A DESIGN METHODOLOGY FOR MAINTAINABILITY OF AUTOMOTIVE COMPONENTS IN VIRTUAL ENVIRONMENT

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The present paper deals with the problem of the ergonomics of maintenance tasks in automotive industry pursuing the following aims: analysis of Human Modelling Software and their use in automotive task analysis; development of a design methodology (named EDIVE) for maintainability of the component parts of a car engine compartment in a virtual environment and, finally, the individuation of an optimal postural sequence to disassemble such components, taking into account human factors. In the paper the authors show how to integrate DMU tools and Digital Human Modelling software in order to individuate the optimal postural sequence of an operator that have to disassemble a component part of a car engine compartment.

COLLABORATIVE TOOLS FOR INNOVATION SUPPORT IN EARLY PRODUCT DESIGN PHASES: A CASE STUDY

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787

During early phases of product design projects, co-operation processes are quite informal and the confrontation of the different actors' points of view leads to unstructured information exchanges. However these phases are strategic for the introduction of technological innovation. We realise a study of the innovative process in Renault VI. We demonstrate that a collaborative tool must be proposed to help actors to structure information and to use specific collaborative functions. We propose first the configuration of a PDM system (Windchill Project Link-PTC). Second we develop a specific collaborative tool named ID2. Then we discuss about these two approaches and their integration in large companies.

CONCEPT OF AN INTERNET-BASED PLATFORM FOR AN EFFICIENT TECHNOLOGY ABSORPTION

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775

Companies rely on external sources of technology in order to apply innovations to their products. Thus, the absorptive capacity of companies, defined as the ability to identify, import and apply new technology, becomes critical to a company's innovative capabilities. Based on existing literature a process model for technology absorption is developed. Obstacles and practices of this process taken from an empirical study are linked to the different stages of the process in order to structure the problems and practices. Finally, a concept is development and briefly introduced to reduce the obstacles and therefore facilitate a more efficient absorption of external knowledge.

BENEFITS AND CHALLENGES OF COLLABORATION IN SMART CLOTHING DEVELOPMENT

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697

As smart clothing development involves many disciplines, the challenge is to reconcile the different views. A strategic approach and NPD process for this collaboration is required. An in-depth understanding about every discipline's work method and personal opinion on how to achieve an optimum of collaboration is needed. This paper examines these issues and reveals the benefits and challenges of collaboration and the future design direction of smart clothing. The result indicates that this industry will take a functional approach. To achieve a radical outcome, the optimum balance between technology and fashion, each discipline needs to go beyond their existing creative boundary and take the other disciplines' work methods into consideration.

AUTOMATIC LANDMARKS PREDICTION USING THE ARTIFICIAL NEURAL-NETWORK-BASED TECHNIQUE ON 3D ANTHROPOMETRIC DANA

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817

The surface of the human body offers a multitude of topological and geometric information which constitutes the main parameters to be taken into account in product and workspace design. The added components of shape provided by 3D scanning offer a more detailed description of human variation compared with traditional manual 1D or 2D data. Landmarks extracted from 3D scanning data can be considered as a reduced 3D configuration of the human body. The Automatic Landmarks Prediction Method is based on the configuration space theory which is widely applied in biology. With the configuration space theory, this paper researches Landmarks using a neural-network-based technique on 3D anthropometric data.

RELIABILITY OF ACTIVE SYSTEMS - AN ESSENTIAL DESIGN ASPECT FOR COMMERCIAL SUCCESS

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In this paper examples will be given to show and assess the significance of the reliability of active systems. The usability period and the failure probability of each system component is essentially depending on the particular operational loading and environmental conditions. It is important to redefine the term failure since with complex active system consisting of highly interacting structural, electronic and software components, a mere consideration of mechanical failure would insufficient. The system reliability analysis especially for active systems produces the possibility to quantify the failure probability with respect application specific concerns and with this to optimise these systems.

STREAMLINED COSTING AND TARGETING OF PRODUCT FUNCTIONS IN VALUE ANALYSIS

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Function analysis is a critical step in product redesign projects based on the Value Analysis methodology. The paper deals with how a product can be more readily and effectively described at the abstraction level of its functions, with special focus on costing and targeting tasks. In the calculation of function costs, it is shown that the complex reallocation of product costs to functions can be limited to a predefined subset of parts. Simulation and regression analysis are used to estimate subset size from simple indicators which are easily evaluated for any product. In the selection of target functions, a fuzzy-based procedure is proposed to point out the most appropriate redesign actions and to evaluate priorities among them.

