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### **A Concurrent Engineering Information Model Based on the STEP Standard and the Theory of Domains**

An information model that is capturing product and manufacturing system design, as well as the idea of concurrent engineering, is emphasized in this paper. First, a case product is decomposed along with its manufacturing system, according to the Theory of Domains. Here, the manufacturing system is regarded as a technical system that is equivalent to a product. Thereafter, the generalization of the case study is conducted by creation of an UML (Unified Modeling Language) information model. The UML-model is containing some general couplings between products and manufacturing systems. This formalized map of the area of product and manufacturing systems development is also harmonized with the international STEP AP214 standard.

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### **DAMOCIA-Design. An Experience of Design of Greenhouses Structures Modeling the Professional Knowledge with CommonKADS**

In this paper, we presents a knowledge intensive design tool, DAMOCIA-Design, which supports the design of greenhouse structures. After stating the initial necessity of a specialized tool that helps the agronomic and industrial engineers developing more competitive greenhouse structures for our area, we presents the evolution of the design tool through three successive versions, analyzing and justifying their technical characteristics and capabilities. Main reason of this evolution was the increasing requirement of flexibility of the design system. Ordering the diverse knowledge contributed by the field specialist, reusing as much as possible work methods and software elements], was the main objective of the third version of the design tool. This was primarily a problem of knowledge management and acquisition, deciding to use the CommonKADS methodology.

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### **Modularisation of Knowledge - a New Approach in the Field of Product Innovation**

Contents of product development knowledge have to be available in a broad range and rank high in quality for teaching, learning and applying. Individuality in presenting and high flexibility in use and arrangement are requested. An approach to modularisation, filing and accessing of various contents of product development knowledge has been developed, considering the requirements of different users. Contents of product development knowledge are modularised based on three levels – elements, modules and containers – and linked and integrated into a knowledge pool. Appropriate modularisation is considered as a basis for higher quality, better understanding of design sciences and improvement of communication and collaboration.

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### **Integrated Engineering Environment**

Today's major industrial challenge in computer-supported product development is to establish corporate development across enterprises. Corporative distributed product development and engineering processes require extensive use of advance information technology. Especially important is the support of distributed processes and the management of distributed product data as well as of other engineering information resources. This article describes an approach to the integration of the product information and product knowledge management using the proposed information model of product which is compliant to the STEP (ISO 10303) international standard. The proposed product knowledge and data information model (PKDIM) is shared between interoperable IEE modules.

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### **Annotation and Knowledge Creation**

Annotation is a natural way for adding information to a specific representation. Every designer knows that, and it is the first thing a designer do when he wants to express a point of view or argument on a solution (evaluate, criticise, ...). Most of the time these annotations remain informal and are considered as mere supports to a verbal exchange. We want to show in this paper that annotation is more than that, and that it is important to consider them as complex and composite elements. We argue that providing annotation facilities within CAD systems is not enough. Regarding what we exposed before we think that a work must be done in formalising organisation that will support annotation process in all its dimensions. For example functionalities of creating, storing retrieving new symbols should be implemented. Rules elicitation and formalisation should be implemented too, without forgetting the level of organisational learning. Indeed, we consider that the process of creating the rule is as much important as the rule itself.

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### **An Integrated System for Improving Lighting Design Strategy**

Architectural illumination is typically designed at the end rather than the beginning, a design process. Designers use visualization to make relevant suggestions concerning lighting as illumination and lighting require expertise. However, in the early phase of a design development process, no alternative lighting or illumination systems are considered by the designer. Therefore, the scope of this research is about artificial lighting in office environment. Expert knowledge and hierarchy searching technique structure the whole system. During initial tests, users are able to use their own design strategies to construct the desired lighting strategies; the effects of system modulation can help users evaluate diversified lighting alternatives.

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### **Aspects to the Coordination of Collaborative Design**

This research studies methods for providing design process support for distributed groups of designers, to allow them to collaborate and co-ordinate their actions, within the context of collaborative design. The process that allows designers to collaborate and coordinate their actions, is seen primarily as an interactive and social one. Using the proposed web-based asynchronous groupware application, designers coordinate their actions but managing what sorts of activities others expect them to perform, and by monitoring the degree of social approval that such plans acquire within the design team community.

