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**SUPPORT OF SYSTEM ANALYSES AND IMPROVEMENT IN INDUSTRIAL DESIGN THROUGH THE CONTACT & CHANNEL MODEL**Albers A., Alink T., Matthiesen S., Thau S. - *University of Karlsruhe (DEU)*

245

The Contact and Channel Model (C&CM) through a clear set of model building blocks, i.e. Working Surface Pairs (WSP) and Channel and Support Structures (CSS), provides a free and dynamic way of modelling to argue systematically about design problem. Regardless whether designers want to generate a new solution for a component, make major modifications or change a very small detail, they can approach the problem in the same way and apply the same thinking steps. This paper introduces a compendium enforcing an effective procedure of building up C&CM models through its application in a real, through time and cost pressure characterized design project. The contribution shows how the C&CM helps designers to escape a typical trap of pre-fixation.

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**A PLM APPROACH INTEGRATING ULM (USAGE LYFECYCLE MANAGEMENT)**Chapotot E., Merlo C., Legardeur J., Girard P. - *ESTIA (FRA)*

327

Nowadays, product 'usages' in competitive market are a rich source of knowledge for designers. This interest for 'usages' appears since the 90's but today this phenomenon gaining emphasis. In this paper, usage concept is explored and situated in the PLM approach. We propose an ULM (Usage Lifecycle Management) tool for managing the usage capitalisation from both end-users and expert actors. This tool is illustrated through an industrial case study based on maintenance stakeholders' reports. This example shows how maintenance knowledge about usage may be re-used through a PLM system by designers to improve the product. This work is an introduction to next steps which will consist in modelling usage knowledge and specifying a ULM tool.

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**FROM FUNCTION TO SOLUTION: A SYSTEMATIC APPROACH**Panetta F., Vigano R. - *Politecnico di Milano (ITA)*

475

Studies in design methods provide various procedural approaches to the design process. These methods are devoted to create a process able to aid the designer for finding suitable solutions of an engineering problem. One issue with design methods is often that such approaches prescribe what a designer should do but not how. In fact, the hazy aspects of these methods are especially how complete the route from the function to the solution and how the systematic methodologies cannot stifle the designer's creativity. This work is devoted to explore a systematic methodology and its use in an application case. Moreover, an example in the home automation field will be presented in order to better explain the application of the methodology proposed.

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**WHAT IS SUCCESS AND FAILURE IN PRODUCT AND SERVICE DESIGN?**Hollins W. J. - *University of Westminster (GBR)*

409

Research has shown that most new products fail. When one attempts to define what actually constitutes a success or failure in the design of products and in the design process, and who is affected, the picture is not so clear. There is a general consensus that there are too many failures. This paper confronts this confusing aspect and identifies potential 'danger areas' in the total design process up to, and including product disposal. From this are drawn solutions and conclusions that should assist in the management of more successful design.

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## GUIDELINES FOR THE DEVELOPMENT OF FLEXIBLE PRODUCTS

Bischof A., Blessing L. - *Technical University Berlin (DEU)*

289

Flexibility is often suggested as a useful approach for companies in fast changing environments to stay competitive. This flexibility does not only include flexible manufacturing systems, flexible processes but also flexible products, which enable easy adaptation to the diverse and fast changing customer requirements. In this paper design guidelines are proposed that support the development of flexible products. They are derived from different DFX topics as e.g. Design for Flexibility (DfF), Design for Modularisation (DfM) and Design for Adaptability (DfA). For better understanding and memorability the guidelines are presented graphically.

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## ANALYSIS AND OPTIMISATION OF DISASSEMBLY DEPTH DISTRIBUTION: AN APPLICATION IN ELECTRONIC DEVICE REDESIGN TO REDUCE ENVIRONMENTAL ...