OBJECT-ORIENTED PRODUCT MODELING FOR EARLY ASSEMBLY COST ESTIMATION

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Although an early assembly cost estimation can lead to decreased manufacturing cost, existent methods do not support sufficiently such an estimation. Therefore, an object-oriented product-modeling framework for the early estimation of assembly costs for new or prototype products manufactured as a unique-manufacture or in small series by means of manually or hybrid assembly systems is presented in this paper. Based on the systematic engineering design theory critical product factors with assembly cost relevance are classified in an object-oriented scheme. Then, based on the fundaments of the systems engineering theory an object-oriented class structure is established in order to introduce the assembly.

AN ADVANCED VIRTUAL REALITY MULTIMODAL INTERFACE FOR DESIGN

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717

Recent research efforts have shown how the use of Virtual Reality (VR) and 3D input devices can significantly aid the initial design phases providing designers with tools that support their natural attitude towards creativity. The system here documented pushes this approach further by introducing a Multimodal Interface for an immersive design tool. The system becomes a valid aid for to the user's creativity and it provides a powerful support to the user's sensorial system by providing an interface mechanism founded upon the effective backing of human communication patterns. This allows both a major decrease of user's fatigue, due to increased ergonomics within the design workplace, and an important incensement of the overall efficiency.

A NEW APPROACH FOR GESTURE-BASED SKETCHING

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735

Tools for engineering design like CAD don´t support creativity in the early design phases. Instead, paper based sketches are still the conceptual designer's first choice for fixing his ideas. Gestures are an intuitive way of behaviour of people. An approach was developed. A data glove is used as input device at a Barco as output device. For interacting intuitive gestures for sketching are defined in an user interface. To validate the approach was evaluated with the following criterias: User friendliness, creating geometry, moving, selecting, and concretisizing of lines. The results were good, nevertheless there is some potential for optimization: Fusion of action- and perception-room, enhancing of the tracking, and an improving of the GUI.

AUGMENTED REALITY AS A NAVIGATION AID FOR THE MANOEUVRING OF HIGH-SPEED CRAFTS

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741

Several accident reports involving high speed crafts (HSCs) show that the major cause of accidents has been that navigators have trouble interpreting radar information. However, with the introduction of Augmented Reality, navigational information can be presented in the "out-the-window scene". The goal here is to find out how the introduction of augmented reality affects the manoeuvring task. Our results show that experienced operators using augmented reality drive faster, have less deviation from the route and have more visual focus on the "out-the-window scene". It is concluded that such changes must be analysed more thoroughly, and that the new technique must be developed further in cooperation with the real experts, the skilled users.

CHEAP PHOTOGRAMMETRY VERSUS EXPENSIVE REVERSE ENGINEERING TECHINQUES IN 3D MODEL ACQUISITION AND SHAPE RECONSTRUCTION

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749

The aim of the paper is to verify a procedure both for acquisition and reconstruction of 3D CAD Models combining photogrammetry and R.E. techniques. This procedure utilizes some photogrammetry-based software. 3D points cloud obtained using photogrammetry software has been compared with CAD model by means of some mathematical tools.The several tests made on different objects confirm the usability of this approach to many real cases where the high accuracy is not mandatary and a fast and cheap solution is required.

TWO REVERSE ENGINEERING METHODS FOR THE RECONSTRUCTION OF AN HIGH SPEED CRAFT SURFACE: A COMPARISON

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755

The aim of the present work is to determine an optimal method for a virtual reconstruction, through Reverse Engineering (RE) techniques, of the hull of an high-speed craft (HSC).A laboratory has been set up for the acquisition of a 4 meter long HSC hull.RE techniques allow to make the digital duplication of a physical object starting from a point cloud acquired with a 3D scanner.A specific algorithm for fitting is proposed to have a local and global control over the reconstructed surfaces.The tests show acceptable errors by means of the custom algorithms.

A SOFTWARE BASED SYSTEM TO SUPPORT THE DESIGN FOR DISASSEMBLY

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In this paper, the current state of a software based system to support the design for disassembly is presented. This system, called "Design Support System", is based on a common partial product model that is capable of representing a large spectrum of information relevant to disassembly and recycling, which is used to describe centrally stored product data. To allow a wide range of tools and applications to access this data, a distributed object oriented approach is proposed, based on CORBA as an open and accepted standard. Using a standard CAD software and a modelling/analysis tool for product structures as an example, it is shown how within such a framework existing applications can be adapted to interact with custom-made software.

