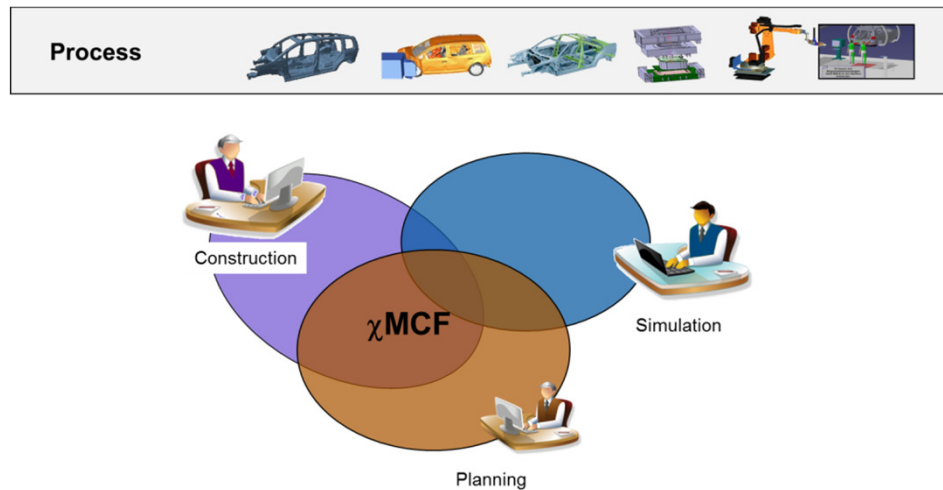# χMCF (extended Master Connection File)

Status of enhancements & bug fixes V3.1.1

Overview

1. \<femdata/\>

2. Weld nuts vs clinch nuts

3. Intermittent weld definition

\<femdata/\>

Problem Description & Outcome

➢ Problem(s):

- It was unclear if \<femdata/\> definition on root level was allowed and possible
  (diff between document and schema file)

- Definition of use cases requested/required for usage of \<femdata/\>

➢ Recommended Change or Action:

- Schema file fixed allowing \<femdata/\> on root level

- Definition of use cases not required

- \<femdata/\> not meant to define communication between different tools
  (unless agreed between the software vendors)

- No change; additional explanations added to the document

- <u>Request to WG members: pls read the added sections (5.2.2 and feed back any issue)</u>

Modified text sections (3.1 >> 3.1.1)

5.2.2 Finite Element Specific Data `<femdata/>`

For the numerical simulation by finite element method, a joint can be discretized (realized) in different kinds and ways depending on the focus of the simulation (crash, fatigue etc.). It is thus frequently necessary to switch from one realization to another one. For this purpose, details of a specific realization may be of interest.

The optional `<femdata/>` can be placed within any single connector[6] (relevant tags are `<connection_0d/>`, `<connection_1d/>` and `<connection_2d/>`).

`<femdata/>` references FEM-entities that are related to the connector in which it is placed. Its content, i.e. the referenced entities, are specific to a single solver.

Usually, referencing is done by solver specific entity IDs, which have no meaning outside the context of a specific finite element model. If e.g. element IDs in this model get renumbered, a χMCF file referencing such element IDs becomes detached and needs to be re-created.

Conclusion: A χMCF file containing `<femdata/>` always refers to *one specific* solver deck.

This solver naming should be taken from FATXML version 1.2 R3 (as current version) which are the following:[7]

- PAM-CRASH
- LS-DYNA
- RADIOSS
- OPTISTRUCT
- NASTRAN[8]
- PERMAS

Added section (3.1 >> 3.1.1)

5.2.2.1 Reasoning about

element can be used versatile for different use cases – even for yet unknown ones. This makes it hard to define exact semantics.

Specific agreements e.g. between preprocessor and solver/postprocessor can be made to support specific use cases.

Relevant object types for

In the first place, *finite elements* which are supported by FE solvers are expected to be addressed via , such as bars, hexahedra, CWELDs etc. "Virtual" connector elements, known to preprocessors only, are *not* relevant, here.

In addition, such solver entities, which are *referenced by* above mentioned finite elements, are relevant, like nodes (grids), properties, materials, coordinate systems etc.

Within the *finite elements*, we can distinguish between following kinds of elements:

1. elements modeling *connections* between parts of the mechanical structure, such as RBEs (spiders), bars, shells, solids *plus* solver specific elements such as CWELDs, etc.

2. elements modeling parts of the mechanical structure, such as shells and solids.
   — And beyond these
   - elements *not* influenced by connections, at all (despite from becoming member of the load path)
   - elements influenced by connections, e.g. in the heat affected zone.