Giudice F., Kassem M. - *University Politecnica delle Marche (ITA)*

377

The present paper proposes the application of a structured method for the analysis and reconfiguration of the disassembly depth distribution of components making up an electronic device with the aim of obtaining a generalised improvement in ease of disassembly, in relation to the necessity of reducing their environmental impact at end-of-life. As evidenced by the results from the case study, by means of an appropriate metric to assess the effectiveness of the distribution, the method provides information regarding the criticality of a system and makes it possible to direct an intervention modifying the principal design parameters in a way that improves the overall efficiency of disassembly.

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## DESIGN FOR VARIETY – EFFICIENT SUPPORT FOR DESIGN ENGINEERS

Kipp T., Krause D. - *Hamburg University of Technology (DEU)*

425

The development of products with many variants is a challenge getting increasingly important due to the trend of individualisation. Product development meets this challenge generally with specific product architectures, e.g. modular or platform architectures. However beside its architecture the design of a product affects significantly the expenses of the creation of new variants.

Therefore this contribution identifies design principles supporting the simple and cost efficient generation of product variants. To make these principles available for design engineers in an efficient way, they are compiled as helpfully illustrated design guidelines. Finally the benefit of these guidelines is discussed on the basis of a real product example.

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## DESIGN FOR POKA-YOKE ASSEMBLY AN APPROACH TO PREVENT ASSEMBLY ISSUES

Estrada G., Lloveras J., Riba C., - *Technical University of Catalonia (ESP)*

351

It is important to be aware about assembly quality issues due to they represent a significant proportion of quality defects in many companies. These issues are commonly analyzed after they occur and it is observed that best solutions to eliminate them are performing poke-yoke redesigns in the product. This research proposes a Design For Poka-yoke Assembly-DFPA approach, focused in define how designers can identify since early design stages the potential assembly quality issues in order to establish, as part of the customer requirements list, the assembly design requirements that has to be complied to design a product oriented to prevent assembly quality issues. By using DFPA approach it will be reduced the need of later poka-yoke redesigns.

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## DESIGN TO COST: NEW IMPULSES FOR TARGET COSTING

Braun S. C., Biedermann W., Lindemann U. - *Technical University Munich (DEU)*

317

The authors of this contribution enrich classic target costing with a costing method developed for the cost estimation of individualized products and a multiple-domain approach considering numerical aspects. The result is an approach for the target costing of functionality improvements and/or extensions of structurally complex mechatronic products. Among others the presented approach offers special potentials regarding the deduction of cost reducing actions in consideration of different aspects such as functionality, component and process structure. Impacts of resulting cost reducing changes can be traced easily through the whole network through the consistent documentation of all relevant information in form of a multiple-domain matrix.

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### **KANSEI PHYSIOLOGICAL MEASUREMENTS AND CONSTRUCTIVIST PSYCHOLOGICAL EXPLORATIONS FOR APPROACHING USER SUBJECTIVE ...**

Tomico O., Mizutani N., Levy P., Yokoi T., Cho Y., Yamanaka T. - *Technical University Eindhoven (NLD)*

529

The aim of this article is to explore the suitability of psycho-physiological measures and psychological explorations for approaching user subjective experience. For this purpose the 2-point Electroencephalogram (EEG) comfort measurement is used to gather real-time information about how a person feels during the interaction with a product and the Repertory Grid Technique (RGT) interview is used to gather information about what people's primary goals and concerns are. These two different methodologies combined allows for analyzing the exploration, usage and reflection process. Thus, it can be used for: track, compare, analyze the comfortableness level and relate it to the consumer's response.

### **PRIORITISATION METHODOLOGY FOR USER-CENTRED DESIGN OF ENERGY USING DOMESTIC PRODUCTS**

Elias E. W. A., Dekoninck E. A., Culley S. J. - *University of Bath (GBR)*

343

An essential element of a user-centred design approach is to understand the differences between the intrinsic energy losses of products due to their engineering construction and technology with the losses associated with their use. This argument for using user-centred design strategies is presented which leads to a methodology for the assessment of behaviour potential and energy impact for domestic energy using devices. From this assessment procedure, the significance of user related energy losses becomes clearer and recommendations for target products requiring an energy efficient redesign can be made.

