



Doctoral Thesis

Die Konfigurations- und Vertraeglichkeitsmatrix als Beitrag zur Darstellung konfigurationsrelevanter Aspekte im Produktentstehungsprozess

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Die Konfigurations- & Verträglichkeitsmatrix als Beitrag zur Darstellung konfigurationsrele- vanter Aspekte im Produktentstehungsprozess

Abhandlung zur Erlangung des Titels
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Abstract

In the last decade, many factors have changed in the enterprise-environment due to the diversification of the market demand. Global competition, increasing functionality of products, shorter innovation cycles and environmental standards are only some of these factors. Enterprises react to the changing situation by offering an increasing number of variants of existing products. The augmented internal product complexity frequently causes an increasing number of dependencies between single modules. These dependencies or rules make the product-configuration process more complicated for vendors and customers and is more difficult to support with IT-software.

A proven valuable attempt is not to deal with short-term measures like designing very customized modules, but to consider the eventual customer requirements already in the first stages of the engineering design process. A modular product architecture provides a generic structure to capture and utilize commonality, and at the same time it provides some degree of freedom for the specific product customisation.

In this work some methods supporting the modularisation process in the engineering design process are presented. Although these approaches fulfill important pre-requirements to support the configuration process, they do not represent configuration knowledge in a structured way. So the K- & V-Matrix-method is introduced and discussed as a simple and easy-to-learn approach for structuring and representing configuration knowledge. The method is based on two kinds of matrices: the K-Matrix (configuration matrix, "Konfigurationsmatrix") and the V-Matrix (compatibility matrix, "Verträglichkeitsmatrix") and allows:

- the description of different product views,
- a consistent mapping between the views,
- the description of correlations between single parts or modules.

The K- & V-Matrix method is discussed in the context of the engineering design process and its ability to combine with the approaches supporting the modularisation of product architectures is presented.

In addition to the method a software-tool has been developed. The aim of the software is to:

- support the analysis of configuration knowledge,
- permit a fast verification of configuration knowledge,
- simplify the management of configuration knowledge.

In this part of the work, aspects of the interface in the software tool are focussed.

An interface-approach for an editing-tool as well as for a query-tool are discussed. Moreover, the query-tool has a generic interface-structure which enables a fast verification of the knowledge in the matrix, independent of the product characteristics. The usability of the interface has been tested scientifically and the results confirmed the validity of the approach presented.

In the last part of the work the method and the related software tool have been verified in the context of the sales process with different products. The results show, that the presented method and the related software-tool can represent the configuration knowledge of assembly to order products. Some limitations in more customisable products show, that the method focusses on aspects of the variety and represents only a part of the configuring knowledge described by compatibilities, formulas, rules or constraints. Nevertheless, the matrix-based methodology and the related IT-tool provide a useful support for analysing and structuring product variety, independent of the product characteristics and complexity throughout the whole product life-cycle.