SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems (1)

Author: Prof. Hakan Kayal
University Wuerzburg, Germany

Prof. Dietmar Seipel
University Würzburg, Germany
Mrs. Saliha Serdar
University Wuerzburg, Germany

A HIGH-LEVEL DECISION SUPPORT SYSTEM FOR NANOSATELLITES

Abstract

In a common space mission the spacecraft acts autonomously in case of a low-level decision, whereas high-level or critical decisions are still taken by the ground station. Due to communication delays in interplanetary missions, these circumstances can lead to a limitation of the spacecraft operations, if the mission is faced with an unexpected situation.

An unexpected situation is defined as the detection of unforeseeable short-lived events or the occurrence of on-board failures. Given these conditions, the spacecraft must be able to take quick decisions in order to not miss a possible interesting, possibly unique event or endanger itself. Higher demands are imposed to the autonomy, if such a science opportunity is detected and an on-board failure occurs at the same time.

The presented paper deals exactly with the stated problem, which requires autonomy in high-level planning. Thereby a decision should be taken between either investigate the event or eliminate the failure. The unique scientific measurements, which can result from the detected event, as well as the impacts of the failure, are considered. In order to reach this objective an approach of rule-based decision support system, also called as an expert system, is designed. For this purpose, events and on-board failures are converted from objective ratings into numerical values by applying the valuation method Analytical Hierarchy Process. Since the logical programming language Prolog is an appropriate language for expert systems, a part of the developed decision support system is implemented in Prolog.