### **ACTIVE CUSTOMER INTEGRATION TO INNOVATION NETWORKS: A PROJECT OUTLOOK**

Kirschner R., Kain A., Franke S, Dick B., Lindemann U. - *Technical University Munich (DEU)*

433

The actual application of customer knowledge in the new product development process (NPD) is underdeveloped, especially in the environment of SME. The project described in the paper aims to develop a new approach for the active integration of customers in the NPD process. The objective is the development of new methods and approaches for innovation processes which enable systematic and early active customer integration in the phase of generating ideas and concepts. A handbook with detailed guidelines and step-by-step suggestion making when to use which method, which departments to involve and what the trade off between possible benefits and cost is, could help to increase the implementation rate of customer integration methods.

### **DESIGN WITH MEDICAL INFORMATION**

Langeveld L. H. - *Delft University of Technology (NLD)*

449

Medical aspects required a new approach because the designer and medical specialist must be on the same level of understanding about the medical information for the project. The design task is first done by a project team for Advanced Product Project which resulted in a functional prototype. In a graduation project the functional prototype is designed as far as a working prototype. In the beginning of the process the graduate student researching the medical information to evaluate the requirements and wishes for the new product design. By observation research he discovers also many unspoken wishes. In the conceptual phase the focus lays on ergonomics, user interface and perfection of parts.

### **A USER-CENTERED APPROACH TO DEVELOPING EMERGENT TECHNOLOGY PRODUCTS**

Restrepo J., McAlone T. C., Schlegel T., Lykke J. - *Technical University of Denmark (DNK)*

483

Current participatory design methods do not allow designers to gain the insight required to develop products with emerging technologies. This poses challenges to the designers, as input from users cannot be used too early in the design process, given that users respond best to issues they know or can relate to. This paper presents a case study where a user-centred approach was used to determine when and how to involve users in the design of a TV-enabled mobile telephone, with the aim of identifying the main form factor drivers for its design. The paper also discusses some methodological issues related to user involvement in the implementation of emerging technologies in the consumer electronics industry.

### **A MODULARIZATION METHOD IN THE EARLY PHASE OF PRODUCT DEVELOPMENT**

Albers A., Burkart N., Sauter C., Sedchaicharn K. - *University of Karlsruhe (DEU)*

253

A modular product architecture possesses many advantages required as one of the design goals. Most of the modularization methods focus on the redesign of existing products, in which a dependency matrix is often used as a tool for an integration analysis. In this research, the modularization in the early phase of the design will be focused. Three more tasks will be added into the modularization of the guideline VDI 2223 with the applying of a dependency matrix, Contact & Channel Model and Genetic Algorithm to find out the optimal architecture. Additionally, the relation between number of modules and the degree of modularity will be emphasized. This approach is validated in the development of a robot forearm for the humanoid robot ARMAR III.

### **ON THE DEVELOPMENT OF MODULAR PRODUCT STRUCTURES: A DIFFERENTIATED APPROACH**

Blees C., Krause D. - *Hamburg University of Technology (DEU)*

301

The process of modularization is influenced by a variety of factors and is therefore a very complex task. This complexity can be reduced by a separated proceeding according to different perspectives. For this reason known module drivers are assigned to the main perspectives product planning, purchase, manufacturing/assembly and after sales. Additionally the modularization from the manufacturing/assembly perspective is presented more in detail. For this purpose the module interface graph and the assembly priority chart have been integrated in the process.

### **MAINTAINING PRODUCT PLATFORMS IN INDUSTRIAL MACHINERY**

Alblas A. A., Wortmann J. C. - *University of Groningen (NLD)*

261

Product platforms describe the range of products offered by a company in terms of functionality, performance and architecture. Based on an extensive case study in industrial machinery, several important elements of a platform approach are identified in this paper. The technological evolution of a platform is highly uncertain and difficult to define beforehand: therefore, a life cycle approach is needed. The paper argues that a platform life cycle requires incorporating the process aspects of platform development: product development yields continuously proposals for platform engineering change, which have to be properly managed during the whole platform life cycle.

