SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Architectures (4)

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DESIGN AND TESTING OF AN AUTONOMOUS MULTI-AGENT BASED SPACECRAFT CONTROLLER

Abstract

In this paper an autonomous spacecraft control system based on autonomous agents and a complimentary testing strategy are presented. The design is tailored to multi-craft missions and concentrates on addressing issues such as formation flying, conflict resolution and redundancy. The control system is based on a multi-agent system (MAS) which consists of a number of task specific autonomous agents that form local groups on each of the spacecraft in the mission. The MAS includes agents dedicated to planning, formation flying commands, formation execution, negotiation and feedback. Autonomous agents are especially suited for multi-craft missions but because of their autonomous nature adequately testing them has posed many problems. The control system is evaluated by utilising a testing suite to simulate the MAS performing mission tasks. The testing suite consists of a number of dynamical models that the MAS uses to reach a decision. The whole control system is run within a simulated environment. Using dynamical models accessible by the MAS and running the control system within a simulated environment allows us to create a number of scenarios to test the control system. These could involve sensor error, actuator failure or other unforeseen events. These scenarios are chosen to allow us to observe the MAS behaviour in both standard operating conditions and emergency type events. We demonstrate this approach using a number of different scenarios and MAS configurations.