In Jan. 2021, the working group decided that case 1 is *not* in the scope of χMCF format.

Clinch nut vs weld nut

Problem Description & Outcome

➢ Problem:

- It was requested to distinguish between a weld nut and a clinch nut

➢ Recommended Change or Action:

- It was already possible to distinguish between weld nut and clinch nut in V3.1
- Attributes of a nut can be fixed_to (i.e. welded) or clipped_to (i.e. clinched)
- Small comment added in the document; No further action required
- Item closed

Intermittent welds
Problem Description & Outcome

➢ Problem:

- Request to offer an option to define intermittent welds

- Accuracy item caused by polygon approximation of curved weld lines need to be addressed

- Strategy how to handle holes (or other features) interrupting a weld line needs to be defined

➢ Recommended Change or Action :

- Proposal for an intermittent weld definition completed

- Details shown on next pages

- Decision to do not allow interruptions of weld lines

Intermittent welds

Explanation of Proposal

first_spacing   spacing   length   last_spacing

num_segments

Overall length (OAL)
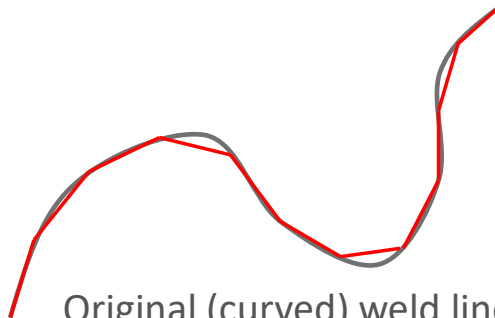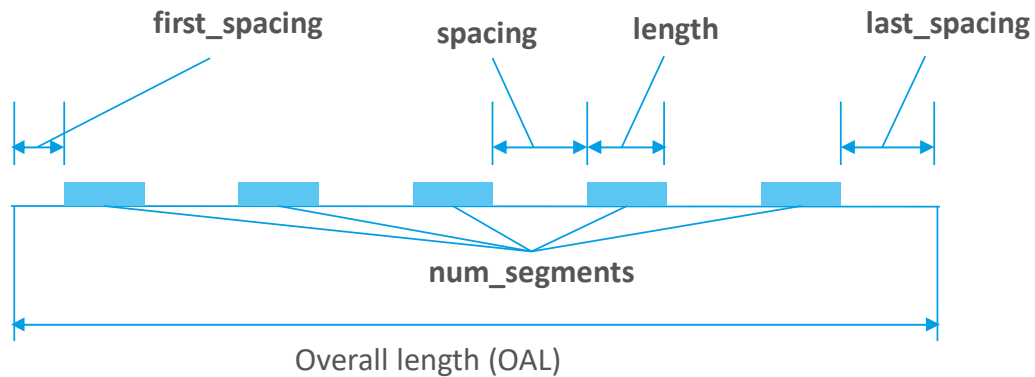
Original (curved) weld line will be represented by polygon with approximation error

- Attributes:
    - first_spacing
    - last_spacing
    - spacing
    - length
    - num_segments
    - keep
   - max_percentage_of_compensation
    - max_absolute_compensation

Intermittent welds

Explanation of Proposal

- **first_spacing**
  - margin before first weld element (default: 0); value must be met
- **last_spacing**
  - margin after last weld element (default: 0); value must be met
- **spacing**
  - spacing between adjacent weld elements
  - can be used for compensation of inaccuracies if not defined as keep parameter
  - mandatory attribute (no default)
- **length**
  - length of weld elements
  - can be used for compensation of inaccuracies if not defined as keep parameter
  - mandatory attribute (no default)
- **num_segments**
  - number of weld elements
  - must be met; mandatory attribute (no default)
- **keep**
  - Defines quantity that will not be changed to compensate for inaccuracies between polygon accumulated length by the given paramters (length, spacing, number_of_welds, begin_margin, end_margin)
  - Options: length, spacing, density (default)
  - Density defines the ratio of the sum of all segment lengths to the sum of segment lengths plus spacings (margins ignored)
- **max_percentage_of_compensation**
  - permitted difference between the prescribed value and realized value for the parameter that is used for accuracy compensation (e.g. if „length" is defined as „keep" parameter, „spacing" can be adjusted within the limits of the compensation parameter & vice versa)
  - (default 1%; valid range between 0% and 100%)
- **max_absolute_compensation**
  - As „max_percentage_of_compensation" but just with absolute limit values (no default given)