### **APPLYING THE MULTIPLE DOMAIN MAPPING APPROACH TO VARIANT MANAGEMENT**

Deubzer F., Braun T., Maurer M., Lindemann U. - *Technical University Munich (DEU)*

335

As today's markets show an increasing individualization, dynamics and diversity concerning the customers, different authors point out the relevance and challenge of efficient variant management. Accordingly to the different domains affected by the complexity of variant management, strategies to deal with this increasing complexity exist within domains such as engineering development, production, the organizational and the process domain. Companies lack the ability to enable transparency for the involved persons and gain overview over the complex interdependencies between those domains of variant management. The paper shows the adaptation of the multiple domain mapping approach to enable this holistic view on variant management.

### **IMPLEMENTATION OF MODULAR ARCHITECTURE OF COOLING GENERATORS**

Osman K., Bojetic N., Marjanovic D. - *University of Zagreb (HRV)*

465

This paper aims to contribute to the understanding of the roles of module, modularity and modularization. This paper's objective is to propose engineering methods for more rational engineering activities base on the idea of modularization and design for reuse. The basic goal of the research is to help the designer in the conception and design of a design solution, reduce the time of preparation of design documents, and thus reduce the overall product development costs. In this paper it is need to research possibility of development cooling generator product family based on modular architecture. For this purpose it is used Modular Function Deployment method [Erixon, 1998.], consisting of five main steps and which describe structuring products in modules. The method analyzes the functional requirements for a product and determines the technical solution and modular concept, and consists of the following steps: clarify customer requirements, technical solutions, define possible modules, evaluate concepts and improve each module.

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### CONCEPTUAL DESIGN OF INDUSTRIAL PRODUCT SERVICE SYSTEMS (IPSS) BASED ON THE EXTENDED HETEROGENEOUS MODELLING APPROACH

Welp E. G., Sadek T. - *Ruhr-University Bochum (DEU)*

545

Industrial Product-Service Systems (IPSS) are proposed as a solution to meet individual customer requirements. Thereby, high-investment capital goods are offered in customized business models which highly include services. This paper proposes an IPSS concept model based on an extension of the heterogeneous modelling approach in mechatronics. To integrate product and service modelling in early phases of development established and mostly diffuse distinctions between the both are abolished. An integrated and formalized modelling spaces constitutes the basis to integrate IPSS-functions, IPSS-objects and IPSS-processes to IPSS systems behaviour.

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### IMPLEMENTING A SERVICE ORIENTED PLM ARCHITECTURE USING PLM SERVICES 2.0

Bergsjö D., Catic A., Malmqvist J. - *Chalmers University of Technology (SWE)*

271

This paper regards the implementation of a service oriented PLM architecture in the automotive industry. To test this, a demonstrator that implements the standard PLM services 2.0 has been developed. The demonstrator supports the change management process of a diesel engine and accesses information from distributed databases across organizations and technology domains. Findings regard issues related to the benefits and limitations of the standard as well as implications of a service oriented PLM architecture experienced from business and user perspectives. In order to manage a shift towards SOA it is also needed to invest in PLM management and support capabilities. SOA contributes to take better control of the business logic, than competing PLM architectures as well as it offers good engineering support.

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### INNOVATION CYCLES CONCERNING STRATEGIC PLANNING OF PRODUCT-SERVICE-SYSTEMS

Hepperle C., Mörtl M., Lindemann U. - *Technical University Munich (DEU)*

401

Managing the innovation process of complex product-service-systems (PSS) becomes increasingly difficult. This can be attributed to characteristics such as higher product and process complexity, increasing dynamics and a higher degree of uncertainty in the innovation process. To face these challenges, this paper proposes an approach in identifying and describing innovation cycles concerning strategic planning of PSS. Thereby, innovation cycles can be seen as recurring processes within and in-between the PSS-lifecycle-stages as well as the recurring process of strategic planning of PSS itself. Further, an approach is proposed how data gained from cycle-oriented strategic planning of PSS can be structured within a product-service-spectrum.

