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INTERACTION-BASED CONCEPTUAL DESIGN METHODS FOR SPACE SCIENCE MISSIONS

Abstract

According to the design, validation and selection of the space science mission in conceptual design phase, a number of aerospace organizations have applied Integrated Collaborative Engineering (ICE) processes to the space system conceptual design, such as ESA's CDF, JPL's PDC, etc. The Chinese academy of sciences Space Science Planning Demonstration Center (SSPDF) is also based on this objective, aiming to achieve a feasible design concurrently, efficiently and effectively in the early conceptual phase. In this process, how do the SSPDF support scientists, sponsors, designers who have completely different knowledge background communicate without disturbance of comprehension, and how to lead all user mining requirements and optimizing design are problems bothering us. In the traditional way, first we define scientific goals and requirements through the literal and sheet description, or some standardized language, and then realize the preliminary design model by professional design tool. This method is getting more and more difficult to satisfy the current demand for efficiency and advanced interaction. Therefore, this paper introduces a design method to satisfy a variety of user's cognitive and intellectual characteristics, which can meet all design personnel in a certain abstract level in the early design phase. Interactivity is the main feature, which can lead scientists to the freedom of expression, and can be fully understood by others; provide an interactive environment that support creative thinking, analysis, and design for domain experts, and show understandable design results to scientists, and sponsors; let sponsors get a clear understanding of the various design results and make decisions.

This article discuss the space science mission interactive conceptual design method from the design content modeling, visualization technology and interactive process designing. The design content modeling definite design constraints, information and knowledge model which involved in the process of the design of space missions, in this paper it mainly focus on classifying and modeling of orbit dynamics design, satellite structure design and mission scenario design. Visualization technology is mainly to discuss various information visualization techniques for the design content. Interaction process designing is focus on establishing the human-computer collaborative designing process based on studies of cognitive psychology. That means according to the people's cognitive characteristics and the computer working characteristics, set up a human-computer interactive design process which can exploit their respective advantages of man and machine.