INFLUENCE OF FEATURE CHANGE PROPAGATION ON PRODUCT ATTRIBUTES IN CONCEPT SELECTION

Koh E. C. Y., Keller R., Eckert C. M., Clarkson P. J. - *University of Cambridge* (*GBR*) 157

This paper introduces an approach which uses a modified House of Quality (HoQ) and the Change Prediction Method (CPM) to consider change propagation during the concept selection phase. The key idea is to capture the influence of unintended feature changes on product attributes which arises due to component change propagation, and present this information as an aggregate performance rating for each product attribute. The results from the case example indicate that the performance rating of product attributes can be different once change propagation is taken into account. The findings in this paper also provide an indication that ignoring change propagation in concept selection can result in project delays due to unexpected changes.

VETUSNET - A SOCIAL NETWORK FOR THE THIRD AGE

Medeiros A. P., Ferreira B. S., Da Fonte C. C., Fernandes A. A. - *University of Porto* (*POR*) 191

This paper reports the work carried out by a team, to develop an innovative product that addresses the needs of aged people, using systematic methodologies of product design and development. The importance of networking in different contexts led the team to think of a product that could act as a vehicle of communication among elderly people, thus increasing their social networks. In order to identify the customer needs (elderly people) a total of 55 interviews were carried out. The sample comprised 69% females and 31% males with ages up to 85 years. The analysis of the answers to the questionnaires revealed that main needs were not only a lack of material goods but specially loneliness, with a clear need for communication. The product selected for development was an electronic device to support a communication network aimed at aged people, the VetusNet.

"PRODUCT IN-USE" INFORMATION FOR ENGINEERING DESIGN ACTIVITIES

McSorley G., Huet G., Culley S. J., Fortin C. - *École Polytechnique de Montréal* (*CAN*) 183

Within the emerging "extended product" paradigm, manufacturers are increasingly involved in the later stages of the product lifecycle to ensure long-term customer satisfaction. Substantial savings can be made by identifying possible performance issues at the design stage, rather than correcting them once the product is in-service. To support designers, it is proposed to create a framework through which they can take advantage of "product in-use" information, defined as all information collected throughout the lifecycle concerning product performance during use. This paper examines the issues with the creation of such a framework, such as the appropriate content of this information, the necessary format and its transfer to designers.

LESSONS LEARNED FROM A WANT BASED NPD PROJECT

Björk E., Ottosson S. - *TERVIX AB* (*SWE*) 115

Incremental innovations often are based on satisfying a "want". Radical innovations often are based on satisfying a "wish". The conditions for want and wish based PD differ much from "need" based PD for which well-known PD models are designed. As want and wish based PD projects are not much described a want based project has been investigated with Insider Action Research. Some findings are that the want based project showed to be impossible to long term plan both what regards development time and cost, that the use of the DPD principles - and especially BAD-PAD-MAD - was needed, that an S-shaped curve did not show up, that milestones were "taken" and "lost" before a stable situation was reached, and that Time-to-Market was not critical.

ON DETERMINING A PRODUCT'S PROCESS RELATED TO THE DEGREE OF MATURITY

Paetzold K. - *University Erlangen-Nuremberg* (*DEU*) 211

It will be shown how the decision about the progress of processes can be supported by using appropriate information about the product's functionality. By choosing behaviour-orientated representations of specific development results and it will be possible to compare with customer requirements as a reference value. So we are able to define the degree of maturity. Interdisciplinary solution approaches and development results can be considered for the definition of the development situation. Parallel to this, it is necessary to compile operating guidelines which support the developer in deriving the characteristics from the attributes, where here different analytical approaches are to be taken into account.

UNCERTAINTY AND RISK REDUCTION IN ENGINEERING DESIGN EMBODIMENT PROCESSES

Grebici K., Goh Y. M., McMahon C. - *University of Cambridge* (*GBR*) 143

The interdependency between information requirements and lead-time reduction is a challenging issue usually addressed by collaborative and concurrent design processes. The combination of temporal issue, multi-disciplinary teams, task parallelization and fuzzy system boundaries introduces additional risks due to the need to provide and receive uncertain information. Engineers often face uncertainty. They adopt a tacit approach in assessing the quality and the maturity of information. An appreciation of both uncertainty and information maturity can influence task execution and the way tasks are solved. This paper discusses a framework that may aid robust decision-making and help in achieving smooth progress in the collaborative and concurrent engineering activities in the presence of uncertainty.

