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## PRODUCT MODELING WITH KNOWLEDGE STORAGE

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**ABSTRACT:** Perhaps the most important issue in engineering design is transfer of designer intent and knowledge into product model definition for purpose of future using of that model by another engineers working on the similar projects. Product model knowledge must be defined or approved for specific tasks in accordance with effective company standards by engineers who are responsible for product design. This paper is devoted to intelligent product modeling for the present-day engineering design methods in Product Lifecycle Management (PLM) systems.

**KEYWORDS:** Knowledge management, knowledge tools, CAD model

### ❖ INTRODUCTION

A customer's requirements increase from year to year. Today is not important only quality of one product, but a choice from more variants of product. That forces producers to be more flexible, effective and more innovative and to look for new methods of engineering work. Every new design task is decisively guided by the engineer's experience, i.e. by the understanding he acquired in earlier works. This fact does influence not only the knowledge itself but also the way the design process is arranged.

There are many of publications devoted to design knowledge in terms of Knowledge Management or Knowledge based Engineering in some information system [1], [2]. But knowledge's are there understood more generally, for example manufacturing time, product costs, list of customers etc. Knowledge Based Engineering (KBE) can be described simply as the process of capturing product design knowledge, and re-using it. This is accomplished by defining the parameters and rules of the design process, and integrating them into design (knowledge) templates. The resulting output is a dynamic product that allows designers to adapt the product without a complete re-design. Knowledge Based Engineering can also be used to eliminate error by ensuring compliance with established standards and design methodologies.

Knowledge-based methodology together with advances in information technologies facilitates development of engineering modeling systems with enhanced decision assistance capabilities. Objectives for including knowledge in engineering design at a higher level are motivated by increasing role of corporate knowledge based modeling in product lifecycle management (PLM) systems. One of the primary objectives in present research works in engineering design is to establish structured knowledge for product models.

### ❖ DATA, INFORMATION AND KNOWLEDGE IN DESIGN DECISION

Traditionally, knowledge in computer based solutions is represented in very pure form, most of all through recent product model or product drawings. However, in the practice of computer assisted engineering, knowledge must be defined or approved by engineers and managers who are responsible for product, production, marketing and other activities.

Decisions in design process bring new knowledge. This knowledge is however based on recent data, information and recent verified knowledge created in recent projects. To move design process from one stage to another, it is necessary to have information about actual stage of design and about next possible solving or procedures for new stage (Figure 1). This process is "value adding" because of designer applies his creativity and changing it to the new knowledge.

Each design process can cause a new impulse which may become the basis for a new knowledge element. This is especially important to modeling of more variant products. Handling of knowledge is a complex task because it includes definition, import, capturing, reusing, sharing, and general management activities, namely Knowledge technologies. Knowledge technologies are new computer based techniques and tools that provides a richer and more intelligent use of Information Technology [3].

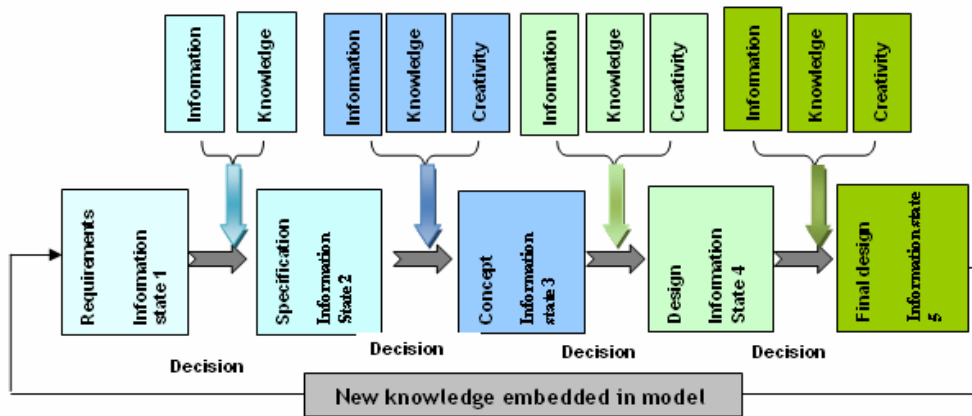


Figure 1. Data, information and knowledge in design process

Knowledge Technologies are tools for knowledge processing, as follows:

