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INTEGRATION OF DIFFERENT VISUALIZATIONS TO REDUCE COMPLEXITY ON THE DESIGN OF SPACE SYSTEMS

Abstract

Aerospace systems are typically complex systems that exhibit an emergent behavior, where the behavior of the system is more than the sum of the subsystem, in the sense that their design, management and prediction cannot be accurately done with a simple combination of detached regards at the subsystem level.

They typically reveal a level of complexity measured by a combination of: size in terms of the number of items/subsystems, dependencies and required interactions amongst them; technical difficulty, since the disciplines involved require a level of understanding and background that cannot be easily perceived from the perspective of a non-specialist; and, socio-cultural issues, where they are usually designed and managed by different organizations, with different underlying objectives (for instance research institutes vs. companies), involving people with different social and cultural backgrounds that cannot be neglected.

We introduce an integrated design process including four different design aspects along with an integrated knowledge management strategy to cover the design representation needs:

- Keep track of design parameter dependencies at the system level, i.e. between the different subsystems (or domains) and their operational status,
- Increase the flexibility of the design and allowing different assignment types for the design parameters. These different assignment types typically act as design decisions and should monitored throughout the design evolution.
- In order to grasp a sense of the maturity of the design, information is given on the quality of the assignments made. This evidence can help emphasize promising designs from initial guesses by providing a metric about the assumptions made.
- The impact of each parameter on the subsystem (or domain) which requested it. Displaying this information during the design phase places the designer one step ahead of his decision, getting an idea where it will impact the most. It can help make critical design choices clearer and reduce burdensome recalculations during reiterations, and therefore increase the performance of the concurrent phase.

The earlier aspects are integrated in a knowledge management strategy where the designer is able to document his/her design decisions with certain requirements, constraints, ad-hoc verifications or any other external files. Every change made through the design process should be saved allowing the visualization of design evolution, along with the justification for that specific choice. This information can afterwards be leveraged for future similar design applications.