

THE MANAGEMENT OF INFORMATIONS AND CAD IN THE CONCEPTION AND DEVELOPMENT PHASES OF A PRODUCT

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***Abstract:** In the paper is presented the importance of computer design and management in early phases of a product development. In the design process of any product, the analysis and identification of the requirements, the search for solutions, the analysis and decision of the solutions variants are very important, mostly in the early design phases, when a product needs tasks clarification, understanding of the concept and embodiment design. The whole course and main characteristics of the resulted product development project are determined by these tasks. The work and costs for design changes increase during the progress of a product development project, but in the concept phase when the decisions for the solutions are taken, are much lower. In order to make decisions between different solution variants in an early stage of a project, it is necessary to have access to relevant informations about the viable solutions.*

***Key words:** computer design, conception and development, design phases, reusing the information*

1. INTRODUCTION

For developing innovative products for new markets in the context of high demanding technology development projects, different creative methods are used by development teams. In this way, the teams are able to create a high number of concept ideas and specific informations within a short period of time. Moreover, any ideas could sometimes be valuable for following steps in the project, other projects, or other project teams.

To support the information generating process, there are several methods and different tools, to analyse product properties in all the stages of the development process. Relevant parameters, which were identified during evaluation, are used as the input values for the

selection of suitable analysis methods. By the application of different analysis methods in the early stages of the product development process, relevant information will be compiled, which is very important for further development.

In the field of mechanical engineering and industrial product development, many companies develop complex products in various series and a new design concept is needed. This design contains results of working steps, which are similar to the results of the same steps in former design projects. A lot of solutions can be derived from an earlier project or the choice between different solution variants will be based on a similar set of criteria met at another project.

Therefore, a structured access to information and empirical studies are the keys for the improvement of design work. Likewise, a clarification of the tasks at the beginning, the structuring of the main problems into sub-problems, the search for solutions, the analysis of the best solutions, their combination to a concept are common steps in every systematic product design.

As the results, the engineer will obtain the requirements list, a structure of functions, principle solutions, characteristics, combinations of solutions according to criteria derived from the requirements. A methodical procedure in the concept phase produces the information, which is also necessary in following design projects. There is a direct link between methodical work in the early design phases and the capturing and reuse of design knowledge. This link needs special software for supporting systematic work in the early design phases, for compiling design information automatically in a structured way and for providing an easy access to it.

2. COMPUTER SUPPORT IN THE PRODUCT DESIGN PHASES

The structure and assembly of most products is becoming more complex every day. Computer support in engineering design is focused on the modelling of geometry with computer aided design (CAD) systems and on providing product related data for the following stages of the product life cycle. In most of cases, engineering designers start their work without an appropriate access to the entire information collected, in former similar projects. Very often this leads to a reinvention of the solutions. The main idea is focused on the solution development by providing solution principles derived from existing patents or finished projects.

Existing CAD systems have been enhanced in their functionality by the integration of feature modelling techniques, parameterization and constraint handling. The possibilities for parallel design of sub-parts for products which are later brought together, in addition to control techniques for these processes, must be further developed.

The general demands on a practice oriented software tool for knowledge management and systematic support in the early design phases are high. Under the permanent time pressure, working with the software tool has to speed up the design process from the first day of use. Also, the tool has to support the designer in creating the design documents in a comfortable and automated way. The created documents need to be standardized according to norms and should be demanded by the management in order to fulfil standards such as ISO 9001. Working with the tool will be faster even in the first time, when there is not the advantage of accessing relevant information or reusing documents from former projects. Regarding the methodological support, an education in systematic design should not be a prerequisite for working with the tool. It has to be very simple and flexible in operation and in its general methodology.

3. REUSING THE INFORMATIONS

Recent studies estimate that ‘90% of industrial design activity is based on variant design and in such a redesign case ‘70% of the information is re-used from previous solutions. The concept of re-using information is inherent within the natural process of design. The origins of formal design re-use are found in the realms of software engineering where re-use became a realistic solution to problems caused by increasing complexity.

The complexity in design is view in such diverse factors: as the product being designed, the design activity itself, the engineers involved, the decision making process, the aspects on the design, knowledge and sources used and generated. Every issue affecting each of these factors has it’s complexity. Even the simplest product is associated with a complex array of factors, which model the activity of design and consequently the final product definition, and result in a vast accumulation of related design knowledge. The final product definition is dependent on: the company organisation, the type of design, the chosen design process, designers, tools and external factors out of the designers control.