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### **Potentialities of Application of the Emerging Systems Engineering Standard AP233**

Nowadays „systems engineering“ is a discipline which is mainly employed in the domains of aerospace and aeronautics. Nevertheless, this discipline is also applicable to other domains. One of the problems in current engineering work is the lack of interoperability of different software systems used in the design context. The emerging ISO Standard “STEP 10303 AP-233 – Systems Engineering” will solve this major problem and opens the door for new applications over several domains using product design data. An overview is given about the current status of the AP-233 information model and the corresponding standardisation activities. Perspectives for further applications of the standard are provided in a concrete example.

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### **The Creation of a Knowledge Sharing Culture for Effective Knowledge Management**

This paper is based on research carried out as part of a workpackage concerned with change management in the 'Experts Enablers in the Machine Engineering Domain (XPERTS)' project. XPERTS is part of the Information Societies Technology programme sponsored by the European Commission. XPERTS seeks to provide a means to capture and store the collective knowledge and experience of designers for its management.

This paper focuses on what needs to be communicated to designers. It describes the construction of training programmes aimed at removing resistance to change by enabling designers to understand how they will benefit from using XPERTS.

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### **Knowledge Management to Support Innovation Processes**

In the commercial world of today knowledge and knowledge management are supposed to be indispensable prerequisites for the competitive ability of companies. This is why in the age of flood of information, sinking knowledge stability and communication highways, the efficient use of the resource knowledge becomes a central strategic topic.

The linkage of innovation and knowledge management with the target to improve the innovation ability of companies can be seen as a possibility of arranging the future of companies. This is positively influenced however not only by implementation of a constantly learning organization but increasingly also by the ability to integrate external resources into innovation processes.

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### **A Simulated Brain Model for Products' Creative Design**

Based on cognition psychology, information technology, artificial intelligence, and knowledge mining based on database over Internet, etc. the paper build a simulated brain model to aid creative design. The core of brain model is a three lever memory structure of knowledge layer, conception layer and signal layer and some responding control mechanism to use the knowledge saved in memory.

Now, we had built a prototype model and some preliminary results have been applied in a computer aided industrial design system. Simulating brain to manage, organize and apply design knowledge, it is not only a road to systematically transplant design knowledge to software, but also an exploration to building brain-style information system.

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### **Early Validation of a Design Method Based on Structured Reflection**

The consistency and usefulness of a design method based on the idea of structured reflections (DMSR) are difficult to assess without having a working software prototype. In order to develop software requirements for such a prototype it is useful to validate the ideas underlying both the method and its formalism as early as possible. The presence of credible user feedback facilitates decisions in later stages of the development.

This paper describes early validation of DMSR. The usage of a re-engineering context for design assignments allows validation of a simplified version of DMSR without having dedicated software at hand. We present our approach together with an example of its practical usage and the results.

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### **Introducing Nucleus as a Modelling Entity for Product Design**

At this moment detail design has been well supported by feature technology, but unfortunately, it has no capabilities to support the intentional aspects of design. Therefore, the conceptual design stage is poorly supported by feature technology, since the intentional aspects of design are not captured. A new modeling paradigm, called nucleus technology is introduced to cover what cannot be covered by feature technology. In this research physically coupled pairs concept is applied, in which relationships between at least two objects are specified. And half spaces or portions of two objects, that are materialized and non-materialized, representing the two objects. Hypothetically, this entity not only can be used to represent part of a component, but also to describe the interactions between components in assembly modeling as well as the changes in products modeling.

