Behavior-Driven Development in Product Configuration Systems

Product Configuration Systems (PCS) are increasingly used by companies to automate the performance of the sales and engineering processes. Since the benefits from such projects have huge variations, it is crucial to make the right decisions when scoping and developing PCSs. The development of PCS is influenced by both business interests and technical insights. Developers of PCS face various challenges while working in team, including different stakeholders such as business owners, developers, project managers, and product experts. The more diverse the team is, the more significant are the challenges. This paper suggests that Behavior-driven Development (BDD) may provide configuration teams with a specific structure to express scenarios (and thus constraints) on PCS in natural language. BDD may yield benefits such as a better expression of PCS constraints, more efficient communication of requirements and incorporation of the expressed rules in a software transformation process. In other words, applying BDD may eliminate unnecessary tasks when gathering knowledge, developing, and testing PCS projects. In this paper, we present a novel approach from an ongoing project on how to relate BDD to the development process of PCS while using Scrum-based methods.

General information
Publication status: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Department of Management Engineering, Management Science, Operations Management, KU Leuven
Contributors: Shafiee, S., Hvam, L., Haug, A., Wautelet, Y.
Pages: 49-52
Publication date: 2018

Host publication information
Title of host publication: Proceedings of the 20th Configuration Workshop
Volume: 2220
Publisher: CEUR-WS
Editors: Feilernig, A., Tiihonen, J., Hotz, L., Stettinger, M.
Electronic versions:
Final_BDD_CW.pdf

Research output: Chapter in Book/Report/Conference proceeding › Article in proceedings – Annual report year: 2018 › Research › peer-review

Improving decision making in the early phases of configuration projects

During the early phases of configuration projects very important decisions are made which will heavily influence the performance of the company, benefits in different functional areas (production, sales, purchase, product development, service etc), maintenance of the configuration system and quality of the dialogue between the configuration system and the users. Today there exists very sparse tools and procedures which can assist the early phases, i.e. conceptual modeling of the products and product assortment. This paper presents a five-phase procedure for conceptual modeling in configuration projects. Each of the five phases is supported by a set of tools. The main idea of the procedure is utilization of a so-called Product Family Master Plan, which is a formal description of the product assortment and its variation. The procedure has been tested at one of Baan's (SSA Global) customers with very convincing results. © International Journal of Industrial Engineering.

General information
Publication status: Published
Organisations: Engineering Design and Product Development, Department of Management Engineering, Operations Management, Department of Mechanical Engineering
Pages: 452-461
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: International Journal of Industrial Engineering-Theory Applications and Practice
Volume: 18
Issue number: 9
ISSN (Print): 1072-4761
Ratings:
Scopus rating (2011): CiteScore 0.3 SJR 0.173 SNIP 0.442
Original language: English
Keywords: Master plan, Sales, Data mining, Product configuration, Product assortment, Conceptual modeling, Visualization, Flow visualization, Product development, Models, Configuration system, Sea global, Formal Description, Early phases, Product variety, Product families, Modeling, Functional areas
Source: orbit
A software System for the Management of Generic Product Information Models

General information
Publication status: Published
Organisations: Department of Management Engineering, Operations Management
Contributors: Haug, A., Lisbjerg, T., Hvam, L.
Publication date: 2009

Host publication information
Title of host publication: Proceedings of the 2nd Nordic Conference on Product Lifecycle Management - NordPLM'09
Source: orbit
Source-ID: 251878

CRC-cards to support development and maintenance of product configuration systems
This article presents a new definition of special Class, Responsibility and Collaboration (CRC) cards to be used for the development and maintenance of Product Configuration Systems (PCSs). CRC cards were introduced as an informal and user-friendly technique for teaching object-oriented modelling. These CRC cards are often applied in the early phases of a software development project to come up with design alternatives. In 1994, extended CRC cards, with the purpose of holding detailed descriptions of classes in structural diagrams, were incorporated into a procedure for the development and maintenance of PCSs. This procedure has since been applied in several configuration projects and further developed at the Centre for Product Modelling (CPM) at the Technical University of Denmark. However, the investigations of two companies that applies CRC cards to document the knowledge base of their PCSs showed that their CRC card layouts differ from the definitions by CPM in many respects. Therefore, this article proposes a new CRC card definition that incorporates the experiences from the studied cases together with other kinds of extensions. The proposed CRC-card definition improves the basis for the companies that take up the technique.