- Identifying what knowledge is important to an organization
- Deciding what knowledge needs to be captured to provide an appropriate solution to problem
- Capturing and integrating knowledge from expert practitioners and existing repositories
- Representing and storing knowledge in ways that provide ease of access, navigation, understanding, maintenance and reuse
- Embedding knowledge in computer system to provide significant and definable benefits to organization

In engineer work is simple knowledge representations such as rules and checks preferred in order to easy define and understand designer intent embedded in product model. As technologies get progressed, CAD software incorporated more and more engineering knowledge and covered new activities and processes in a sphere of mechanical engineering. Twenty first century is typical with development and implementation of “intelligent solutions” in any area of human life. Present CAD systems dispose of intelligent tools, which provide a possibility to embed design intent and knowledge directly in CAD model. For example CATIA V5 includes module which name is Knowledge ware. That is a design tool which allows users to embed knowledge within design through parameters, formulas and rules and leverage it to assist in engineering decisions, in order to reduce errors or automate design, for maximum productivity. Knowledge is then taken into account and acts according to its definition (Figure 2).

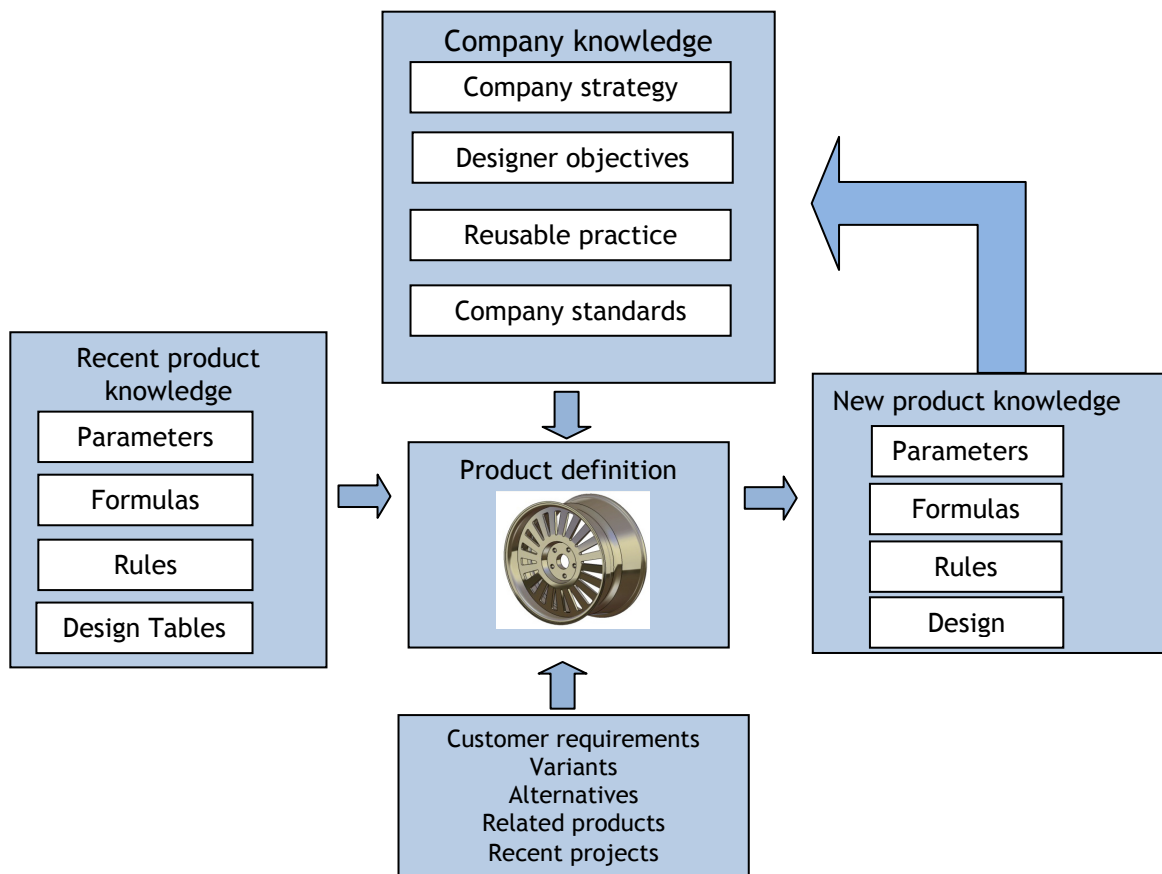


Figure 2. Product Knowledge Embedded in product design

Many companies today employ CAD technology on multiple projects at the same time, often across a number of offices, even across several locations worldwide. This combined with the trend towards outsourcing and off-shoring of production, means it is vitally important for enterprises to have designers using CAD software in high standards.

#### ❖ PRODUCT LIFECYCLE MANAGEMENT – TOOL FOR PRODUCT KNOWLEDGE SHARING

Besides CAD systems in last 20 years have arisen systems for better control and reusing of data and data documents (EDM - Electronic Data Management, PDM-product data Management) for better saving and storing enterprise knowledge and intellectual capital. The necessity of integration of data and processes in product development has given rise to a new category of software solutions known as Product Lifecycle Management (PLM). PLM is philosophy based on Concurrent Engineering and collaboration and integration in product development process. PLM is a strategic intelligence that permeates enterprise wide tactical and operational decision-making.