Thus, the design team meet a complex problem in creating knowledge for re-use. The problem is further amplified by the differences in terms of characteristics, types, sources,

forms and origins of design related knowledge, which can be considered from many viewpoints such as: functional, structural, and behavioural.

Design by re-use relies on the availability of appropriate knowledge sources. This requires a suitable knowledge modelling mechanism to support design for re-use which would capture knowledge from differing sources and represent an evolution through the design activity. Formal knowledge modelling mechanisms which adequately support design for re-use must be capable of defining knowledge elements. This would facilitate a better understanding as to how and why design knowledge had developed into the final product definition and provide the designer with a greater knowledge resource to utilise in future projects.

4. KNOWLEDGE IN PRODUCTION PROCESS

Several information has to be handled for the manufacturing of a specific product. These information is represented by three major information models: product model, resource model and process model (Figure 1). The amount of information rises owing to higher product complexity and an increasing number of variants. Improvements in the field of manufacturing processes lead to complex manufacturing knowledge. Thus, efficient information management is very important in the conception and development phases of a product.

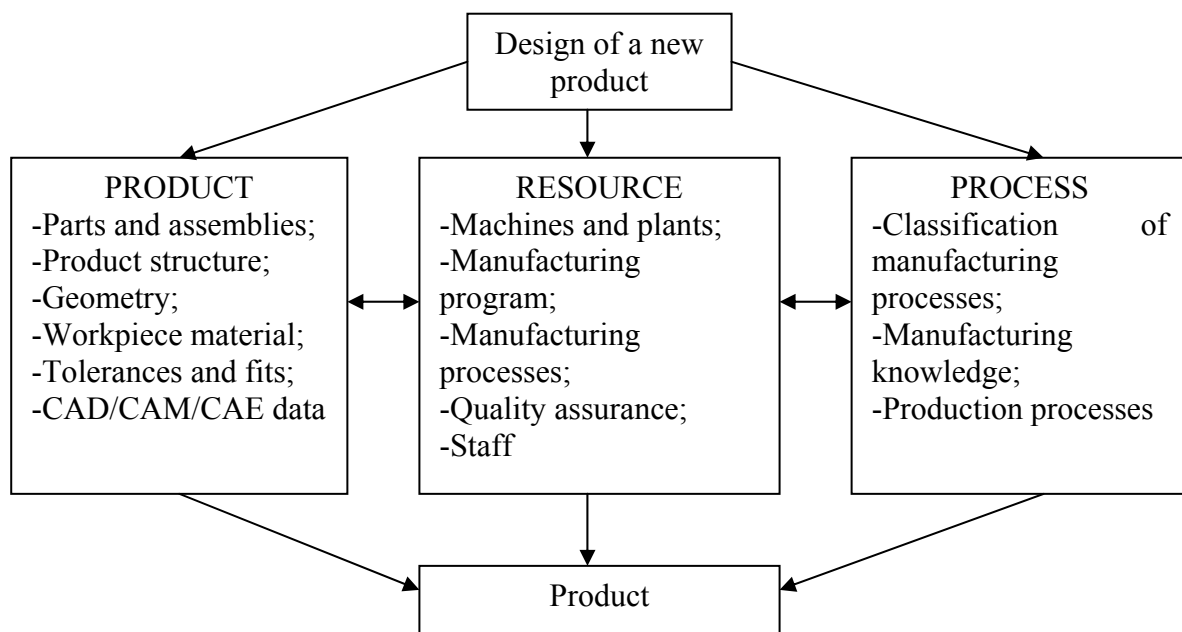


Fig. 1. Information models in the production engineering domain

The information flow can be separated into two major flows: one flow focusing on technological details of the product and another one preserving economical or administrative information. These two separated flows correspond to the differences between process planning, production control and scheduling systems. The traditional approach of separating planning activities (e.g. process planning) from implementing activities (e.g. production control and scheduling) results in a gap between the involved systems. It implies loss of time, of information and, in consequence, loss of quality and prolonged time-to-market.

5. CONCLUSIONS

The implementation of methodical design procedures is a very important step in computer design. The management has to ask for informations and CAD data for tracking the work in the determining early design phases. The computer does not only support systematic work of the designers, it also asks for a systematic management culture which is in continuous attention in the early phases and not only in task forces, when avoidable mistakes due a former lack of leadership are hurting in later project phases.

Today, a link is needed between knowledge management in the early design phase and product data management functionalities in the embodiment and detail design. A computer with the right software can help to compile the conceptual design knowledge and to link it to the further product data management.

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