CAE Process Support by MIDAS and MEDINA

Software-Integration and Simulation Data Management.

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CAE Process Support with MIDAS and MEDINA Agenda.

1. Introduction
2. Model Assembly / PreProcessing
3. Results Data Management / PostProcessing
4. Discussion

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Introduction.
Development of Analysis Variants in the Automotive Sector.

Introduction.
Requirements for the CAE-Process.

Boundary Conditions:
- Number of Analysis/Product Variants
- Amount of Data
- Development Cycles

Requirements:
- Faster Model Assembly
  - Management of Modifications
- Faster Post-Processing
  - Automation of Standard Analyses
  - Flexible Result Comparisons
- Process Security
  - Data and Variants Management
  - Documentation, Traceability
  - Standardisation, Comparability

......T-Systems......
Introduction.
CAE-Process Support with MIDAS & MEDINA.

MIDAS + MEDINA:
- Software Integration
- Simulation Data Management

Approach:
- Integral
- Open
- Modular
- Platform-independent

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Introduction.
CAE System Landscape.

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Model Assembly.
Sub-Process Model Assembly: Objectives.

- **Management of Changes**
  - Fast Insertion of Changes
  - Prompt Update for all Loadcases and Product Variants
  - Documentation of analyzed Product States

- **Process Acceleration**
  - Automated Model Assembly

**Solution Approach:**
Combination of MEDINA and MIDAS Parts Database
Model Assembly.
Tasks of MEDINA and MIDAS Parts Database.

Parts Database
- Modification Management
- Common Data Pool for all Disciplines

MEDINA
- Assembly of Loadcase-specific Full Vehicle Models from single Parts
- De-Penetration, Mass Balance

Objective: One-click Assembly of ready-to-solve Models from Database

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Model Assembly.
Overview Data Flow.

Parts Database
DB Client 1
DB Client 2
XML
Control
Protocol
MEDINA

PDM
STEP
Product Structure and Part Definitions
Documents

Documents
Catal
Weld
Screw

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Model Assembly.
Contents of Parts Database and Assembly-Process.

For each Part:
- FE-Models for different Loadcases and Disciplines
- Selection of Product Version + Loadcase for Assembly
  - Part Number
  - Version
  - OD
  - Material
  - Thickness
  - Dims
  - Target Numbers,

Only 1 Data Base for all Disciplines

Model Assembly.
Benefits: Modification Management.

- Versioning Concept
- Variants Management

Benefit:
After Modifications faster, prompt Model Update for
- all Loadcases/Disciplines
- all Car Variants
Model Assembly.
Benefits: Assembly-Process.

Features in MEDINA + Parts Database:
- Adoption of complete Product Structure Information from PDM (incl. Versioning)
- Support of Part Number Areas for Nodes, Elements,...
- Support of Mirrored/Repeated Parts
- Support of Transformations for Construction/Mounting Position

Benefit:
- Documented, reproducible Computing Model States
- Time/Effort Savings for Modelling of Modifications
- Reuseability of Parts in Car Variants
  (same Part e.g. Motor at different Position)

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Model Assembly.

Process in MEDINA:
- Part-Attribute in Structure Tree (taken over from Database):
  - Target Mass per Part/Assembly
  - User-defined Mass Additions
- Computation of Structural Mass
- Generation of Added Masses
- Generation of Trim Masses (Remaining Difference to Target Mass)

\[
\text{Structural Mass} + \text{Added Masses} + \text{Trimmed Mass} = \text{Target Mass}
\]

Benefit:
- Timesavings for all Modifications
- Mass Additions traceable and documented
- Error Minimisation

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Model Assembly.
Benefits: Automatic De-Penetration.

Features:
- Automatic Elimination of Penetrations over Sheet Thickness
  (resp. Contact Thickness)
- Specification of Default Parts to include/exclude via MIDAS Parts Database

Benefit:
- Timesavings
- Error Minimisation

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Model Assembly.
Benefits: Part Connections (I).

Modelling of Part Connections in MEDINA:

Connector Elements for
- Weld Spot       SPOTWELD
- Screw           SCREW
- Bearing/Hinge   BEARING

- Weld Lines + Glueing: deferred to later Version of MEDINA

Import via Connector Lists from MIDAS Parts Database.

