χMCF – Enabler for Integrated Digital Processes

VDA FAT AK 25, Darmstadt, 2019-05-28

Meeting results are documented in blue font.

Agenda

- 9:45 Welcome & Introduction
- 10:00 Recap of 2018 meeting
- 10:30 Status of Beta CAE Project for VDA
- 12:30 Lunch
- 13:15 Status & feedback of χMCF 3.0 implementation at software vendors
- 14:15 New speaker of the group
- 14:30 Miscellaneous topics
- 16:00 Next meeting
- 16:15 End

Welcome & Introduction

Recap of 2018 Meeting

Recap of 2018 Meeting

- Overview of 2018 decided & started activities

1.	Maintenance of Spec 3.0	Status will be presented by BETA CAE later, today.	wip
2.	Examples	Provided by BETA CAE.	wip
3.	Schema to be created	Provided by BETA CAE.	wip
4.	Documents to be shared on GitHub	Done by BETA CAE.	done
5.	Promotion Activities		
	– Presentation at BETA CAE conference, May 21st	Done by PROSTEP & Volkswagen.	done
6.	ISO Standardization		
	– Describe ISO process & probably expenses	Done by PROSTEP.	done
	– Investigations at VDA / DIN / ISO	Pending at Ford.	open
	– Co-evolution with STEP (AP 242 XML)	Done by PROSTEP.	done

See following slides

Status of Beta CAE Project for VDA

Status of Beta CAE Project for VDA *(Presentation by BETA CAE)*

- Changes to standard document (Word) due to review
  - Differences between χMCF 3.0.0 and 3.0.1
  - Discussion of the changes
  - Discussion & decision of open issues (see list at Git Hub)

  } See following slides.

    - Not in detail discussed. Just as an overview.
- XML schema for χMCF 3.0.1
  - XSD Standard 1.**1** is used – enables assertions.
- Conversion of Word file to Markdown format
  - Canceled: Poor effort-benefit-ratio.
- χMCF at GitHub
  - How to access the standard document
  - How to obtain the examples
  - List of (open) issues
  - What are “branches” in git, anyway?

  } Was presented interactively.
- Open questions
  - See following slides.

New χMCF Schema

More details to be found on BETA CAE slides "xmcf_3_0_1_document_changes.pdf"!

<appdata/>:

- New χMCF schema allows to provide additional tool-specific schemas for <appdata/> – this is optional.
- However, list of known applications (Table 3) is *not* enforced by schema:
  "The above given list does *not* imply that other application names are forbidden. Its only purpose is to reserve the registered names against inappropriate use."

<femdata/>:

- … is not yet validated by the new χMCF schema, due to some more need for discussion. (See below.)

Changes to Standard Document

More details to be found on BETA CAE slides “xmcf_3_0_1_document_changes.pdf”!

- Multiplicity “0” is deprecated by "Optional".
- Rivet attribute “hardness” moved from self piercing rivet to general rivet. However, schema accepts old location in case χMCF file is of version 3.0.0.
  – Confirmed by Altair, MAGNA & Siemens.
- <custom_attributes/>:
  <integer_list/> was renamed to <int_list/>.
  – Confirmed by Altair, MAGNA & Siemens.
- Welded & clipped nuts have (optional) part codes.
  – Confirmed by Volkswagen & Ford.
- Bolt vs. Screw: Current differentiation
  • A screw has a tapped bore.
  • A bolt needs a nut.
  is replaced by the Wikipedia* definition
  “Where a fastener forms its own thread in the component being fastened, it is called a screw.”
  All other threaded fasteners are called “bolts”. They may or may not have a nut.
- Hence, <nut/> becomes an *optional* element within <bolt/>.
  - A <nut/> without data still says: A nut is needed.
  - If there is a <nut/> element, there *still can* be "fixed_to" attribute: Consider e.g. counter-nuts.

*) https://en.wikipedia.org/wiki/Bolt_(fastener) – There, cited from *Machinery's Handbook (Twenty-First ed.). New York: Industrial Press. 1980. p. 1131*.

Changes to Standard Document

More details to be found on BETA CAE slides "xmcf_3_0_1_document_changes.pdf"!

