

An Expert System for Spacecraft Design

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Abstract

Designing a spacecraft is a complicated process that can be problem-prone. This is particularly true in the case of a small spacecraft where volume and mass limitations are enforced by form factor requirements. The Open Prototype for Educational NanoSats implements several restrictions beyond those from the CubeSat form factor, including two different board size specifications which impact the configuration of the payload area support structure and the size of available batteries.

OpenEdge aims to avoid the discovery of form factor, OPEN-specific and other configuration issues during final assembly by checking prospective configurations against the applicable requirements and constraints set during design. OpenEdge is an expert system and modeling tool that allows users to specify various different design choices (e.g., boards selected, battery types) and validates their compatibility. For cases where a configuration is detected, the system generates corrective instructions based on what expert system rule was violated.

Through an interface with computer aided design (CAD) software, OPEN Edge will allow extended testing of the configuration using the capabilities of the CAD program. This may include determining the location of the center of mass, assessing structural performance, predicting the response of the hardware to shocks and vibration and/or performing finite element analysis.

This presentation describes the OpenEdge concept and the initial design work that has been performed on this software tool. It also assesses the value of the proposed tool in terms of the additional capabilities that it provides to the OPEN platform and the cost of potential mistakes that the software may avoid. The plans for completion of this tool are also enumerated.