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ONBOARD GENETIC ALGORITHM-BASED SCHEDULER FOR OPTIMIZED SATELLITE OPERATIONS

Abstract

In the last few decades, space has become significantly more accessible due to the lower costs and increased launch opportunities, boosting the number of satellite missions, often developed by private companies or universities. With this, more sophisticated tools to optimally solve the satellite scheduling problem, i.e., assignment of tasks to the satellite in order to reach mission goals, are necessary for the generation of effective schedules. An approach to tackle this challenge, is to develop systems and algorithms able to autonomously generate optimized schedules, and ultimately also able to run in space, onboard a satellite.

In this paper, a genetic algorithm-based scheduler for optimized satellite operations is presented as a component of the Autonomous Space Operation Planner and Scheduler (ASOPS), planned to be on board the small satellite ATHENE-1, developed within the Seamless Radio Access Network for Internet of Space (SeRANIS) project. The scheduler is supported by simulations of both environment and satellite. With access to real-time satellite telemetry, the simulations offer an accurate evaluation of constraints as the available energy onboard, data storage, satellite attitude and mutual exclusive payload operations. Additionally, the scheduler is designed to manage specific user requests, ground station access times and predefined schedules uplinked from ground. All these constraints are finally used as input for the resource optimization process aimed to maximize the mission outcome. The scheduler is tested and verified on the use-case of ATHENE-1, where it has shown promising results in autonomously and efficiently schedule operations for the large number of different payloads on board the satellite.