PARAMETRICAL CAD MODELS AS A DATABASE FOR MASS CUSTOMIZATION CONFIGURATION PROCESSES

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The paper presents a possible approach for the intensive integration of the customer within the product development process. Existing methods to deal with the complexity of product development cycles have been adopted to fit the new requirements for individualized products. By increasing efforts in the middle stages of the product development, costs for late changes can be reduced rigorously. Formulas, rules, and other parametrical CAD-functionalities are used to implement the necessary information within the CAD-model. Once this is done, the model is used as a database for Mass Customization configuration process resulting in consistent CAD-information, which builds the base for subsequent tasks e.g. semi-automated process planning.

AN INNOVATIVE USER INTERFACE FOR INTUITIVE 3D-SKETCHING IN AN AUGMENTED REALITY ENVIRONMENT

Müller F., Lex S., Briegel C., Lindemann U. - *Technische Universität München (DEU)*   793

For better support of the conceptual phase of product development a new tool is suggested that combines the advantages of paper based sketching and 3D software tools – a "3D-sketcher". Acting directly in a three-dimensional working space requires new user interaction concepts that are different to current 2D-WIMP (Windows-Icons-Menus-Pointer) interfaces and allow intuitive working. A two handed interface emulates the familiar usage of paper and pencil. The Graphical User Interface (GUI) is based on a palette-like context menu that is displayed on demand directly at the actual cursor position. This enables the user to reach the core functions within short-distances.

A NEW 3D SCANNING-AIDED PROCEDURE IN CUTTING TOOL DESIGN

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A new process of cutting tool design by using 3D scanning-aided technology has been invented by using rapid prototyping principles. The main demands of designing process is getting the precise position of 3D burr line from a real casting that differs from the CAD model. Collected and captured data from the scanned object provides the generation of a 3D cloud of points. The defined step-by-step procedure meets the highest quality standards and significantly improves the efficiency of tool production. The method has been invented in Laboratory of Experimental Mechanics, Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, and can be easily implemented in standard tool design procedure.

USING REVERSE ENGINEERING TO SUPPORT PRODUCT DEVELOPMENT ACTIVITIES

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One of the major tools in concept design is the prototype model and one consequence of this is that engineers are faced with the challenge of converting prototype models into CAD models at the appropriate stage in the product development cycle. This paper is concerned with reverse engineering strategies to build valid CAD representations based on prototype models with complex features. The problems associated with the construction of CAD representations from multiple sets of scanned data are also discussed.

HAND MOTION PROCESSING IN APPLICATIONS: A CONCISE SURVEY AND ANALYSIS OF TECHNOLOGIES

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This paper deals with various hand motion processing technologies that can be used to input shape information to a computer aided shape conceptualizing system. Direct incomplete, direct complete, indirect incomplete and indirect complete information processing approaches and scanning technologies were identified. We briefly survey the technologies and systems for hand motion processing, the related application methodologies, and confront the technologies with the requirements originating in application of hand motions in shape conceptualization. Our conclusion is that many useful technologies are available, but more research is needed to provide the most effective technological solution for a hand motion based shape conceptualization.

DESIGN OF SCREENING ELEMENTS

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Screening in digital graphics is controlled with a simple mathematical function that represents a special configuration in it's 2D or 3D format. All vector and pixel graphics configurations may be interpreted with new screening elements. The initiator or seed for starting to generate a sequence of random numbers for raster form choice may be taken from personal data. Programmed graphic is generated during display or printing. This paper gives PostScript algorithms simplified for vector and pixel graphics for color screening with new raster forms. Thus instead of a screening dot we may create a waterdrop or a toy elements. It may be visible if the lpi is low or "hidden" if the lpi is high - high resolution. The most significant screening use is in the printed material's visual message interpretation and individualisation.

HOLOGRAPHY ON DOCUMENTS, A MULTI–LEVEL PROTECTION

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A multi-level approach to protection techniques should be applied in protecting documents and banknotes. The first step in a document's protection is by using holograms in printing, a technique that may not be reproduced or copied by any other graphic technique. This paper covers the situation in respect to holography in our country, and makes comparisons with the use of holograms in the world. All countries in the world turn to use holograms on new editions of banknotes. Holograms open many possibilities in developing multi-layer visual messages, messages in motion and a 3D presentation. On University we have ability to design holograms including 3-D Models, Computer-Generated Animation, Dot Matrix and Multimatric Holograms. In addition to providing security against counterfeiting and fraud, holograms also provide distinctive branding, design and image enhancement.