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### **Upgrading a CAD System with Expert System**

The article describes an expert system which is fully adapted to computer aided development of products in mechanical engineering and is based upon feature technology. It supplements the features of commercial 3D modeller with semantical descriptions. We can prescribe qualitative constraints and the rules that, besides geometrical constraints, consider operating conditions, manufacturing technology, assembly, transportation, etc. Every attempted change, input by the designer, is first checked by the expert system. Considering the rules, contained in its knowledge base, it adapts the technical system in a way that it corresponds with the input change. The design procedure is therefore shorter and the designer can automate individual phases. The greatest effect can be observed in designing complex typified assemblies.

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### **Synthesis and Analysis Steps According Product Precision in Early and Later Development Stages**

The Precision of Technical Systems can be divided into the term Accuracy in early stages and Tolerances in later stages of design. In the early design stage, the requirements acc. the precision of positioning systems etc. have to be fulfilled by the technical system. The tolerances are then the realisation of the accuracy by form, dimensional and positional tolerances acc. DIN ISO 1101 and references acc. DIN ISO 5459 on the existing embodiment layout.

Both mentioned fields are not supported by simulations systems. Our approach is a multi-body simulation system. It contains non-ideal joints with allowed little movements in all cartesian directions, which represent the accuracy in early stages and the tolerances in later stages. The integration of this method into the design system mfk supports the designer in a suitable way.

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### **Supporting the Early Stages of Product Design by Function-Based Tools**

The state-of-the-art in the early stages of design is a situation, where practically no computer-supported tools for a designer's work exist. To get rid of this problem and to make decisions comprehensible and clear to other collaborating designers, a tool called "Engineering Workbench mfk" has been developed at our institute. To support especially the early stages of design, the tool "FunctionStructureModeller" was created as a further module for this extensive workbench. In the paper on the one hand the methodical approaches to this software-tool will be presented. On the other hand the "FunctionStructureModeller" will be introduced.

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### **Integrating Design Processes in an SE-Environment**

The principle of Simultaneous Engineering (SE) has generally reached its limits. Today the issue of process security is central in product development. Therefore enterprises will have to work out a Standard-PDP (Product Development Process) with the participation of all relevant departments and hierarchy levels. Otherwise process security can not be secured as design processes become increasingly complex.

The aim in this contribution is to:

- take a close look at interdependencies between design processes and other processes in product development;
- show how SE-processes can be shaped by a combined effort of the entire organisation;
- give an example of how agreement was reached at an automotive enterprise on project phases and milestones.

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### **Decision Based Knowledge Management for Design Project of Innovative Products**

This paper describes a framework to analyse decision flows in design projects of innovative products. The objective is to provide tools to specify KM systems that satisfy projects stakeholders' needs. The approach is based on a model of decision flows with 2 views. An organisational view leads to decision processors identification and processors interactions identification. Another view characterises the functional aspects of the decision flows and their nature.

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### **A KBE System to Manage the Module Configuration Using the Corporate Knowledge**

A key point, today, is the development of products that fulfil the individual customer needs as close as possible. The market trend, hence, is towards the "mass customization". However, mass customization in itself introduces new demands on firms, these include improved product development processes, flexible manufacturing planning, and closer supply chain management.

The goal of our research is the identification of an approach (method and technology) for the design of product families that can be configured for the needs of SME's.

The objective of the present work, in particular, has been the development of a KAE system application to shorten the time of module configuration phase (instantiation) aiding the designer decision-making activity.

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### **Modelling the Relation Network in the Integrated Product and Design Process Model**

The aim of this paper is to consider criteria for classifying the relations in engineering data structures. Some methods of modelling the network of relationships in the object-oriented environment are proposed. The network of relations is considered as established between objects which are instances of classes in the object-oriented design process and product model. In the presented approach, the relations between objects are also viewed as objects. An instance of such class represents binary or n-ary relation between instances of elementary classes. Having a class that represents the relation, the procedures of searching, retrieving and updating are easier to implement and maintain. The prototype of proposed system is developed in object database environment.

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### **Variant Design Based on Product Platform**

This paper details the approach for design a product variants based on the scalable product platforms, called scalable product variants. A short overview of the terms in product variety it is given. Support of design a scalable product variants is tied with the system managing of product structure and geometric information. Product platform model, as a basis for developing scalable product variants, is proposed by two information models. The first information model is focused on the product structure information and it is linked with the information model which is focused on geometric information of product.

