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DEVELOPMENT OF SIMPLE SIMULATORS OF SATELLITE AND GROUND STATION FOR SOPHISTICATION OF AUTOMATIC OPERATION SYSTEM

Abstract

An automatic satellite operation system (ASOS) is implemented at the REIMEI ground station in order to reduce human load of its steady operation phase. In the ASOS, software called "scheduler" as a substitutive operator manages all the operations, namely sending command, receiving telemetry, driving antenna, performing diagnostics of satellite anomaly, etc through a unified procedure. While the ASOS has turned out to be effective for reduction of human load, the problem of insufficiency of the test environment to verify this system came out. A prototype model of REIMEI's onboard computer (OBC) is utilized to verify the automatic operation plans before sending them at the OBC hardware level. Although almost the same signals are easy to acquire from the prototype model as those from the OBC, it is difficult to acquire the expected patterns or history of the signal and the status of the satellite, for example, the values of the bus voltage and the battery temperature, which are fixed in the prototype model. Hence, the test patterns to verify the ASOS are restricted. To improve the test environment of the ASOS, "simple simulators of satellite and ground station(GSE)" which imitate the arbitrary pattern of the signal and the status of the satellite and the ground station are under development. The aim of the simulators is to improve the robustness and the reliability of the ASOS. The simulators consist of two independent hardwares. One imitates the satellite, the other imitates the GSE. The simulator of the satellite generates pseudo telemetry data to imitate the signals or the status of satellite, for example, the bus voltage, the battery temperature, etc. The simulator of the GSE generates pseudo telemetry data to imitate status of the ground station, for example, the status of the servo controller and the antenna receiving power, etc. These simulators have command-telemetry data model as an XML-based database and they are easily applicable to other satellites and ground stations. By using these simulators, it is easy to construct a closed-loop test system including both pseudo satellite and pseudo GSE which is connected to the operation system. Small and inexpensive one-board computers, for example, "Raspberry Pi", are used to implement the simulators to attain "one set simulator to one developer". In this paper, the basic concept of the simulators is introduced as well as some applications to show how the automatic operation system is sophisticated by using the simulators.