

Methodology of building an automated system for design of configurable products using knowledge based engineering

ABSTRACT

Modern manufacturing companies, striving at increasing competitiveness, use different strategies. One of them is individualized mass production, also known as the mass customization, which links together features of piece and mass production. It assumes taking requirements of each client into account, by developing a variant of a product which fulfills individual needs of a client. Implementation of assumptions of the mass customization strategy requires appropriate organization of the whole production system, including the design process. In such a context, it is justified to develop dedicated computer systems, improving and coordinating design of configurable products, to shorten the process and ensure appropriate quality.

Systems of this class are prepared to meet requirements of a specific company and their development requires engaging persons of various competences, including design engineers, programmers and knowledge engineers. In literature, solutions of such a type are presented as case studies and it is difficult to find a general proceeding pattern in them. Moreover, publications which undertake a problem of design automation in CAD systems do not explain details related to the developed solutions. Lack of methodology of building a system aiding design of configurable products may be therefore a relevant barrier for the manufacturing companies, potentially interested in such a solution.

Subject of the thesis is a methodology of building a computer software system, meeting requirements of the mass customization strategy, in which configuration of a product variant can be realized by its recipient, while design of the variant is prepared in the company in an automated way, i.e. without participation of a design engineer.

The methodology was presented in a form of procedure, proposing a way of conducting work during building an automated system for design of configurable products, as well as

selected tools of the knowledge based engineering, aiding gathering, recording and implementation of knowledge about methods of designing variant products.

The thesis consists of a theoretical part and a practical part. The theoretical part of the thesis is divided into four chapters. The first chapter is an introduction, presenting a need of development of design of configurable products. In the second chapter, characteristics of configurable products are presented, as well as tools aiding processes of configuration and design. Different approaches used in design of configurable products are described. A need of developing a methodology which includes a process of using engineering knowledge is defined. In the third chapter, basic concepts and tools and methods applied in scope of knowledge based engineering, in context of the design process are presented. The theoretical part ends with the chapter four, which defines aims of the work.

The practical part of the thesis consists of three chapters. The fifth chapter presents the developed methodology, describing its stages and algorithm of building automated design system. In the subsequent, sixth chapter, the database application prepared for knowledge processing is described. It was used for validation of the prepared methodology, showing a process of building two systems for automation of design of configurable products. The seventh chapter contains conclusions drawn from the work and directions of further work.