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ONTOLOGY-DRIVEN MODEL BASED SYSTEM ENGINEERING FOR AUTOMATING THE DESIGN OF SATELLITES

Abstract

With the entry of commercial and other non-state actors, space has become much more accessible compared with the days of the Cold War space race. Private industries, universities and students now operate in space, and the first mass-produced satellites are in orbit. These actors are often new to the domain, work on more limited budgets and sometimes have a profit motive, thus requiring spacecraft to be built easier, faster and cheaper. A possible approach is building upon the current methods, such as Set Based and Model-Based Engineering. These methods will be used as a framework for further automation of satellite development. This is achieved by implementing an Ontology-driven Knowledge Based Engineering (KBE) system around the mentioned methods. The ontology system will be implemented as a backend to current concurrent design software like Valispace or Comet-CE to best facilitate spacecraft development. Here, it will work as a "translator" from these programs to programs used for simulations, CAD or other data models, and vice versa, thus linking the knowledge of the programs. Since the knowledge of requirements, the current state of the satellite, and evaluations of the satellite are all located in a commonplace, a form of backpropagation is possible. This paper is thus an exploration of the technical feasibility of such a system by creating a prototype system that aims to generate preliminary spacecraft designs based on a list of requirements and an ontology. With this, it is possible to rapidly generate preliminary spacecraft designs. This would aid in the early phases of spacecraft development by rapidly evaluating different possibilities and by generating a base design and system for further development. The latter is important since utilizing an ontology-driven KBE system based on current methods reinforces and facilitates the proper usage of standardized structures, work methodology and aids in knowledge management. Overall, this would significantly reduce time spent on repetitive tasks, such as updating calculations, organizing data/knowledge and exploring different configurations, thus allowing for more time to be used on finding creative solutions, or on improving the chosen design.