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论文

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飞机装配型架中骨架的数字化设计原理及实现

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Principle and Implementation of Digital Frame Design for Aircraft Assembly Fixtures

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摘要

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摘要 骨架设计对型架的总体性能和研制进度具有重要的影响。因此,在FixCAD系统的研制中,将骨架的数字化设计方法作为一个主要的问题,开展了专门的研究。但是,由于这些研究未考虑到现在的骨架结构中含有曲轴线和新型材元件的情况,其研究成果已不再适应于这些骨架结构的设计。为此,从对骨架轴线的抽象定义、表示和计算入手,探索和提出全新的骨架数字化设计技术,从根本上解决现有方法存在的局限性。具体包括:(1)根据骨架结构轴线及其设计方法的特点,提出线元、线列和线链等新概念,建立线元逻辑端矢的计算算子;(2)应用所提出的概念和算子,构建骨架的轴线模型、元件端面法矢计算方法、设计过程模型以及元件造型算法等;(3)介绍利用所建立的数据模型和算法技术实现的“骨架数字化设计子系统”及其应用。最后,总结了所介绍的技术特点和意义以及后续研究重点。

关键词: 飞机装配型架 数据模型 数字化设计

Abstract: The frame design significantly affects the whole performance and development time of an aircraft assembly fixture. So the digital modeling of a frame was studied as a special topic during the research and implementation of the FixCAD system. But the proposed techniques are confined to the design of a frame which only contains all the elements with straight axes and standard sections, and unable to create the modern frame structures in which there are elements with curved axes and new sections. In order to solve the problem, the definition, representation and computation of a frame sketch are studied, and a new technique of digital frame design is proposed. This paper presents the technique and includes: firstly, based on the characteristics of the frame sketch and its design, some new concepts, such as line-segment, line-series and line-chain, are abstracted and defined, and the calculi of logic end vectors of a line-segment is created; secondly, according to these concepts and calculi, the sketch model, the end vector computation of an element, the process model of frame design and modeling of an element are constructed; thirdly, with the application of the proposed models and algorithms, the new system for digital frame design is developed and some of its applications are introduced.; finally, the characteristics of the new technique are concluded and the focal points in the future researches are proposed.

Keywords: aircraft assembly fixture data model digital design

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