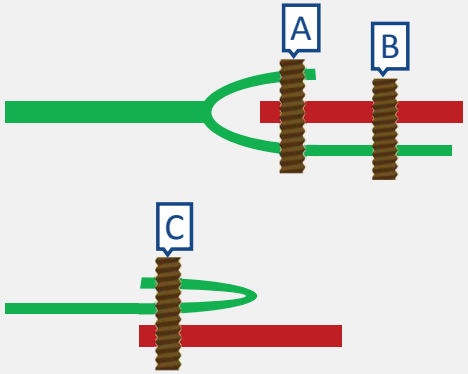
- Table 66: head_height=0 is allowed for a heat stake.
- Tables 111 & 115: Suggested unification
  thickness → *sheet_ thickness*
  was confirmed.
- Contact definition: Simplification suggested by BETA CAE was confirmed.
- Empty <connected_to/> becomes allowed.
  Use cases:
  – STEP connection referring to χMCF file.
  – Connection partners not yet known / to be found geometrically.

<femdata/>:

- It was decided to re-use the lowest level FATXML construct to reference solver items for χMCF.
- FAT AK 27 will care for extracting the relevant snippet from FATXML schema into an "includable" schema. Syntax of FATXML files will *not* be altered by this.
- Update of FATXML schema (now consisting of two files) will be published by AK 27 on VDA server.
- Standard document must clearly state that the referenced objects are understood as "created for connector realization". This means, they are to be deleted, if user decides for another realization type. *Implication*: Heat affected zones (HAZ) *cannot* yet be described by <femdata/>. This would require to define different types of references, in future.

(Partial) Self Connections

Special topological situations



1. χMCF standard document (as of 2016) suggests that all three connections, A, B & C belong to the same <connection_group/>, i.e. one with
   <connected_to>
   <part index="1" label="green"/>
   <part index="2" label="red"/>
   </connected_to>
2. However, some implementation interpreted, A & C belong to *another* <connection_group/>, i.e. one with
   <connected_to>
   <part index="1" label="green"/>
   <part index="2" label="red"/>
   <part index="3" label="green"/>
   </connected_to>

➔ We need to formulate the standard document more precisely!

(Partial) Self Connections

Special topological situations

To solve the situation in a most compatible way,
it was decided:

- Both alternatives 1 & 2 are allowed.
  However, alternative 2 shall be *discouraged*
  in the standard document wrt. a future version.
- A new optional element shall be introduced at
  connection level to describe the stacking, e. g. like this:
  For A:

```
<stacking>
   <level order="1" part_index="1" />
   <level order="2" part_index="2" />
   <level order="3" part_index="1" />
</stacking>
```

For B:

```
<stacking>
   <level order="1" part_index="2" />
   <level order="2" part_index="1" />
</stacking>
```

For C:

```
<stacking>
   <level order="1" part_index="1" />
   <level order="2" part_index="1" />
   <level order="3" part_index="2" />
</stacking>
```

In case that *only the number* of levels is known,
alternatively an attribute can be given:
<stacking nr_levels="3"/>
In this case, no <level/> elements are allowed, beneath.

Lunch

Source of icon: https://www.flaticon.com/free-icon/restaurant-interface-symbol-of-fork-and-knife-couple_37481 - Icon made by Freepik from www.flaticon.com.

Status & Feedback of χMCF 3.0 Implementation at Software Vendors

Altair / BETA CAE / Dassault Systèmes / HBM Prenscia / Magna ECS / Siemens

Implementation Review

- Altair
  - HyperMesh
- BETA CAE
  - ANSA
- Dassault Systèmes *--- today missing. Will provide slides, afterwards.*
  - CATIA, SIMULIA, DELMIA
- HBM Prenscia *--- today missing.*
  - nCode
- Magna ECS
  - FEMFAT
- Siemens
  - NX, Teamcenter, Simcenter, Syncrofit, etc.

Implementation Review – Altair Statement

- Up to now, improvements happened mainly “under the hood”.
  Hence, no GUI changes and no visualization are currently available.
- The complete set of xMCF connectors will be supported.
- New GUI “Connector Control” will be implemented.
- Old deprecated connectors will be converted to new ones upon file import.

