

# 53. IWK

Internationales Wissenschaftliches Kolloquium  
International Scientific Colloquium



Faculty of  
Mechanical Engineering



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## PROSPECTS IN MECHANICAL ENGINEERING

8 - 12 September 2008

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TECHNISCHE UNIVERSITÄT  
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Home / Index:

<http://www.db-thueringen.de/servlets/DocumentServlet?id=17534>

## Published by Impressum

Publisher  
Herausgeber Der Rektor der Technischen Universität Ilmenau  
Univ.-Prof. Dr. rer. nat. habil. Dr. h. c. Prof. h. c. Peter Scharff

Editor  
Redaktion Referat Marketing und Studentische Angelegenheiten  
Andrea Schneider

Fakultät für Maschinenbau  
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Editorial Deadline  
Redaktionsschluss 17. August 2008

Publishing House  
Verlag Verlag ISLE, Betriebsstätte des ISLE e.V.  
Werner-von-Siemens-Str. 16, 98693 Ilmenau

### CD-ROM-Version:

Implementation  
Realisierung Technische Universität Ilmenau  
Christian Weigel, Helge Drumm

Production  
Herstellung CDA Datenträger Albrechts GmbH, 98529 Suhl/Albrechts

ISBN: 978-3-938843-40-6 (CD-ROM-Version)

### Online-Version:

Implementation  
Realisierung Universitätsbibliothek Ilmenau  
[ilmedia](#)  
Postfach 10 05 65  
98684 Ilmenau

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## **A novel Function-Structure-approach exemplified by Selection of Gearless Drives**

### **Abstract**

During the design process the designer has to choose an optimal conceptual design for the specified requirements. Up to now this process is based on the designer's personal experience. In mechatronic system design the diversity of heterogeneous subsystems like actuators and their integration leads to an infinite number of possible solutions which can not be surveyed by the designer.

The design of precision positioning systems is a typical example of mechatronic design, which considers magnetic-, electric-, mechanic-, and measure-properties and needs to follow a systematic approach. Existing design methods are commonly limited to mechanical design featuring a general solution plan [1, 2]. They define an overall function to be implemented and assume for this reason so called function structures, which realise the needed overall function with arrangements and correlations of sub-functions. The crucial issue of this process is assignment of system-characteristics and required properties.

The new function-structure-approach creates a database applied on gearless drives that provides a new quantity and quality of property-characteristic-relations, thus enhancing the capability of finding alternative working principles. Compared to existing tables the database expands the small number of cross relations, allows the holistic evaluation of multiple actuator working principles and makes trade-offs aware.

At the Faculty of Mechanical Engineering of TU Ilmenau a prototype of a software tool – the function-structure-database - has been implemented. The selection is supported by novel parameters given by the interlinkage of characteristics and properties, thus enabling function-driven actuator selection. The main advantages of this novel tool are the enlargement of the manageable solution space, the assistance at the restriction of the possible solutions and that geometrical limitations in the preliminary design-phase are also taken into account.

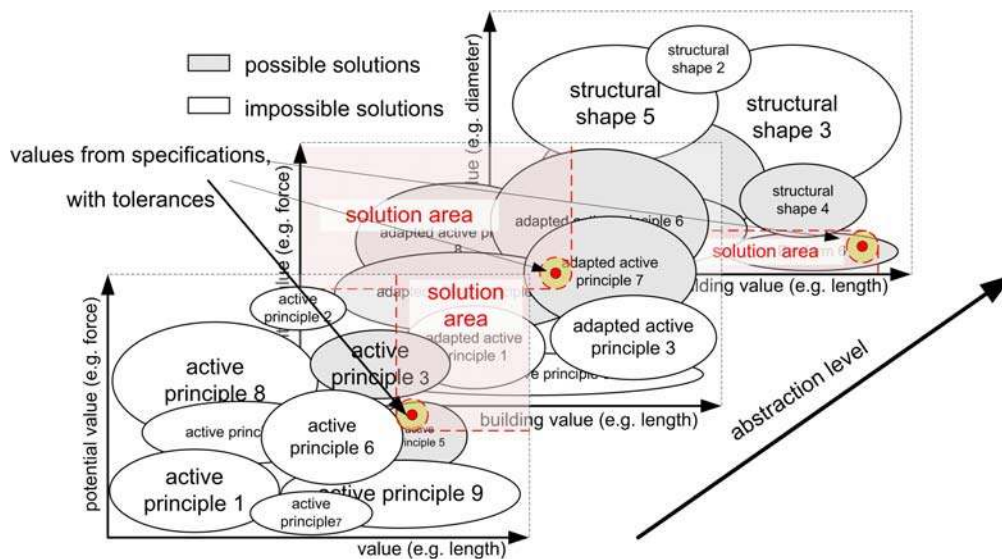


Fig. 1 idea of function-structure database

The new function-structure-database with its intended and possible enhancements is a novel, systematic selection-tool approaching the transition of systems from function to embodiment level [3]. The database is actually applied on gearless drives.

Fig. 1 shows the principle of the database: specifications define a solution area of active principles. In the development process different abstraction levels provide multiple feasible working principles and structural shapes, respectively. The developer surveys the limited solution space and chooses from the multi-variable-optimised output.

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