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### **Management of Different Types of Configuration Knowledge with the K- & V-Matrix and Wiki**

The K- & V-Matrix is a description language for configuration knowledge. Its focus is on small and medium sized enterprises. While easy-to-use, it allows the user to describe a significant part of this knowledge. However, although the K- & V-Matrix is a good approach, not all configuration knowledge can be managed with it. Especially when it comes to unstructured configuration knowledge, the K- & V-Matrix is not applicable. To solve this problem, an easy but effective way to describe unstructured configuration knowledge and integrate it with the K- & V-Matrix is needed. A solution to this problem, its functionalities, its integration with the K- & V-Matrix as well as the knowledge acquisition process related to it will be discussed.

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### **The Artificial Intelligence Application to the Analysis of the Constructive and Working Parameters of Plane Mechanism**

A computer based analysis method of a plane lever mechanism is described in this paper. Software, based upon conventional methods of analysing plane lever mechanisms, is developed for a concrete mechanism. The database, consisting of the results of the software based calculations of kinetic and dynamic values for the kinetic and dynamic analysis of the observed mechanism, were used as a basis for a more comprehensive analysis of the dependence of certain outlet values on the set inlet variables. The adaptive neuro-fuzzy module of conclusions drawing was used in this paper for this purpose, which is, as a matter of fact, the application of an artificial intelligence to resolving the analysis problems.

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### **Examples of an Expert System in the Estimation of the Quality of Lubricants**

By applying expert systems and new systems of automation of the experimental researches based upon experimental methods, it is possible to come by quantitatively and qualitatively significant databases. The results obtained by means of analyzing oil of a certain type, as one of the experimental methods, are used to generate a neural network as a system of an artificial intelligence as well as in the admixture of the ANFIS module of drawing a conclusion in the oil quality estimation.

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**A Study on the Characteristics of Product Color on the Internet - With an Emphasis on the Interaction Between the Expression of Product Color Information and Color Perception**

The internet has offered the breakpoint changes for design research though, some studies have indicated the importance of comprehending customer interactions in prior to adhering to technological development. Therefore in designing digital contents on the internet, it is necessary to understand the attributes of the user's behavior in a new media environment related to.

The purpose of this study is to identify representational methods of delivering product color information on e-commerce, and to analyse the internet user's color perception depending on those methods. Accordingly literature reviews, web analyses and empirical studies are carried out, and finally main influential factors are categorised with a set of guidelines.

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**Knowledge Technologies in Engineering Design**

An analysis of recent research on knowledge technologies in engineering design shows that a majority deals with modelling issues. The interest in acquiring and retrieving knowledge seems to be dropping, whereas reuse gains more attention. There is little research on publishing and maintaining knowledge. These findings are confronted with current development in knowledge technologies and with industry needs.

Future research will have to consider the development potential of technologies to reuse, publish and maintain knowledge. Acquisition, modelling and retrieval issues are though not to be neglected. Research should be carried out in multi-disciplinary projects. Industrial partners should consider the practical impacts of tools developed.

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**Transparency in Documents and Activities in Product and Process Development at Automotive Suppliers**

The development processes of three companies are analyzed and laid down in three representations. These representations are compared and based on the similarities found in these comparisons a so-called example model of the development process is created. In this example model the knowledge and experience of the three companies is bundled. On the one hand the example model can be used as an initial expectation when charting an as-is situation of a company and on the other hand the model is useful as a resource of ideas when creating a to-be situation for a company. In the paper the format of the representations is shortly explained.

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**Overview of the Initiatives on the Development of Designer's Toolkits**

We investigated the initiatives on the development of designer's toolkits by a literature search. To categorize the tools for the different design phases we use a design model. Also an historical overview is given. The main difficulties described in the literature are discussed. Also three initiatives to develop a complete toolkit are presented. We conclude that the first phases of the design process would benefit from a tool which guides the designer in the retrieval of required information and helps to structure data generated in these phases.