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### CONCEPTUALISATION OF PRODUCT/SERVICE-SYSTEMS THROUGH STRUCTURAL CHARACTERISTICS

Tan A., Andreasen M. M., Matzen D. - *Technical University of Denmark (DNK)*

517

Many manufacturers today are shifting from a product to service-orientation, where instead of the product, the activity and knowledge associated with the use is considered to be more valuable to the customer. This approach has been dubbed product/service-systems (PSS). It appears that no theories have crystallised about PSS's structural and behavioural attributes, and no mindset exists for conceptualisation based upon the nature of service in design. Starting with Hubka's Transformation Model, service-oriented models are reviewed. Based on this an understanding of the conceptual aspects of PSS are outlined. An account is given of how this is applied when teaching PSS design. Directions for research in systematic PSS design are also given.

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### A COMMON DENOMINATOR FOR PRODUCT SERVICE SYSTEM DEVELOPMENT

Schindler S. O., Schendel C., Matzen D. - *Technical University Darmstadt (DEU)*

493

Products and services have long been combined into integrated offers, referred to as Product Service Systems. The question of how best to design PSS in an integrated process is currently under discussion. The material in this paper is the outcome of a joint project in which the prerequisites for PSS development at a manufacturer of office furniture were explored. The objective is to identify a common denominator in products and services suitable for design purposes and discuss its applicability in the design process of a company. Models of the product life cycle and customer activities are combined and similarities are determined. This conceptual view of the design elements in PSS is compared to findings of the industrial case study.

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### **SPECIFICATION RISK ANALYSIS: INTRODUCING A RISK MANAGEMENT METHOD FOR PRODUCT ARCHITECTURES**

Wagner C., Graebisch M., Seering W., Lindemann U. - *Technical University Munich (DEU)*

537

This paper presents an adaptation of the FMEA as a risk management tool for embodiment design. The development of the approach and important decisions are described. By means of three dimensions, risks of not meeting specifications can be assessed and prioritized. Furthermore the method enhances the development and follow-up of mitigation measures. The method has been tested by product development teams of a university course. The field study identified the Specification Risk Analysis as a useful tool to mitigate potential deficiencies of a product architecture. Additionally, it was shown that the highly matured procedure of the FMEA can be adopted for various purposes and is not limited to quality issues.

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### **ROBUST DESIGN METHOD FOR PRODUCT LIFE CYCLE CONSIDERING THE FUTURE UNCERTAINTIES**

Kondoh S., Masui K., Mishima N., Matsumoto M. - *National Institute of Advanced Industrial Science and Technology (JPN)*

439

Product life cycle design has gained more interest in recent years due to growing concern about environmental problems. In general, there exist significant uncertainties (e.g., operating condition, user preference, collection rate etc.) in product life cycle and a design method that is robust and tolerant against these uncertainties should be established. To this end, this paper discusses the uncertainties in product life cycle and evaluates their impact on total performance throughout a whole product life cycle. Based on this discussion, a design method for product life cycle that maximizes its total performance handling these uncertainties is proposed.

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### **ENHANCING SUPPLIER'S QUALITY BY PREVENTIVE QUALITY ASSESSMENTS DURING DESIGN OF AUTOMOTIVE ELECTRONICS**

Graessler I. - *Robert Bosch GmbH (DEU)*

395

Proceeding and results of a strategic improvement project at Bosch Automotive Electronics aiming at enhancing quality of mechanical vendor parts are presented in this contribution. In contrast to electronics, quality problems with mechanical vendor parts in high level series production sometimes follow no pattern. Analyzing weak points of past development projects lead to the following solution approach. Milestone reference plan of product development was supplemented by preventive quality assessments (QA-M). As tooling knowledge was identified as key success factor, company-internal tooling experts were set up. The new procedure was defined in a new development guideline and globally rolled out. Implementation progress is since then measured by QA-M application rate in development projects and feedback about applied technical expertise.