SUPPORT OF DESIGN ENGINEERING ACTIVITY – THE CONTACT AND CHANNEL MODEL (C&CM) IN THE CONTEXT OF PROBLEM SOLVING AND THE ROLE OF ...

Albers A., Deigendesch T., Alink T. - *University of Karlsruhe* (*DEU*) 97

The Contact and Channel Model (C&CM) is a means to describe design problems on any level of abstraction, in order to provide a representation of the product as the problem situation requires. With the C&CM a support is provided, which in an unstructured, through multiple goals and through different procedures characterized environment of product development makes possible a systematized but free and dynamic way of modelling. The basic systematic of the C&CM allows everybody to use the model in their own strategy of problem solving. This paper firstly briefly introduces the C&CM before the methodological background of the C&CM with special focus on “model building” and “solving design” problems is enlightened.

AN OPPORTUNITY SEARCH METHOD FOR NEW PRODUCTS DEVELOPMENT

Benedicic J., Žavbi R., Duhovnik J. - *University of Ljubljana* (*SVN*) 103

Launching of new product on the market is necessary for company growth and business development. Only 10% of launched new products are successful. How can we increase successfulness of new products? We have developed a special method for identifying opportunities for new products. A new product can mean improvements of existing products, radical innovations or services. The method is suitable for small as well as big companies. We defined social, economic, technological and legislative factors which help us to recognize opportunities while taking into account company characteristics. The method presents more systematic approach to opportunity identification process

UNCERTAINTY HANDLING IN INTEGRATED PRODUCT DEVELOPMENT

Lindemann U., Lorenz M. - *The Boston Consulting Group* (*DEU*) 175

Innovation projects have to face uncertainties resulting from lacking or imperfect information on market or technology-related issues. Common development process model do not fully support radical and thus uncertain development projects. The widely recognized integrated product development framework can be expanded through a flexible but direction setting process. The overall set-up is front-loaded, embeds options on the market and technology side, and stipulates an integrative work mode. Uncertainties are thus addressed using real options that support integrated decision making. Cases study research applied in radical innovation projects in the engineered goods sector demonstrates the positive impact of such a real options approach.

ANALYSIS AND IDENTIFICATION OF RESEARCH OPPORTUNITIES IN PRODUCT DESIGN USING THE MULTIDIMENSIONAL PROJECT MODEL

Aguilar-Zambrano J. A., Prada-Molina M., Gómez-Senent E., González-Cruz M. C. - *Universidad Politécnica de Valencia* (*ESP*) 89

This paper shows a comparative analysis of classical product design theories with Gomez-Senent multidimensional model, identifying dimensions absent from such theories and detecting research opportunities. The Dimensions identified as absent were Factors (context) and Metaproject (project team organization). Currently in Factors Dimension, there is a transition from a technological point of view to a point of view focused on the human being and the systematization of contextual qualitative information. In Metaproject Dimension there is research about negotiating processes, design team organization and communication. Research opportunities are detected with multidisciplinary teams and in emotional, sensory, perceptive evaluation methods.

DESIGN FOR NOVELTY – A FRAMEWORK?

Srinivasan V., Chakrabarti A. - *Indian Institute of Science* (*IND*) 237

A model of designing and a framework for design for novelty in conceptual design are presented. The model integrates essential elements of activity, outcome and requirement-solution from literature; it is empirically validated using design protocols. As constructs for activities, Generate, Evaluate, Modify and Select (GEMS constructs) are used; for outcomes, State change, Action, Part, Phenomenon, Input, oRgan and Effect (SAPPhIRE constructs) are used; for requirement-solution, co-evolving relations are used. Analysis of protocols reveals weaknesses in usage of phenomena and effects. To alleviate this, usage of GEMS of SAPPhIRE for requirements and solutions at all levels of the outcome is proposed as a framework for design for novelty.

A REVIEW OF THE FUNDAMENTALS OF SYSTEMATIC ENGINEERING DESIGN PROCESS MODELS

Motte D. - *Lund University* (*SWE*) 199

In this paper it is shown that the central features of systematic engineering design process models: a step-by-step concretisation of the product with a systematic variation of subsolutions and recombination are not absolutely necessary. Current models are neither generic nor ideal. Instead of using product characteristics as a basis for design process models, the focus should be on the concrete goals of product development in industry. As these goals are manifold, the design process needs to be flexible, giving the engineering designer more freedom . Finally it is recommended to separate the feasibility study (term to be preferred to conceptual design) from more routine-like product development.

