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INSAT3D: REAL-TIME SPACECRAFT MONITORING IN 3D

Abstract

Three-dimensional visualisation provides an intuitive perception of a spacecraft's dynamics in its environment. Our aim is to demonstrate how an accurate 3D representation of the spacecraft and its internal subsystems, connected to real-time telemetry data, can also improve system monitoring for operations. Space systems are becoming more and more complex, requiring the creation of 3D models to optimise their internal design. In addition, the tools required to operate satellites are moving towards more visual displays, taking advantage of the increased computing capabilities available in control systems. We have developed a 3D monitoring tool called inSat3D, co-funded by the French space agency (CNES), which combines both trends by optimising and connecting the satellite 3D model to real-time telemetry.

In order to achieve a cost effective solution, we have chosen to base our software largely on open source components for GUI management and 3D rendering. To ensure durability, it also relies on open standards such as XML for the description of the CAD assembly or XTCE for the system database. It maps telemetry data into the model using pseudo-colour encoding to get an immediate overall, systemic and synthetic picture of the system. This is particularly useful for thermal and spatial analysis of complex systems, where traditional alphanumeric displays reach their limits. In order to help the creation of links between the CAD and the system databases, syntax matching algorithms are used along with user-driven 3D object picking. Using similar patterns, these links can be automatically or manually updated when both CAD and system databases evolve. This ensures our tool can be used from start to end of the spacecraft development process, i.e. from design to training and operations.

The ability to easily navigate in 3D through the spacecraft and all its internal subsystems provides a new efficient means to access on-the-fly contextual information for end-users. Moreover, the creation of simplified views of the system, through domain or subsystem filtering, allows them to focus on relevant status parameters and respond faster and more effectively to alarms. We believe that this tool increases the efficiency of spacecraft operations and adds value to operations training solutions. The paper will discuss these benefits, describe the development methodologies, and will summarise future plans for further development.