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### **PREVENTIVE COST AND RISK MANAGEMENT IN THE EARLY PRODUCT DEVELOPMENT PHASE**

Szeghő K., Bercsey T., Eigner M. - *Budapest University of Technology and Economic (HUN)*

509

Today, it is very important for managers of the engineering process to define innovative products in a complex and globalised environment. Each time they have to proceed more rapidly, more low-cost and usually with less capacity in order to be able to exist successfully on the market. The well-known question is at the beginning of the product development process: How can I develop a "good product" in less time and with low cost? A new method for optimising the development process to reduce product costs in the early product development phase has to be found. The new to be developed method should include all important factors (costs, risks) whose modification and optimisation will have a positive influence on the development process.

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### **THE RELATION BETWEEN PROJECT RISKS AND ROBUSTNESS OF DESIGN – A CRUCIAL FACTOR OF SUCCESS IN PLANT ENGINEERING**

Moehringer S., - *Simon Moehringer Anlagenbau GmbH (DEU)*

457

In competitive markets with global sourcing the acquisition phase in plant engineering is essential. It is the aim of the contractor to quote a project with the best price possible in order to compete but a considerable risk is involved. A new approach is presented using the experience of error situations to evaluate the risk in the acquisition phase. The risk areas and the risk specification of a potential project are identified and individually valued. In addition to this the design robustness of the project is configured. In order to achieve a configuration as accurate as possible a matrix correlating the project risk and the project design is established. The matrix helps to identify the critical design areas and their specifications.

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**NEEDS AS A BASIS FOR DESIGN RATIONALE**

Bergström M., Ericson A., Larsson M., Nergard H., Larsson T., Renström B. - *Lulea University of Technology (SWE)* 281

This study is based on data from a Swedish real-life industrial product development project for e-health care of elderly. The purpose in the paper is to discuss identification of user needs. Information about the elderly is transferred in recurrent meetings. Besides the perception that these meetings occupy time which could be spent giving care, the nurses find it problematic to convey such information to substitutes, as well as they have to rely on their memory. In this case, a Dictaphone device was a solution. Reports on practical activities of identifying user needs and how they affect decisions in product development are limited; one contribution of this paper is insights into such a case.

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**REQUIREMENTS MANAGEMENT IN EARLY STAGES OF MECHATRONIC DESIGN BY VISUALISATION OF INTERDEPENDENCIES**

Stechert C., Bauer S., Franke H. J., Meerkamm H. - *University Erlangen-Nuremberg (DEU)* 501

In this contribution, applications of a new Decision Making (DM) tool based on a qualitative modeling and visualization of interdependencies between requirements are shown and discussed. Concretely, DM tasks occurring when designing parallel robots are qualitatively modeled by a pairwise comparison of interactions between requirements. The resulting interaction matrix is the input model required by the visualization method. Based on that interaction matrix, the tool calculates and shows an easily understandable visualization of the entirety of all requirements based on their interactions in a three-dimensional space. Such visualization is shown for two DM tasks from different development stages in the field of parallel robots.

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**A SYSTEMIC ANALYSIS OF OLDER DRIVERS REQUIREMENTS TO GATHER KNOWLEDGE TO BE USED BY DESIGN ENGINEERS**

Flöck C., Le Cardinal J., Mekhilef M. - *Ecole Centrale Paris (FRA)* 361

The challenge of our very next future is to design cars that face the specific needs of the growing number of older drivers. We suggest an approach that takes into account the whole system. Beside different expert groups we include the enduser in our research and propose using inclusive design to assure usability for a wide range of users. The functional analysis conducted in this study allowed us, to gain a better picture about the key elements, stakeholders and approaches in the research field. It gives insights into the complex system, shows interrelations and will help us to advance in the development of coherent research aiming at the multidisciplinary delivery of sets of requirements to be considered by car designers and constructors.