# χ**MCF** (e**x**tended **M**aster **C**onnection **F**ile)

ISO Submission
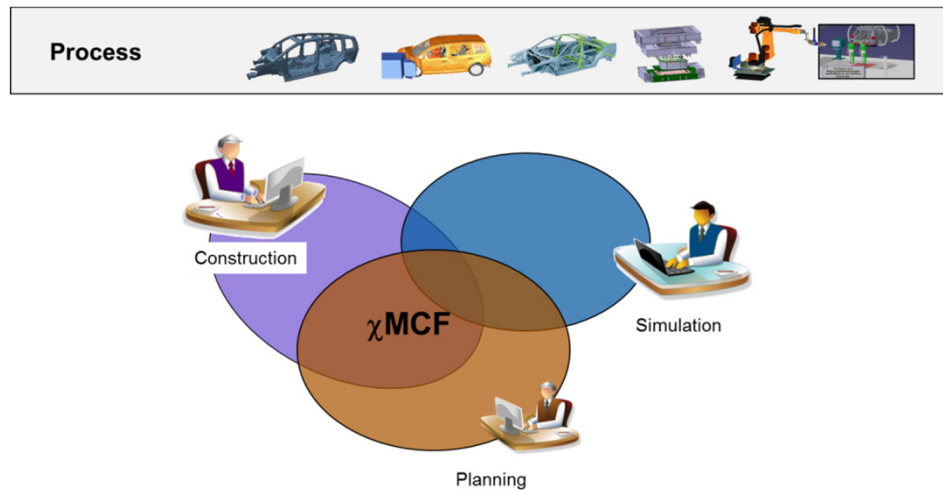
Overview

- 2nd presentation & discussion (May 5)

- Submission accepted

- Ballot ongoing (need 5 P-members)

- NWIP timing plan proposed

- plan for final publication as Publicly Available Standard (PAS) May 2022

- Main doc can be kept and maintained

- Draft to be ready 18.11.2021

χMCF (e<u>x</u>tended <u>M</u>aster <u>C</u>onnection <u>F</u>ile)

New Requests & Work Items
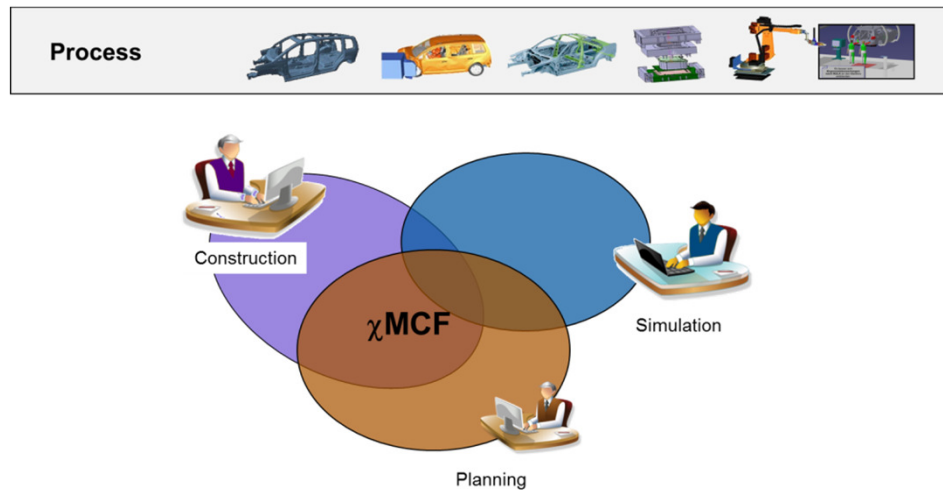
Overview – New Requests

1. <tangential_direction/> for

2. IDs

<tangential_direction> for <rivets>

➢ Explanations:

- Request for such a parameter to be supported for rivets at least

- BMW has rivets that are not rotational-symmetric and their orientation matters

- at the same time, paragraph 7.1.3 leaves room open for interpretation towards assuming that <tangential_direction> might be applicable for all 0d-welds "wherever necessary"

- can we extend the format accordingly or fix the schema file ?

➢ Discussion Notes & Decision:

- ....

IDs
Problem Description & Outcome

➢ Explanations:

- current xmcf implementation is id-agnostic, at least in the way ids are understood in a CAE context

- meaning pure integers in the range 1-99999999

- which is also the way welds are identified inside ansa

- so, since the standard has use within the cae world as well, we believe its necessary to extend the format accordingly

➢ Discussion Notes & Decision:

- ....