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# MODEL-DRIVEN ENGINEERING FOR SWARM-BASED SPACE EXPLORATION MISSIONS

**Abstract**

In swarm-based space exploration missions, unmanned vehicles are enabled to go where traditional manned spacecraft simply cannot. It requires a significant adaptation to the unpredictability of the environment and increasing complexity of the software managing these systems. This increasing complexity required the adoption of automatic approaches for the evaluation and the assessment of the availability, reliability, safety, and security, that is hardened by the exposure to uncertainty and variability. Model-Driven Engineering is a candidate technique for meeting these challenges. In fact, Model-Driven Engineering is a software development methodology that exploits system models, design patterns and reuse of standardized models to increase the productivity simplifying the development process. The same approach could be applied at system-level, hence including peculiar aspects of unmanned vehicles such as failure rates, performance indicators, replications and redundancies so allowing dependability and performability analysis. This paper discusses the advantages of adopting Model-Driven methodologies in swarm-based space exploration missions. It also describes a concrete architecture that applies the Model-Driven techniques for the dependability assessment of special missions. The proposed architecture is able to describe both the subcomponents and their behaviours of unmanned vehicles. This work represents a first step towards the complete adoption of Model-Driven Engineering in space exploration, which could represent a way to improve the adoption, the simulation and the execution of models during the entire lifecycle.