

FMC User Group

Hybrid meeting (Millennium Gloucester Hotel, London / MS Teams)

1 February 2023, 4.00-5.00PM

Agenda

Present

In person: Paul Wilcox (PW); Andreas Schumm (AS); John Jian (JJ); Sumana Sumana (SS)

Online: Abdeldjalil Bennecer; Vincent Bergeaud; Shiva Bhat; Joe Buckley; Olivier Burat; Ewen Carcreff; George Connolly; Mark Dennis; Larissa Fradkin; Yann Gelebart; Katherine Kirk; Benoit Lepage; Dave Lines; Gary Luckett; Terrill Massey; Parhaam Parikhaah; Jerome Pogue; Philippe Rioux; Ray Ten Grotenhuis; Wilson Vesga; Dr. Ir. Casper Wassink

Minutes of last meeting

Summary and status of actions

- PW to update website to reflect discussions on group's objectives. **DONE**.
- PW to produce document describing options for discussion on taking MFMC file format forward. **DONE** in form of online discussion forum.
- All to provide PW with suggestions of possible people / organisations who might be able to offer the necessary software engineering services. **ONGOING**.
- PW to ensure ICNDT page contains necessary details about FMC User Group. **ONGOING** as link and text have been provided to ICNDT but page has not been updated.
- PW to discuss options for future talks / meetings on FMC User Group activities with relevant conference organisers. **DONE** – Abstract submitted to ASNT research symposium.
- All to feed suggestions for future meeting topics and volunteers to speak to PW. **ONGOING**.
- PW to organise next meeting in early 2023. **DONE**.
- PW to investigate most suitable option and set up online discussion forum for group. **DONE** (<https://fmc-user-group.freeforums.net/>).

Chair's update

PW continues to attend NDE File Formats Group (led by Prof Steve Holland, Iowa State University; Dr Dave Forsyth, TRI Austin), which has ambitious aim is to define a self-documenting, hyper-consistent structure for any type of NDE data using HDF5 as the container. The idea is that user communities (such as the FMC User Group) for different modalities / applications define their own sub-classes within this framework.

Presentation from Andreas Schumm (EDF) "NDE Data Formats: the EDF Perspective"

Key points

- Motivation for open formats
 - Legal obligation to store results for a long time
 - Avoid vendor lock-in - proprietary formats require old software (sometimes hardware) to be maintained
 - FMC increases benefit of storing raw data (e.g. to subsequently exploit newer reconstruction algorithms, or reconstruct in different regions)

- EDF have decided to impose open format for raw data, results, and metadata on subcontractors (different ones for EC, RT, and UT)
 - Effectively obliges subcontractors to develop file convertors
- Known UT formats for consideration
 - MFMC 2.0 – developed by this group, uses HDF5 as the container
 - ECUF¹ – developed by EPRI, uses HDF5 as the container
 - UFF² – from medical domain, uses HDF5 as the container
 - NKC – developed by Airbus/Testia but for traditional ultrasound
 - DICONDE³ – based on medical DICOM format, focused particularly on images and the communication of data
- Decided first two above are only contenders for FMC data
 - MFMC contains (almost) all information needed to convert raw data to images; files are easy to produce and good for producing images but specification does not define or mandate inclusion of practical engineering data (e.g. about the probe used or part geometry inspected).
 - ECUF contains a lot of engineering data, including canonical part geometries, but does not distinguish between compulsory, optional, and custom data, whereas MFMC does.
 - Both formats contain many good ideas, with different strengths and weaknesses
- EDF used MFMC in ADVISE project (EDF, Eddify, and Framatome all implemented it) and will use it in forthcoming iWeld project; have implemented MFMC/ECUF browser and have simulation programme that outputs to MFMC format.
- Missing functionality in MFMC: no definition for contact zone of wedge; no way to specify annular arrays; two different ways to implement TRL probes presents possible ambiguity; no way to specify interface geometry even for canonical surfaces; no specification for recording reconstructed images.
- No specification for engineering data (any number of custom data fields can be added, but cannot be part of specification without standard definitions); specification for engineering data would make format more easily adoptable in short term; however, it requires a lot more detail in specification with danger of inconsistency between engineering data and current data; suggested way forward is to include “hints” that enable easy extraction of engineering data from current data (e.g. by telling the reader that the array is a linear array, on which basis the reader can immediately determine the pitch from the coordinates of the closest two elements in the array), thereby avoiding duplication and possibility of inconsistent information.
- ECUF format gaining traction in US utilities and vendors. It would be worth considering whether formats could be merged.

ACTION: PW to review ECUF format, compare with MFMC, and discuss with Mark Dennis at EPRI if there is a common way forward.

¹ EPRI Technical Report, “Common Ultrasonic Data File Format”, 3002013177, 2018, <https://www.epri.com/research/products/000000003002013177>

² O. Bernard et al., "The Ultrasound File Format (UFF) - First Draft," 2018 IEEE International Ultrasonics Symposium (IUS), Kobe, Japan, 2018, pp. 1-4, doi: 10.1109/ULTSYM.2018.8579642.

³ “Standard Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Ultrasonic Test Methods”, ASTM E2663-14, 2018.

Suggestions for future meeting topics and volunteers for speaking

PW reiterated the call for suggestions for speakers/topics at future meetings. It was suggested that it would be interesting to hear from an organisation that had been through the qualification process for an inspection involving FMC. PW suggested BAE Systems had developed an FMC inspection for small-bore pipe welds and might have someone who could speak.

ACTION: All to continue to suggest speakers / topics. PW to contact BAE Systems (post meeting note – this was done, and it emerged that the target for the inspection was ultimately achieved with regular PA techniques. PW to look for alternatives.)

Any other business

None.