General information
Publication status: Published
Organisations: Operations Management, Department of Management Engineering
Contributors: Haug, A., Hvam, L.
Pages: 38-57
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: International Journal of Mass Customisation
Volume: 3
Issue number: 1
ISSN (Print): 1742-4208
Ratings:
BFI (2009): BFI-level 1
Original language: English
DOIs:
10.1504/IJMASSC.2009.021660
Source: orbit
Source-ID: 236885

Representation of Industrial Knowledge - as a Basis for Developing and Maintaining Product Configurators
Abstract A product configurator is a software-based expert system that supports the user in the creation of product specifications by restricting how different components and properties may be combined. The use of product configurators has for several years provided many engineering-oriented companies such benefits as: shorter lead times, improved quality of product specifications, preservation of knowledge, use of fewer resources for specifying products, optimized products, less routine work, improved certainty of delivery, and less time needed for training new employees. Unfortunately, not all configuration projects are successful, but in fact many fail or experience great problems during the course of the project. An important factor for the success of a configuration project is the quality of the methods, techniques and tools applied when extracting, representing and documenting relevant domain knowledge. Despite this fact, research in the knowledge acquisition process of configuration projects is an area that has been much neglected till now. Therefore, this thesis deals with some of the most important aspects of the knowledge acquisition process in configuration projects by answering seven research questions in nine papers, produced during the course of the PhD
The questions are grouped under three topics: domain expert knowledge; knowledge representation techniques; and documentation of configuration knowledge. The thesis takes its point of departure in analysing existing literature, after which research questions are defined, a frame of reference established and the scientific approach outlined. Next, the main contribution of the PhD project is described, namely the papers that are part of the thesis, starting with analysis of the process in which domain experts provide relevant information to knowledge engineers. The process is investigated by analysing the role of tacit knowledge in configuration projects and by proposing a classification of the kinds of information involved in this process. The thesis then investigates how the information retrieved from domain experts can be represented in analysis and design models. To solve inadequacies of an existing graphic knowledge representation technique, the thesis proposes a representation technique that combines the existing technique with tables and other modelling constructs. Next, the two most commonly applied graphic knowledge representation techniques in configuration projects are investigated by analysing their mutual strengths and weaknesses. Having clarified the nature of these strengths and weaknesses, a new layout principle is proposed that combines the advantages of both notation techniques. To deal with cases where graphic models with overlapping content are to be maintained, the thesis proposes and tests a modelling principle that allows maintenance of models with overlapping content in a common model. Finally, the thesis investigates how knowledge in configuration projects can be documented, from a software perspective. This is done by proposing definitions of the modelling techniques that a software-based documentation system should support. To test the definitions, a software prototype is developed. In conclusion, this thesis provides new insights into the knowledge acquisition process of configuration projects and several new modelling techniques and principles. The contributions provide an improved basis for future research in product configuration and for the companies that engage in configuration projects.

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Haug, A.
Number of pages: 268
Publication date: Jul 2008

Publication information
ISBN (Print): 978-87-91035-67-8
Original language: English
Electronic versions:
PhD_Thesis_AHaug_v2.pdf
Source: orbit
Source-ID: 208641

Improving decision making in the early phases of configuration projects
During the early phases of configuration projects very important decisions are made which will heavily influence the performance of the company, benefits in different functional areas (production, sales, purchase, product development, service etc), maintenance of the configuration system and quality of the dialogue between the configuration system and the users. Today there exists very sparse tools and procedures which can assist the early phases, i.e. conceptual modeling of the products and product assortment. This paper presents a five-phase procedure for conceptual modeling in configuration projects. Each of the five phases is supported by a set of tools. The main idea of the procedure is utilization of a so-called Product Family Master Plan, which is a formal description of the product assortment and its variation. The procedure has been tested at one of Baan’s customers with very convincing results.

General information
Publication status: Published
Organisations: Engineering Design and Product Development, Department of Management Engineering
Contributors: Mortensen, N. H., Harlou, U., Haug, A.
Pages: 185-194
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: International Journal of Industrial Engineering (Online)
Volume: 15
Issue number: 2
ISSN (Print): 1072-4761
Ratings:
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Original language: English
Keywords: Product configuration, early phases, modeling, product variety, visualization
A classification of the information that domain experts do and do not provide in configuration projects

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Haug, A., Hvam, L.
Publication date: 2007

Host publication information
Title of host publication: Proceedings of the 12th annual international conference on Industrial Engineering Theory, Applications & Practice
Source: orbit
Source-ID: 208640
Research output: Chapter in Book/Report/Conference proceeding › Article in proceedings – Annual report year: 2007 › Research › peer-review

A comparative study of two graphical notations for the development of product configuration systems

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Haug, A., Hvam, L.
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: International Journal of Industrial Engineering (Online)
Volume: 14
Issue number: 2
ISSN (Print): 1072-4761
Ratings:
Web of Science (2007): Indexed yes
Original language: English
Source: orbit
Source-ID: 208637
Research output: Contribution to journal › Journal article – Annual report year: 2007 › Research › peer-review

A prototype of a documentation system that supports the development and maintenance of product configuration systems

