Doctoral Thesis

Die systematische, rechnerunterstützte Prozessauswahl und -kettenerstellung in der Grobplanungsphase der Produktionsplanung

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Abhandlung zur Erlangung des Titels

Doktor der Technischen Wissenschaften

der Eidgenössischen Technischen Hochschule Zürich

vorgelegt von

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Dipl.-Ing., Universität Karlsruhe (TH)

geboren am 28. August 1968

von Deutschland

Angenommen auf Antrag von:

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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 and shorter innovation cycles are only some of these factors. Enterprises react to the changing situation by offering innovative products, adapted workflows, variant cooperation methods and modern information technology.

Nevertheless within the product development process the designing engineer is still faced with the problem to define solely the design characteristics influenced by the chosen manufacturing processes. Therefore the designing engineer creates his design with regard to his manufacturing experience, not considering enough any other alternative processes, which could satisfy the product demands better.

The parallel work of the designing engineer and the production engineer, and the different localities of designing department and production plant are only some factors leading to this situation.

Various existing methods to determine the manufacturing processes along the product development process are presented. Although their contribution for production planning purposes is proved, these approaches only can be applied under restrictions. Other methods are based on fully automation, but they're not accepted by the users especially the production engineers as the traceability of the solution is not obivous.

In this work a new approach to improve the interaction between the workflow within the product development process, the usage of IT-Tools and the product information as base for production requirements is described.

The approach is embedded in the "COPE planning methodology" a production planning approach. Within the COPE planning methodology a DFMA method is applied by a Simultanous Engineering Team in order to determine the manufacturing processes and the process chain manually. All informations are stored within the digital factory tool "Process Engineer" of DELMIA.

The aim of the new approach is to verify the manually chosen manufacturing processes and to decide whether the verified processes are able to generate the product design or not. Otherwise alternative processes, enterprise experienced, should be suggested to the the Simultanous Engineering Team.

As first part of the work the product information has been extended to a feature-based product model. In the second part properties of enterprise experienced processes and the related ressources have been recorded and were edited for a

database design. The third part implies the comparation of the requirements of the featurebased product model with the properties of the related process and its manufacturing ressources. The criteria therefore can be associated to the process and to the process chain.

The implementation can be divided into three steps for the user. In the first step the approach identifies those features determining the product design. After the export from the CAD-system, the feature data are imported to the digital factory tool. The second step screens the manually chosen process in the digital factory tool for a appropriate process in the process database. After relating the process properties from the database to the process within the digital factory tool, the comparation of the feature data and the process properties can be accomplish. Following to the verification all processes the process chain will be optimised with algorithm of the Boolean Algebra: QuineMcCluskey and Karnaugh-Veitch.

Some limitations in the featurebased design within the CAD-System show that the approach is focused on molding, bending, separating and coating processes as well as heating treatment.

Nevertheless the featurebased process verification and choice provide a useful support for the production planning activities for the Simultanous Engineering Team.