

Design and Development of Hardware-In-the-Loop Simulator for Spacecraft Attitude Control

Do-Hee Kim¹, Jong-Woo Kim², Sang-Young Park¹, and Kyu-Hong Choi¹

¹*Astrodynamics and Control Lab, Department of Astronomy and Space Science, Yonsei Univ*

²*Mechatronics Center, Samsung Electronics., Ltd.*

In order to realize various space missions and satellite formation flying in the future, it is required to develop a variety of attitude stabilization techniques as well as equipment to prove these techniques using hardware simulator. In this research, therefore, Hardware-In-the-Loop (HIL) simulator which can be utilized both development and test of high-level complex system is designed and developed. Moreover, air-bearing system allowing low torque environment to be possible on the ground is developed on the basis that attitude algorithm test for spacecrafts needs the replication of space environment. The compositions of HIL simulator for spacecraft attitude control are the same as the following: air-bearing system that can replicate space environment, an embeded computer (Onboard PC) for simulator system control, Host PC for simulator health monitoring, command, and post analysis, wireless adapter for wireless network (Tcp/Ip networking) between Onboard PC and Host PC, Inertial Measurement Unit to measure 3-axis attitude of the simulator, 3 momentum wheels to actuate the simulator according to attitude change, and 3 sealed lead acid battery sets to independently supply power only for the simulator. Additionally, there were momentum wheel tests developed just for HIL simulator and implementation of PD control to verify the performance of HIL simulator.