NEW HOLISTIC APPROACHES FOR CAX-BASED CONCEPTUAL DESIGN

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Agenda

- Introduction and Motivation
- Description of Research Project
- Selected Topics
- Summary
1. Introduction and Motivation

Objectives for development in the automotive industry:

- Much more innovative cars need to be developed and will be developed!
- Managing requirements on the desired product is mandatory for successful frontloading
- Managing collaboration in conceptual design to improve efficiency
- Creation and analysis of alternatives and use of optimization to fully scan the design space available
- Reversing the weight spiral is an objective
- Strengthen collaborative design and engineering to improve “logistics of knowledge” and remove obstacles
More innovative car bodies required

- „Conversion Design“
- „Purpose Design“
- Much more innovative cars need to be developed
- **Managing requirements on the desired product**
- **Managing collaboration in conceptual design**
- Creation and analysis of alternatives and use of optimization
- Reversing the weight spiral
- Strengthen collaborative design and engineering
Creation and analysis of alternatives and use of optimization to fully scan the design space available

**Traditional**

Simulation driven Process

**Desired**

Generation of alternatives, mutations, Optimization, Robustness, Reliability
Reversing the weight spiral is an objective

- Much more innovative cars need to be developed
- Managing requirements on the desired product
- Managing collaboration in conceptual design
- Creation and analysis of alternatives and use of optimization
- Reversing the weight spiral

**Strengthen collaborative design and engineering to improve “logistics of knowledge” and remove obstacles**
2. Description of Research Project

Project Input: architecture, clearances, legal regulations, package, materials, conceptual sections, ...

Definitions Constraints

Project Input: architecture, clearances, legal regulations, package, materials, conceptual sections, ...

Geometry allowing modifications of topologies, shape and parameters

Parametric CAD Model

Design alterations worked out in a hierarchical analyses sequence to minimize computational effort

FEA-meshing (beam/shell) + analyses to check feasibility of alternatives

Models for Simulation

Manufacturing Processes

Structural Integrity

Manufacturing Cost

Optimized CAD Geometry

Analysis environment (backbone) to control modeling and analysis workflow, managing data, constraints and perform tasks for optimization and robustness

Optimization and Robustness

Job / Workflow Management

Constraint Management

Data Management

Final result, feasible with respect to all constraints and requirements as defined
3. Selected Topics

- Parametric modeling of geometry
- Coupling industrial design (styling) and structural design
- Simplified analysis methods for conceptual models
- Data and knowledge management
- …
Parametric modeling of geometry
Functional based modeling approach vs. CSG/BREP
Concept modeling and detailed design

Pure conceptual geometry

FCM geometry

Detailing

+FCM bead
+FCM hole
+FCM flange

Ready for production

+GSD fillet
Coupling Industrial Design and Structural Design

Autodesk MAYA: Design

FCM: Package and BIW

Model Transfer

FCM: Design + BIW

FCM Parametric Structure of BIW

Simplified analysis methods for conceptual models

- peak load, initiation of deep plastic collapse
- deep plastic collapse with folding
- squash load, full crushing length used up or jamming of a hinge
- deep plastic collapse without jamming
- elastic range
- deformation (translational, rotational)
Simplified analysis methods for conceptual models

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[Rustaee Khoshbijari, Mohammad: Crashgerechte Absicherung von parametrisierten Fahrzeug-Konzeptmodellen. Diplomathesis, Munich University of Applied Sciences (2010)]
Data and Knowledge management