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SPACECRAFT SIMULATOR FOR DEEP SPACE MISSIONS

Abstract

This paper discusses the simulator design for a spacecraft intended for deep-space missions. Deep-space constraints of inconsistent visibility and delay in communication compound the effects of inadvertent design faults and failure conditions. Hence, precise simulations in close-to-actual environments are imperative to test the spacecraft's fault detection and recovery features. The simulator is based on an integrated design which increases the reliability and reduces the turnaround time for the onboard system. It simulates the performance of all the subsystems pertaining to spacecraft attitude and orbit control, space dynamics and all external disturbances. It works in real-time and runs models of the subsystems and simulates their interfaces, runs various test cases - both normal and with failure conditions and monitors the parameters of the systems. The distributed architecture for handling these processes and other design implementations like Closed-loop Simulations and Real-time Implementation are discussed. The simulator has been successfully employed in India's first interplanetary venture – the Mars Orbiter Mission (MOM). It was used for ground testing of interface logics and autonomy features of the Attitude and Orbit Control System (AOCS) and is still being used in simulations to continuously validate the AOCS functions in space during different mission phases.