### TRANSPARENT 3D VISUALIZATION OF MECHATRONIC SYSTEM STRUCTURES

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Within this paper an interactive tool for the transparent visualization of cross discipline and cross domain dependencies in the context of the development of mechatronic systems is presented. The visualization technique is designed to support the engineers in their daily work within the development process of mechatronic products. We describe how the necessary dependency data can be acquired and how a transparent visualization of these dependencies helps to better handle complexity.

### SYSTEMATIC DEVELOPMENT OF CONTROLLERS BASED ON THE PRINCIPLE SOLUTION OF SELF-OPTIMIZING SYSTEMS

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The conceivable development of information technology will enable mechatronic systems with inherent partial intelligence. They will be able to learn, to communicate, and to optimize their behavior autonomously in response to environmental changes. These systems are called self-optimizing systems. The development of such systems starts with the conceptual design phase. The result of the conceptual design is the domain-spanning principle solution. On the basis of this principle solution, further design concretization will take place in the technical domains involved. This paper addresses how controller design can be started based on the principle solution of self-optimizing systems. The method is exemplified by a self-optimizing motor drive.

### PROCEEDING FOR THE CONCEPTUAL DESIGN OF SELF-OPTIMIZING MECHATRONIC SYSTEMS

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The conceivable development of information technology will enable self-optimizing mechatronic systems with inherent partial intelligence, which are able to react autonomously and flexible to changing environmental conditions at run-time. The design of such systems requires a domain-spanning principle solution for a smooth cooperation of the involved engineers. This principle solution is developed within the early design phase "conceptual design" and describes the fundamental structure as well as the system’s action mode. The paper presents the proceeding during the conceptual design and describes the synthesis of the principle solution exemplary; a self-optimizing air gap adjustment system for a linear drive points out the approach.

### A PROPOSAL FOR THE USE OF DIAGRAMS OF UML FOR MECHATRONICS ENGINEERING

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The paper intends to explore the use of the diagrams of UML (unified modeling language) in the product development process of mechatronical products. The analyzed product development process concerns the development of a brake for a mobile robot. The patented steering principle of the robot is based on torque differences. This kind of steering system can by enhanced by equipping the steering axles with brakes. The developed brake uses a smart material - a ferromagnetic shape memory alloy (FSMA) - and had the unique characteristic to compensate wear and tear. The embodiment of the brake has already been registered as a patent. The experience during this development was used to reflect on an appropriate methodology for mechatronical design.

### MECHATRONIC-ORIENTED DESIGN OF AUTOMATED MANUFACTURING SYSTEMS IN THE AUTOMOTIVE BODY SHOP

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Accelerated and more robust ramp-up processes of highly complex automated manufacturing systems based on shorter design cycles are a key demand in the automotive industry. To cope with these market- and/or cost-driven challenges, new solutions for production design and ramp-up processes are required. Thus, a mechatronic-oriented design methodology is introduced, taking the example of the development process of automated manufacturing cells in the automotive body shop. Apart from the presentation of the most important characteristics of the newly developed methodology, its software-technical implementation as well as some practice-relevant introduction aspects are also illustrated.

### APPROACH ON THE CONTROL OF ITERATIONS IN THE MULTIDISCIPLINARY DEVELOPMENT OF TECHNICAL SYSTEMS

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Due to the increasing complexity of products as well as the product development the course of the product development process is not foreseeable in detail; it develops iteratively in its progression. To help the developer to distinguish unnecessary iterations from helpful ones and to avoid time-consuming and cost-intensive detours, a classification of iterations and based on this a practical method of accomplishment for each identified class of iterations is shown in this paper. An approach on the control of iterations in the multidisciplinary development is depicted and shown by an example. By the presented procedure, the developer is aided in the accomplishment of inevitable iterations and unnecessary iterations can be avoided.

### TO THE DEVELOPMENT OF A SYSTEM ARCHITECTURE OF COGNITIVE TECHNICAL SYSTEMS

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Today increasingly intelligence is expected by technical systems with which they should be enable to operate autonomously. Therewith technical systems are to be put in the position to react flexible in terms of system purpose to various environmental conditions. Both descriptions of system tectonics and system dynamics are elementary preconditions to develop cognitive abilities in a technical system. It is crucial that cognitive abilities can not be implemented per se, rather it must be ensured that these can develop themselves. Hereunto further work for the refinement of the approach is necessary, because the idea is in principle helpful for the development of interdisciplinary products.