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F.-L. Krause / R. Stark

Potentials and Future Innovation of Virtual Product Creation

The presentation aims at conveying insights into product creation as well as into the augmentation by computers. Product creation today is a key engineering discipline to ensure best suitable products. Targets such as product function, customer needs, product use and environmental impact as well as economic revenue expectations are drivers for the creation process of products whereas technical requirements and manufacturing process circumstances remain critical constraints.

The term virtual product creation (VPC) is similar to the term virtual product realization (VPR). The difference in principle understanding, however, depends on the engineering view point. VPC looks from the design perspective to this creation process, VPR does the same from manufacturing perspective. The term VPC is about ten years old. It was first used in the project iViP (Integrated Virtual Product Creation). In former times traditional design process terms such as drafting, design and product development were used. Extending those terms allowed for more integrative work.

The most important change in understanding is the extension from design to product development. Nowadays designing is focusing on concepts, embodiment and detailing, whereas product development also includes critical aspects of process planning. Such comprehensive creation process requires substantial computer aided operation, not necessarily in an automatic way but in a partly automated and highly interactive mode. Time to market drove faster development cycles whereas higher robustness for production readiness called for more complex digital process interactions. The longest possible process chain starts with product planning and runs up to the start of production. This overall process chain augmented by computers is called Virtual Product Creation. It allows taking into account also first steps of production as feedback to design and process planning.

Today's industrial demands are manifold. Costs, quality, development time, innovation, complexity, individual products and environmental issues like energy and resource saving put demands to development staff involved in these processes. Such complex development scenarios can only be handled by augmentation through computers. In addition, future scenarios will require more stringent technologies which already support the entire product life cycle during the process of virtual product creation.

With a set of systems which have been developed and partly are still under development we intend to characterize the state of the art. Needless to say that there exist a range of commercial systems on the market like CAD, CAE, CAPP for PDM, ERP and the Digital Factory. What was missing up to iViP was the capability to integrate heterogeneous systems. Ten years ago this was solved by a middleware concept called CORBA. Today this is tackled by SOA.

Important topics for industrial use have been worked on during the last ten years in national research and industrial projects, as the following examples show:

- The cooperation of heterogeneous PDM systems was enabled by the project PDM-Collaborator.
- Consistent gathering of product requirements and functional descriptions for mechanical products was made possible by FOD (Function Oriented Design).
- The repair of geometry for CAE use and NC programming is meanwhile feasible as operationally demonstrated in industrial applications.
- Digital Mock-Ups in automotive and aircraft design are in daily use.
- Distributed product development by the usage of Virtual Reality can be realized.
- Mechatronics product development gets assisted by new design methodology and a new IT system support.
- Grid computing technology is a future means to support the usage of simulation technology in a new flexible way.

The future is demanding and will require a number of innovations that are able not only to be competitive on the global market but also to maintain leadership in technology. Product development methods and processes have to be investigated. They have to become product and factory oriented. The simulation of these processes has started and

has to be continued.

- Product modeling and validation has to make use of combined geometric and physical modeling as well as of interaction and visualization.
- Virtual prototypes have to be generated with intuitive interaction. These prototypes should reflect reality as much as possible.
- Information management for product creation needs to support the development processes with easier to implement PDM capabilities, storage and retrieval of data and has to be enhanced in functionality (for example with the help of semantic context filters).
- Digital manufacturing and factory processes have to be integrated with product creation. The usage of Virtual Reality is necessary and will no longer just be an option.
- Mechatronics product development processes have to be enlarged to multi-discipline engineering processes. Another step in design methods will be made.
- The development of Digital Mock-ups to Functional- and Conceptual-Mock-ups in context with usage of Virtual Reality will give capabilities to work already in the early phases with augmentation.
- Assistant systems will agglomerate the configuration of functionality within an intuitive context and compute power like grids.

Moore's law describes the further enhancement of computer power over at least the next ten years. Virtual Product Creation will have to enable new ways of engineering with the help of adequate methods, tools and systems to make the best use of this upcoming power for a sustainable industry.

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