The right decisions are based on getting the correct data in real-time in the right format and at the right place. PLM is about integration of existing enterprise systems as CAD, CAM, CAE, ERP, and PDM etc through the collaboration web portals. The target is to completely envelope and controls the creation, test, manufacture, service, and recycle of product. Very important is a fact that PLM system allows a using and reusing the common shared enterprise knowledge (Figure 2).

From designer point of view managing of knowledge of product model require first of all to embed structured knowledge directly to CAD model. It is not easy and consequences are that enterprises use only 4% of enterprises knowledge in structured and reusable form [1]. The rest is either in paper form or in heads of engineers or managers. Creating of structured knowledge and its transfer to explicit form is a main goal and role of Knowledge Management. This is in the same way also the role of PLM, which provide sharing of information and knowledge in electronic form through the web.

In recent years provide CAD systems a possibility of knowledge embedding directly to CAD models through so-called Knowledge tools that modify implicit design to explicit knowledge reusable in next projects and help to store know-how of enterprise. Through the Knowledge tools is possible to transfer knowledge that is clear to human to knowledge that is clear to computer.

For purpose of more variants products design represent Knowledge tools a meaningful simplification of engineering work and relevant time saving. With Knowledge embedding is engineering work more flexible and quick. Knowledge created during design of product model is stored in database as template documents for future reusing. This database is directly integrated in PLM system. It is specific type of intelligence embedded to system. *Designing in context* is procedure that facilitates not only intelligent models of separate parts, but also intelligent assemblies that have parameter relations between parts and rules embedded. Each part can be modified and all assembly is able to response and adapt to that changes.

#### ❖ CONCLUSIONS

It is assumed that throughout the years not only big firms but also middle and small enterprises will have to accept a new strategy of product development that provide knowledge management systems and CAD system with knowledge features. These modern methods of engineering work generate also a new qualification of knowledge engineers that will universities of technology have to produce in future.

Product modeling in product lifecycle management system has been developed into a high level of knowledge representation. The way towards knowledge and intelligent modeling requires also new skills of new engineers, so that is necessary to implement new approaches in education at the universities of technology.

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Figure 3. Product Knowledge sharing in Product Lifecycle management