Positioning of Car Seat Structures

06.06.2013 - S. Sinne, F. Richter
Agenda

1. Brose – system supplier of the international automotive industry
2. Seat Types & Test Requirements
3. Seat Positioning
4. Summary
## Agenda

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
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<td>Seat Positioning</td>
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<tr>
<td><strong>4</strong></td>
<td>Summary</td>
</tr>
</tbody>
</table>
Founding and building of a family-owned company
Three generations in 100 years
Product range
Mechatronic Systems and Drives for Automobiles

Structures and components for vehicle seats

Systems for engine cooling, electric motors and drives

Modules and components for vehicle doors
Global presence
53 locations in 23 countries

America
Employees: 4,750
Turnover: 20%
Locations: 9

Europe
Germany
Employees: 11,830
Turnover: 65%
Locations: 29*

Asia
Employees: 3,710
Turnover: 15%
Locations: 15

*incl. South Africa
Customers worldwide
Business development
Continuous self-generated growth

Issuer: Sven Sinne
Function: SVS
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Issue Date: 17.05.2013
System expertise vehicle seat

Components:
- Power seat adjuster
- Complete seat metal structure
- Manual seat adjuster

Integration:
- 2. and 3. row
<table>
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</table>
Seat Positioning
Overview

Cushion Extension

Tilt

Height

Length

Backrest

Upper Backrest

Headrest
# Seat Types

<table>
<thead>
<tr>
<th>Adjuster</th>
<th>Basic</th>
<th>Comfort</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="#" alt="4-way man" /></td>
<td><img src="#" alt="4-way pow" /></td>
</tr>
<tr>
<td></td>
<td><img src="#" alt="6-way man" /></td>
<td><img src="#" alt="6-way pow" /></td>
</tr>
<tr>
<td></td>
<td><img src="#" alt="8-way man" /></td>
<td><img src="#" alt="8-way pow" /></td>
</tr>
</tbody>
</table>

## Backrest

<table>
<thead>
<tr>
<th></th>
<th>4-way</th>
<th>6-way</th>
<th>8-way</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>man</td>
<td>man</td>
<td>man</td>
</tr>
<tr>
<td></td>
<td>pow</td>
<td>pow</td>
<td>pow</td>
</tr>
</tbody>
</table>

## 12 Seat Types
## Test Requirements

### Crash

<table>
<thead>
<tr>
<th>Frontal Impact</th>
<th>w/o Dummy</th>
<th>5%-ile</th>
<th>50%-ile</th>
<th>95%-ile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
<td>P3</td>
<td>P1</td>
</tr>
<tr>
<td>Crash w/o Dummy</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rear Impact</th>
<th>5%-ile</th>
<th>50%-ile</th>
<th>95%-ile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
<td>P3</td>
</tr>
<tr>
<td>Crash w/o Dummy</td>
<td>●</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cargo Load</th>
<th>5%-ile</th>
<th>50%-ile</th>
<th>95%-ile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
<td>P3</td>
</tr>
<tr>
<td>Cargo Load</td>
<td>●</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14 Loadcases CRASH
Test Requirements
static / dynamic

<table>
<thead>
<tr>
<th>Position 1</th>
<th>Belt Anchorage Test</th>
<th>ISOFIX</th>
<th>Moment H-Point</th>
<th>Headrest Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>right</td>
<td>straight</td>
<td>left</td>
<td>static</td>
</tr>
<tr>
<td>Position 2</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Position 3</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Loadcases STAT / DYN

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Validation Matrix

14 Loadcases CRASH

12 Seat Types

22 Loadcases STAT / DYN

> 400 FE-Runs
## Agenda

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User interactive kinematic articulation
Example: Length adjustment

7 Clicks per Adjustment x 8 Configurations = 56 User Interactions

Time consuming and error-prone model adjustment in case of many loadcases!
Automation approach

Overview

Requirements:

- Error free model handling
- Speed up model assembly
- Speed up seat positioning
- Reproducability of setting up FE-runs
Kinematic automation approach

Input Files

Routing File

```
*KEYWORD
$
*PROJECT_NAME
5th ANSA & pE gia International Conference
$

$AnsA_Includesfile
*ANSA_INCLUDE_FILE
C:\Conference\ansa2013_include.k
$

$AnsA_Kinematics
*ANSA_KINEMATICS_FILE
C:\Conference\ansa2013_kinematics.ansa
$

$ANSA_Seatadjustment
*ANSA_KINEMATICS_POSITION
$X_CONFIG , min, max, value, direction
Length , , , 240, TRANSLATE Z
Height , , , 100, TRANSLATE Z
Tilt , , , 40, TRANSLATE Z
SeatCushion , , , 60, TRANSLATE Z
UpperBackrest , , , 13, TRANSLATE Z
Headrest , , , 80, TRANSLATE Z
$

*END
```
Kinematic automation approach

Model Assembly

Routing File

```plaintext
*KEYWORD
*
*PROJECT_NAME
5th ANSA & META International Conference
*
$AnsIncludeFile
ANSINCLUDE_FILE
C:\Conference\ansa2013_include.k
$
$AnsKInematic
ANSKINematics_FILE
C:\Conference\ansa2013_kinematics.ansa
$
$ANSASeatadjustment
ANSKINematics_POSITION
OK_CONFIG , min, max, value, direction
Length , , , 240, TRANSLATE Z
Height , , , 100, TRANSLATE Z
Tilt , , , 40, TRANSLATE Z
SeatCushion , , , 60, TRANSLATE Z
UpperBackrest , , , 13, TRANSLATE Z
Headrest , , , 80, TRANSLATE Z
$
EN0
```

ANSA Scripting
Kinematic automation approach
Assignment of sets

LS-Dyna Include Files

Pre defined sets

ANSA Kinematics File

Kinematic Bodies

ANSAScripting

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Kinematic automation approach

Routing File

```
*KEYWORD
*PROJECT_NAME
5th ANSA & μETA International Conference
$AnsIncludefile
*ANSA_INCLUDE_FILE
C:\Conference\ansa2013_include.k
$AnsA_Kinematic
*ANSA_KINEMATICS_FILE
C:\Conference\ansa2013_kinematic.k
$AnsA SeatAdjustment
*ANSQKINEMATICSPOSITION
BK_CONFIG   min, max, value, direction
Length      0, 240, TRANSLATE E
Height      100, 100, 0, 0, 0
RCL         40, 40, 0, 0, 0
SeatCushion 60, 60, 0, 0, 0
UpperBackrest 13, 13, 0, 0, 0
Headrest          80, 80, 0, 0, 0
*END
```

ANSA Scripting

Kinematic Articulation
Kinematic automation approach
From Input to FE-Run

Input Files → Model Assembly → Kinematic Articulation → FE Run

Routing_File_1.txt
Routing_File_2.txt
Routing_File_3.txt
...
Routing_File_n.txt

1 Click + ANSA Scripting

FE_Run_1.k
FE_Run_2.k
FE_Run_3.k
...
FE_Run_n.k
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Summary

• The needed standardization for the automation leads to consistent model build up

• Process automation is successfully realized

• Error free model assembly and seat positioning

• Time to set up FE-runs is enormously reduced

➡ Efficient handling of various seat types in combination with many load cases
Thanks' for your attention!
Brose – system supplier of the international automotive industry