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Model Assembly.
Benefit: Part Connections (II).

Features of Connector Elements:
- Mesh Independent
- Automatic Connection to Structure

Benefit:
- Connection-independent Modelling of Parts
- Simple Exchange of Parts for Modifications
- Different Part Models for different Disciplines/Loadcases

Model Assembly.
Benefits: Part Connections (III).

Features of Connector Elements:
- Only 1 Connector for Triple Joints
- Reference to Part Numbers from PDM (or Property-Ids)

Benefit:
- 1:1 Relation of Connector Elements to Constructive Connection
  => improved Control/Handling
- Simple Adoption e.g. of Weld Spot Lists from CAD
  without manual Transcription Part Number => Property
- Modified Lists can be passed to Construction 1:1
Model Assembly.
Benefits: Part Connections (IV).

Connectors are Solver-independent and Generic.

| Connector Element = Solver-independent Definition of Connections |
| * Geometry | * Parts | * Search Strategy | + Parameter |
| Connector Property = Definition of Discretisation |
| * Discretisation rule for each Solver: |
| NASTRAN: CWELD, HEXA,... |
| PAMCRASH: PLINK, HEXA,... |

Benefit:
- 1 Set of Connector Elements for all Solvers and Disciplines
- Minimal Maintenance, Consistency

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Result Data Management / Post Processing
CAE System Landscape

MIDAS Workflow Support
- MEDINA
- Data Processing Tools
- NASTRAN, LS-DYNA, ABAQUS...
- MEDINAC,E
- HYPERGRAPH ANIMATOR...
- MIDAS-Viewer, POWERPOINT...

MIDAS Data Management
- Parts Database: Part Meshes, Part Connections, Product Structure...
- Vehicle Models
- Primary Results
- Secondary Results
- Job Information

Post Processing
Process Support with MIDAS

Utilisation and Development of existing Standards
Automatisation of Analysis and Data Organisation

Advantages:
- Timesavings while increasing Process Security
- Flexible Variants Comparison by Dynamic Data Access
- Open Architecture regarding Applications and Data
PostProcessing.
MIDAS Data Management.

- Filesystem based
- Standardised, transparent Data Storage
- Split up into primary and secondary Results (Migration)

Advantages:
- Data accessible for the entire Team
- Use of existing Hardware + Data Migration Concepts
- Small Investments for Infrastructure and Operation
- Continuity: Benefits without Risk

MIDAS Broker

Data Storage  Program Call  Data Storage

Primary Results  Automatic Postprocessing  Secondary Results

e3plot, op2, pch, bdf  Standard Tools (Hypergraph, Animator, MEDINA,...)  Data

BOF  XY-Data

Documents
- Pictures
- Videos
- Other, e.g. xfs

MIDAS Viewer

T-Sysystems
PostProcessing.
MIDAS Components: broker.

Batch Procedure for Processing of Primary Results
- Automatic Start
- Control Statements in Solver Deck
- Call of Standard Tools (Animator, MEDINA, Hypergraph,...)

Functions:
- Generation of Car Variants from Data Management
- Check of Compute Job towards Regular Completion
- Generation of Overview with „Solver“-typical Information
- Execution of Standard Analyses
- Execution of User Controlled Analysis
- Storage of all Associated Data of the Data Structure

Benefit:
Relief of Routine Tasks, Timesavings, Comparability

* * * * * * Systems *

PostProcessing.
MIDAS Components: viewer.

User-Interface:
- Navigate
- Visualise
- Filter
- Edit + Dynamical Comparisons
- Third-Party Applications
- Management of Additional Project Data (incl. Display)

One-click Interactive Execution of Comparisons between Variants (Diagrams, Tables)

Benefit:
Timesavings, Improved Analysis Methods

* * * * * * Systems * *
PostProcessing
Availability of MIDAS.

Supported Applications:

- Crash (LS-DYNA) Productive for 2 years
- NVH (NASTRAN) Productive for 6 months
- Stiffness/Durability (NASTRAN) in Production

Openness with respect to Solvers and Embedding of Standard Postprocessors, e.g. MEDINA, Animator, Hypergraph,...

Thank you very much for your attention!