Implementation Review – BETA CAE Statement

- ANSA version 19.0.* features χMCF 3.0.

Implementation Review – Magna ECS Statement

- FEMFAT is still using χMCF 1.1.
- Migration to χMCF 3.0.0 is planned.
  Schema file will be very helpful with this.

Implementation Review – Siemens Statement

- Existing features have been taken from LMS Virtual.Lab to Simcenter 3D.
  - χMCF is featured by “Universal connections approach”.
  - Adhesive faces are *not* yet supported.
  - (Most) other connector types are supported.
  - Visualization functionality of seam welds to be improved, soon.
  - χMCF 3.0.0 is supported.
- Simcenter 3D version 2019.2 Is scheduled to be released in a month
  - Durability features are still lacking.

- Support of χMCF 3.0.**1** can be discussed for version 2020.**2** (i.e. *not* for *beginning* next year, but later).

New Speaker of the Group

Miscellaneous Topics

Miscellaneous Topics

Overview of following slides:

1. Catalogs
2. To Do List
3. New χMCF Release – Pros & Cons …
4. Improved / Defined / Sustainable Process for Maintenance of χMCF Standard
5. χMCF Terms of Use
6. Promotion of χMCF
7. ISO Standardization of χMCF

Catalogs

Requirements of AG 2.6.2:

- Catalogs of *standard parts* (screws, bolts, nuts, washers, rivets, clips, …)
- Reference to e. g. JT files. – Rationale:
  - Describe geometric details of weld beads (grooves), screws, deformed rivets etc. up to photo realistic quality (DMU).
  - Consider different deformations of the same rivet, applied to different sheet thicknesses.

Additional catalogs, which have been discussed earlier in our working group:

- Catalogs of *tools* (dies for rivets, …)

Decision: 2018: Postponed to χMCF 3.1 or later.

To Do List

Slide skipped due to time.

- χMCF Benchmarks / Software certifications
- Recommendations / Recommended Practices
- User's Community Web Site / Forum
- Implementer Web Site / Forum – also for synchronizing collaborative work with updating χMCF to new version.

Is partially addressed by ~~planned~~ GitHub facility.

- Step welds aka stepped weld lines.
- Process parameters, e.g. tolerances, maximum permissible welding distortion, electrode material of spot welds, …
- Process codes, e. g. according to American Welding Society.
- Exceeding weld line ends (cf. section 8.2.1 / p. 96)
- Studs (cf. section 7.5.6.1, figure 25, p. 78)
- Clinch with additional material (TOX®-ClinchNiet) & tangential direction (TOX®-TWINpoint). (Requ. by AG 2.6.2)
- STEP can describe part list, but no joint details. For joint details, a reference to a χMCF file could be used.
  To avoid inconsistencies, AG 2.6.2 suggests empty or missing *<connected_to/>* in this case.

Decision: … . **Rationale:** … .

New χMCF Release – Pros & Cons …

Pro

- Do we see some demand for χMCF 3.1?
- … (t.b.c.) …

Contra

- χMCF 3.0.* is not (fully) implemented everywhere, yet.
  A new version could increase confusion.
- … (t.b.c.) …

Decision: … .

Improved / Defined / Sustainable Process for Maintenance of χMCF Standard

- Defined process requires documentation e.g. of:
  - How to place requests & issues, how to contribute, … ?
  - How decisions are made and how to participate?
  - Currently participating companies.
  - Time scale, e.g. “Meeting every May at PROSTEP”?
  - Forum for “Q&A” and/or “FAQ”?
- Possible support by GitHub infrastructure
  - Publication of above mentioned definitions as web pages (GitHub’s Markdown format).
  - Issue management
  - Reference to the officially latest released version on VDA server.
  - …
- Shall we publicize scheduled meeting(s)?

Decisions:

- PDF version of the accepted Word file to be published on GitHub, too.
- Date & place of next meeting to be published on GitHub.
- CF will suggest explanation about how to contribute to the AK’s work. After confirmation by the AK, explanation is to be published on GitHub.

