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基于开放式知识表示的智能化产品设计

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Intelligent Product Design Based on Open Knowledge Representation

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摘要

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摘要 基于知识的智能化产品设计是CAD技术的发展方向之一,但现有知识表示方式缺乏对产品设计人员的开放性,不利于设计人员理解和维护设计系统中的知识。针对这一不足,研究机械产品设计领域常见的公式、表格、二维映射图、过程、规则等类型知识的开放式表示方法,给出了其BNF(Backus Naur Form)范式描述,并研究了各类知识的推理方法。所研究的开放式知识表示及相应推理方法具有以下优点:1)知识不再固化于设计系统;2)知识便于设计人员自行录入和维护。最后以基于知识的航空发动机涡轮叶片气膜孔设计为例,验证了该方法应用于工程实践的可行性。

关键词: 开放式知识表示 知识推理 知识驱动 智能化设计 涡轮叶片

Abstract: Knowledge based intelligent product design is one of the pioneering trends of CAD technology. However, existing knowledge representation is not sufficiently open to product designers, which makes it hard for them to understand and maintain the knowledge in the design software. To solve the problem, open representation of design knowledge in the forms of formulas, tables, 2D mapping graphs, procedures and rules is studied respectively, and the BNFs (Backus Naur Forms) of the knowledge in these original forms are provided. Corresponding knowledge reasoning methods are proposed as well. Open knowledge representation and its reasoning methods lead to these conveniences: 1) it is not necessary for knowledge to be coded in the design software; 2) knowledge can be added and maintained by designers without the help of software developers. Finally, the knowledge based design of cooling film holes in an aero engine turbine blade is taken as an example to validate the feasibility of the design methods.

Keywords: open knowledge representation knowledge reasoning knowledge driven intelligent design turbine blade

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