iCASD –
intelligent Computer Aided Satellite Design

DLR

iCASD

Overview

The intelligent Computer Aided Satellite Designer (iCASD) serves as an interactive configuration software for modular satellite missions. It enables operators to manually select a set of iBLOCKs and calculate an optimal satellite configuration for the mission. The design process is done through a chain of operations: computing the satellite requirements based on user input, proposing additional iBLOCKs from a given standard iBLOCK catalogue, calculating the power consumption, estimating the cost of the satellite and finally solving the satellite configuration through an evolutionary algorithm. The iCASD is currently available with an easy to use graphical interface, which also enables non-experts to create modular satellite configurations suitable for their requirements. It cooperates directly with the Virtual Testbed iBOSS (VTi) to execute advanced simulations with the generated models. To provide these configuration and simulation capabilities to a broad range of interested customers, a website is currently developed to highlight the key features of iCASD.

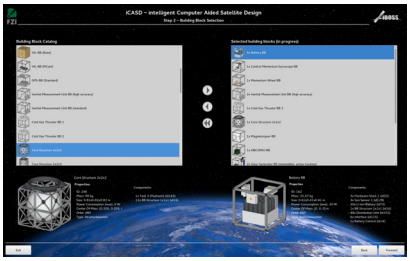

Fig. 1: Interactive user interface of the iCASD software

In order to reduce the complexity and time of solving the optimization problems, the following synthesis process is used: This process is divided into three steps (selection, optimization, visualization), which use a common XML-based data format. During the first step, a solver finds the correct set of iBLOCKs based on the electrical balance and components, specified by the user. The costs of the designed iSAT is then summarized and further changes in the composition can be done freely. A genetic algorithm finds the best special configuration for all iBLOCKs and generates solutions to be visualized or used to plan reconfigurations and handed to the VTi to verify -physical properties in a virtual mission scenario.

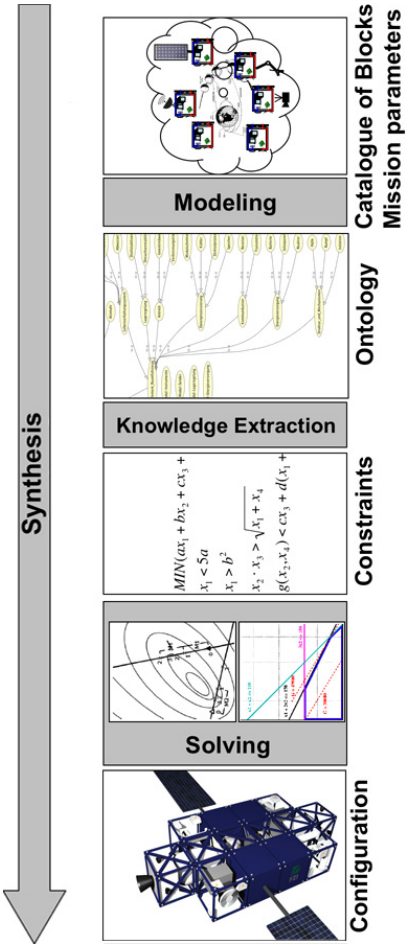

Fig. 2: Synthesis process of the iCASD to generate an optimized satellite configuration

Selection of iBLOCKs

The iCASD uses the catalogue with pre-qualified iBLOCKs. Each building block contains different subsets of the specified components. Based on the mission-specific parameters and user-defined components, the minimum required set of iBLOCKs is automatically selected.

Inference of constraints and rules

With the selected set of iBLOCKs and the modelled information of the catalogue, constraints and rules are inferred, e.g. relations between iBLOCKs. These rules influence the placement and thus lead to different shapes and geometries of the assembled satellite.

Optimization of the satellite configuration

Assembling cube-like building blocks in 3D space results in a very large number of possible configurations. Finding the optimal configuration represents a tedious task for a single or multiple engineers. To solve this optimization problem, an evolutionary algorithm with a population of 1,000 individuals is used, where an individual represents a configuration of assembled iBLOCKs. At each iteration, only 50% of the best individuals survive, while the other 50% are generated using modification operations (mutations) such as 'move', 'rotate' and 'swap'. The fitness of each individual is determined by a cost function composed from cost terms for each inferred constraint and rule.

For contact and more information visit us at:
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DLR at a glance

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