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**ON THE DESIGN OF MANUAL WHEELCHAIRS FOR PEOPLE WITH SPINAL CORD INJURIES**

Gooch S. D., Woodfield T., Hollingsworth L., Rothwell A. G., Medland A. J., Yao F. - *University of Canterbury (NZL)* 387

Manual wheelchair propulsion is an important part of daily living for people with tetraplegia. New surgical procedures, such as the posterior deltoids to triceps transfer surgery (known as TROIDS), better enable people with tetraplegia to propel their wheelchairs. 22 people with tetraplegia participated in this study. Their power output was measured using a wheelchair dynamometer. Wheelchair propulsion technique was captured using a video and analysed. Distinctly different wheelchair propulsion techniques were observed. Post TROIDS subjects were found to have changed their wheelchair propulsion technique. Results obtained in this study pose new requirements for the design of wheelchairs for people with tetraplegia.

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**THE RELATIONSHIP BETWEEN FUNCTIONS AND REQUIREMENTS FOR AN IMPROVED DETECTION OF COMPONENT LINKAGES**Boersting P., Keller R., Alink T., Eckert C. M., Albers A., Clarkson P. J. - *University of Karlsruhe (DEU)*

309

Functional product models in design so far were built up by asking for the main function of a product first and then breaking the main function down into sub-functions, until an appropriate level of granularity was reached. A problem of this approach is that a product often provides even more functions which are not subordinate to the main function. This paper presents an approach how these functions can be captured in a reliable and structured way, using the requirements of a product as a superstructure. The improvements of this new approach are demonstrated by predicting change propagation based on an improved functional product model and comparing it to the results of a change prediction using the conventional functional product model.

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**MANUFACTURING SYSTEM DESIGN BASED ON REAL-LIFE DEMANDS - A METHOD DESCRIPTION**Karlsson A. - *SWEREA IVF (SWE)*

417

Manufacturing system design is a process that often results in sub-optimized systems with less than intended performance. It is therefore of utmost importance to base the design on factors originating from a defined interested party and then translate them into performance shaping factors of a manufacturing system. Sometimes the complexity of the factors affecting the system takes over in the design process, making the designers, system builders and even the buyers forget about the initial requirements – customer demands. The manufacturing system design method presented in this paper is aimed at being simple enough to use, though providing accurate enough results by taking into account relevant system demands.

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**FLEXIBLE SUSTAINABLE PROCESS INNOVATION: INTEGRAL BUILDING DESIGN METHODOLOGY**Zeiler W., Quanjel E. - *Technical University Eindhoven (NLD)*

553

There is a growing awareness of sustainability that leads towards knowledge transfer and research between companies and the Dutch knowledge and research institutes within the building industry. The principles of the IFD (Industrial Flexible Dismountable) concept aim at an integrated approach within the design process to reach a maximum level of integration between designers from different disciplines. A newly developed methodology for structuring integral design processes enables design team support during designing and further stimulates exchange of ideas and concepts. This approach is tested within a professional context of a building design project.

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**METHODS IN PRACTICE – A STUDY ON REQUIREMENTS FOR DEVELOPMENT AND TRANSFER OF DESIGN METHODS**Geis C., Bierhals R., Schuster I., Badke-Schaub P., Birkhofer H. - *Technical University Darmstadt (DEU)*

369

Nowadays, methods play an important role in supporting design processes and activities. Nevertheless, many potentially useful methods are seldom applied, not carried out in the intended way or poorly adapted. This paper analyses reasons for deficient method usage in daily industrial job routines and also names requirements for development, transfer and implementation of methods in the industry. It shows the potential of new methods, gives an overview of necessary measures for better method usage, and sets up a model that shows how all these measures (like simplification of adaptation of methods, promotion of methods in companies or specific training of methods) interconnect to allow successful implementation of methods in the industry.

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