χMCF Terms of Use

Up to now, χMCF does *not* formulate any terms of use / licensing etc.

- An example taken from "I++" standard reads like:
  "Das Ziel der I++ Arbeitsgruppe ist die flächendeckende Umsetzung der I++DME und I++DMS-Schnittstellen in den einschlägigen Software-Anwendungen.
  Die „Mitgliedsfirmen" verzichten auf Lizenzgebühren. Auch dürfen sie keinerlei Ansprüche aus dem Patentrecht ableiten. Jedwede Beschränkung der freien Nutzung ist nicht im Interesse der Arbeitsgruppe und wird, wo immer es in der Macht der Arbeitsgruppe liegt, so bald wie möglich aufgehoben. Alle Beschreibungen und Dokumente sollen frei verfügbar sein. Die Arbeitsgruppe behält sich die Rechte zur Weiterentwicklung und Erzeugung von Releases vor. Anforderungen oder Änderungen sollen über das I++-Gremium oder die relevanten Foren eingebracht werden.
  Die Arbeitsgruppe lehnt jegliche Haftung bezüglich der Umsetzung und Nutzung der Schnittstellen ab. Die „Mitgliedsfirmen" räumen den Nutzern der I++Schnittstellen ein nichtexklusives Recht zur Nutzung gemäß der jeweiligen eigenen Interessen der Nutzer ein. Da die Schnittstelle kostenlos zur Verfügung gestellt wird, wird hiermit jegliche Haftung für Mängel in dem Maße ausgeschlossen, in dem es die Gesetze gestatten."
- In case, χMCF is transferred to ISO, ISO copy right statement applies, e.g.:
  "© ISO 2014 All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester."
  Implication: Standard document would *not* be provided for *free* download.
- Other suggestion: Attach to some well-known license, e.g. GPL, Creative Commons (Wikipedia), …
  (Is currently discussed e.g. at SmartSE prostep ivip working group, too.)

Decision 2018: PROSTEP translates and shares English draft text. / PROSTEP does research at STEP.
Draft to be checked by VDA lawyer.

Promotion of χMCF

- χMCF presentation at ANSA User's meeting, Thessaloniki, 2017-06-01.
- χMCF (& FATXML) presentation at Forum "Simulation in Automotive Industry", 2017-04-06.
- χMCF presentation at ANSA User's meeting, Munich, 2019-05-21, referring to BMW & Volkswagen examples.
- …

More to be found!

Ideas from 2018 meeting:

- Setup vendor neutral χMCF slide set (using SIMVEC 2014 as starter). → CF
- Logo for χMCF → waiting for suggestions / any restrictions at VDA? → VDA lawyer
- More conference presentations. Preferably by the OEMs. Communicate about BMW example …

ISO Standardization of χMCF

- PROSTEP to describe ISO process & probably expenses, e.g. inspecting JT standardization process.
- Dr. Weinert to ask within VDA, since VDA is associated with DIN, which is associated with ISO. (Pending)
- Get in contact with STEP AP 242 XML people and check for co-evolution with STEP. → CF

- ISO (see mail 2018-06-08 08:54):
  - ISO knows different "value levels" of standards.
  - Most basic is "PAS (Publicly Available Specification)".
  - The according standardization process is called "Harvesting".
  - Would take spec. document unchanged for ISO-publication.
  - For official agreement, there would be only one "Ballot".
  - Expected expenses about 30k€ (min.) for this process.
  - Higher valued standard levels accordingly more expensive.
  - Alternatively, we could consider DIN or OMG instead of ISO.
- No motivation found at STEP ISO Community, last June.

Next Meeting

Next Meeting

- When?
  03. December 2019
  – Unfortunately, C. Franke will be travelling 3. & 4. Dec. – "Doodle" survey started to find an alternative!

- Where?
  PROSTEP AG, Darmstadt (again)

- Agenda (Suggestions):
  - Status of BETA CAE Project for VDA
  - New requirements, questions & doubts
  - Standardization Status (ISO et al.)
  - Siemens Simcenter 3D – Demo
  - Dassault Systèmes status