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A KNOWLEDGE BASED TOOL-KIT FOR COLLABORATIVE TRADESPACE EXPLORATION:A FRONT-END SUPPORT TO CONCURRENT DECISION MAKING

Abstract

Concurrent engineering has reached a huge popularity among companies and agencies, especially when compared with classic design approaches in early design phases. This trend is caused by all the benefits observable in early design performances. Examples are given by reduced design time, reduced costs and improvement of design quality. These qualities are also proven by the space agencies experiences. Indeed, agencies are currently adopting the concurrent approach as their state of the art approach for conceptual and preliminary design of their future space missions. Despite all the benefits obtained by the concurrent approach designers currently don't have a clear view of all the alternatives that can be evaluated when designing a space system. The manuscript presents a Microsoft Excel add-on, which can be integrated with a concurrent engineering open source software, such as the European Space Agency's Open Concurrent Design Tool. The aim is to assist the designers via a graphical user interface which integrates two main tools: autonomous generation and exploration of the concurrent tradespace and domain knowledge exploration. The generated tradespace is constrained to the choices of the other designer. In fact, the generation is obtained by the analysis of the data shared within the design team and also, by the applicable knowledge when components database and mission information are presented. The proposed tool is also flexible with the environment of application from academic one to industrial mission design and optimization. Indeed, it could be used in either academic or industrial environment, aiming to both assisting during the design phase and assisting the training activates. The user can explore the sensitivity of their choices and learn how an actual decision on his domain influences all the other technical domains involved with the design. The tool offers also the capability of learn and explore new concepts thanks to the assistance of the stored expert's knowledge that can be applied when a specific context is under analysis. Furthermore, in an industrial environment, the tool demonstrates its benefits. Examples are given by stored and updatable knowledge and guided tradespace optimization which entails reduced design time and costs. These benefits are obtained thanks to a clear and complete visualization of the design alternatives with a quantitative measure of their outcomes. Finally, the paper presents the decision-making tool within a university concurrent design facility exploring in details the peculiar characteristic and benefits given to the design sessions.