Product configuration systems (PCSs) can be defined as product-oriented expert systems that allow users to specify products while restricting how different elements and properties may be combined. For several companies the use of PCSs has led to improvements of product specification processes, such as shorter lead times, reductions of resources needed and fewer errors. A procedure for the development and maintenance of PCSs, which has been applied in configuration projects for more than ten years, includes three main modelling techniques to support the development and maintenance of PCSs. Unfortunately, no software exists which supports all three techniques in an integrated fashion. This means that when developing PCSs based on this procedure there is no automatic integration between the created models. Therefore, for some years, researchers have worked on creating a basis for developing a documentation system that supports the development and maintenance of PCSs. This article describes how some of this research has been converted into a prototype of a documentation system and what has been learned from the evaluation of the prototype

General information
Publication status: Published
Organisations: Department of Management Engineering, Computer Science and Engineering, Department of Informatics and Mathematical Modeling, Industrial Engineering and Management
Contributors: Haug, A., Degn, A., Poulsen, B., Hvam, L.
Pages: 1048-55
Publication date: 2007
Peer-reviewed: Yes
Creating a documentation system to support the development and maintenance of product configuration systems

Measuring process and knowledge consistency: A necessary step before implementing configuration systems

When implementing configuration systems, knowledge about products and processes are documented and replicated in the configuration system. This practice assumes that products are specified consistently i.e. on the same rule base and likewise for processes. However, consistency cannot be taken for granted; rather the contrary, and attempting to implement a configuration system may easily ignite a political battle. This is because stakes are high in the sense that the rules and processes chosen may only reflect one part of the practice, ignoring a majority of the employees. To avoid this situation, this paper presents a methodology for measuring product and process consistency prior to implementing a configuration system. The methodology consists of two parts: 1) measuring knowledge consistency and 2) measuring process consistency. Knowledge consistency is measured by developing a questionnaire with a 5 point Liker scale and a corresponding scoring system. Process consistency is measured by using a first-person drawing tool with the respondent in the centre. Respondents sketch the sequence of steps and people they contact when configuring a product. The methodology is tested in one company, and the paper presents and discusses these results.
Product Structured Class Diagrams to support the development of Product Configuration Systems

General information
Publication status: Published
Organisations: Department of Management Engineering, Department of Industrial Management and Engineering
Contributors: Haug, A., Hvam, L.
Publication date: 2007

Host publication information
Title of host publication: Proceedings of MCPC 2007
Source: orbit
Source-ID: 208639

Reflections on the transition from ETO to Mass Customization

General information
Publication status: Published
Organisations: Department of Management Engineering
Publication date: 2007

Host publication information
Title of host publication: Proceedings of MCPC 2007
Source: orbit
Source-ID: 208638

Tacit knowledge in configuration projects

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Haug, A., Hvam, L.
Publication date: 2007

Host publication information
Title of host publication: Innovative Processes and Products for Mass Customization (Proceedings of the Joint Conference IMCM'07 & PETO'07
Source: orbit
Source-ID: 208636

The modelling techniques of a documentation system that supports the development and maintenance of product configuration systems

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Haug, A., Hvam, L.
Publication date: 2007
Peer-reviewed: Yes

Publication information
Journal: International Journal of Mass Customisation
Typology of Product Configuration Systems

Many organisations are moving from mass production to mass customization. Product configuration systems (PCS) are increasingly seen as an interesting option for firms who wish to pursue a strategy with a high degree of product variance while retaining a low cost of specifying the product. To become more specific in relation to how product configuration systems can support mass customization, it is necessary to understand how different product configuration systems can be classified, and how these differ. This paper presents a typology of product configuration systems based on the five kinds of knowledge needed for the configuration task. Lastly, we discuss the implementation and use-related issues that can be derived from the typology.

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Jensen, K. L., Edwards, K., Haug, A.
Number of pages: 441
Pages: 175-184
Publication date: 2007

Host publication information
Title of host publication: Innovative Processes and Products for Mass Customization
Place of publication: Berlin
Publisher: GITO
Edition: 1
ISBN (Print): 978-3-940019-03-5
(Business Informatics and Application Systems; No. 3).
Keywords: Mass Customization, Product Configuration Systems, Configuration Readiness
Source: orbit
Source-ID: 208280

CRC-cards for the development and maintenance of product configuration systems

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Haug, A., Hvam, L.
Publication date: 2006

Host publication information
Title of host publication: Customer Interaction and Customer Integration
Publisher: GITO-Verlag, Berlin
ISBN (Print): 3-936771-73-1
Source: orbit
Source-ID: 194929
Research output: Chapter in Book/Report/Conference proceeding – Article in proceedings – Annual report year: 2006 – Research – peer-review

Merging models with different perspectives on product configuration knowledge

General information
Publication status: Published
Organisations: Department of Management Engineering
Contributors: Haug, A., Hvam, L.
Publication date: 2006
The modelling techniques of a documentation system that supports the development and maintenance of product configuration systems

Developing 3D configuration systems for manufacturers of complex building components

Product analysis as a basis for building product configuration systems