PRODUCT DEVELOPMENT PROCESS OPTIMISATION WITH HEURISTICS METHODS

Rick T., Groma I., Bercsey T. - *Budapest University of Technology and Economics* (*HUN*) 229

Product development processes are specified as bounded work tasks. It is advised to use design structure matrices for process representation, through which the relationships between tasks during the development can be revealed. This approach supports modeling of iterations, which are quintessential in practice. With a genetic algorithm a semi optimal task schedule (in both: cost and duration) can be found. Another important problem of development process planning is to assign resources fairly to tasks in order to get a fine parallelization. For solving this, a heuristic algorithm was introduced where the resource planning is done by combining various strategies in order to minimize the duration of the development project.

MODELLING DECISION-MAKING IN COMPLEX PRODUCT DEVELOPMENT

Eriksson J., Johnsson S., Olsson R. - *Malardalen University* (*SWE*) 1129

One challenge today for companies lies in finding the right approach to measuring and continuously improving the current state of a company's product development process. The task of continuously improving the performance demands the successful management of information, communication, cooperation and decision-making in a context of uncertainty, which is a highly complex task in itself. To be able to manage a complex product development system in an appropriate way, the authors have identified three important interdependent aspects of product development. The aspects are decision-making, uncertainty and performance. These aspects form the foundation for the suggested model which is intended to be used by engineering design researchers.

A CLASSIFICATION SCHEMA FOR PROCESS AND METHOD ADAPTATION IN SOFTWARE DESIGN PROJECTS

Ploskonos A., Uflacker M. - *Hasso Plattner Institute for IT Systems Engineering* (*DEU*) 219

Aligning generic methodologies in human-centered design with the very specific demands of individual software projects presents a challenge during project planning and execution. Generally discussed in isolation of a particular context, many design process theories and methods need to be tailored to fit particular project needs. This work presents a classification schema to support in the project-specific adaptation of design processes. Based on design project observations, we identify four major project types ‘Usability’, ‘Capability’, ‘Extension’, and ‘Innovation’. The distinct process characteristics and commonalities for each category are discussed, qualifying the schema to support in the design project planning process.

MOBILISING CRITERIA IN ARGUING ABOUT PRODUCT SOLUTIONS: A MOTOR FOR DESIGNER CONVERGENCE DURING A PROJECT REVIEW?

Cassier J. L ., Prudhomme G., Lund K. - *Université de Grenoble* (*FRA*) 123

In the context of market globalization, companies are now collaborating; concurrent engineering has taken the place of sequential engineering and therefore is generating many changes in designers' work. Inspired by studies in argumentation, our objective in this article is to model the dynamics of human interactions by which designers construct a common ground, allowing them to converge during the decision process. Our ultimate goal is to propose methods and tools that support designers during the decision process. Through two original representations, we analyze a project review meeting at AB Volvo and show how in their quest to satisfy criteria, designers are led to propose new solution elements and thus to come to agreement.

ANALYSING THE RELATIONSHIP BETWEEN DESIGN PROCESS COMPOSITION AND ROBUSTNESS TO TASK DELAYS

Chalupnik M. J., Wynn D. C., Eckert C. M., Clarkson P. J. - *University of Cambridge* (*GBR*) 131

In this paper, Monte-Carlo simulation is used to investigate how the robustness of hypothetical process fragments is influenced by the number of dependencies between tasks and the resource constraints within the cluster. We show how aggregation of these results on a graphical 'robustness profile' allows conclusions to be drawn about the factors which govern process robustness, and argue that this can provide insight to support the improvement of more complex, realistic processes.

A MATRIX REPRESENTATION OF THE CPM/PDD APPROACH AS A MEANS FOR CHANGE IMPACT ANALYSIS

Köhler C., Conrad J., Wanke S., Weber C. - *Saarland University* (*DEU*) 167

This contribution describes an approach to analyse the impacts of engineering changes using a new form of representing the Characteristics-Properties Modelling/Property-Driven Development (CPM/PDD) approach. First, some general remarks about Engineering Change Management (ECM) as well as the ECM process will be made. Then, the CPM/PDD approach will be introduced. In the main part, inspired by the Design-Structure Matrix (DSM) and Matrix-FMEA, the authors introduce the matrix-representation of CPM/PDD (Matrix-CPM/PDD) which enables them to analyse the impacts of engineering changes with a lower perceived complexity.