testing, especially for the nanosatellite regime. However, the spacecraft undergoes several vibrational analyses to withhold extreme forces during launch, that later it does not hinder other payloads. Building such a test setup demonstrates the interfaces are operating and the bus lines are optimally performing. HiL is a powerful tool to verify accurate results since its employees readily available hardware, sensors, and actuators for verification. These elements operate in specific environments and conditions which are difficult to reproduce in a laboratory and need computer modelling. The testing determines the worst-case scenarios and is a valuable means for supporting the verification process of nanosatellites. Lastly, it may help reduce the time and cost of the construction phase and increase mission reliability. This paper produces typical datasets for the entire mission that can help in examining similar programs like SRMSAT-3.