TE
Technology Department

Opera 2D update and OperaPy - Roundtable meeting for magnet designers, 05/07/2023.

Present:

- Kieran Geiger (KG)
- Luke Von Freeden (LvF)
- Pierre Alexandre Thonet
- Vera Korchevnyuk
- Carl Jaermyr Eriksson
- Jeremie Bauche (JB)
- Raul Key (RK)
- Line Everaerts (LE)
- Ambre Visive (AV)
    - *Additional follow up meeting 09/07/23*
- Thomas Zickler (TZ)
- Miroslav Georgiev Atanasov (MA)
- Tobias Stadlbauer
- Farhad Saeidi
- Julie Skoven Hinge
    - *Additional follow up meeting 17/07/23*
- Christos Gentsos (CG)

Unable to attend:

- Antony Newborough
- Mikko Karppinen
- Philip Schwarz
- Vittorio Ferrentino
- Attilio Milanese
    - *follow up meeting 14/07/23*
- Mike Barnes

Notes:

Opera 2D has been used by CERN magnet designers for more than 30 years. Models were originally developed using a COMI scripting language – today there is a large library of COMI 2D and 3D model files. The 2018 software release was the last to fully support 2D COMI scripts (Opera 3D is unchanged in this respect). The 2021 and 2023 releases subsequently use an object-oriented python distribution for scripting, with some limited and flawed functionality for running legacy COMI scripts.

An internal roundtable meeting was held with the objective of bringing magnet designers together. This way we can begin determining a strategy for managing the change and preventing disruption to our work.

Agenda:

1. Demonstrations (KG)
    a. Opera 2D 2018 and 2021+
    b. Python Integrated Design Environment (IDE)
    c. COMI script conversion
2. Presentation: "What could OOP and GIT do for you?" (AV)
3. Strengths and Weaknesses of Opera 2D
4. Group Discussion

Minutes:

Demonstrations

- **JB:** It would be useful to record these explanations.
    - **Action on KG:** Make short video tutorials.
- COMI functionality which has been lost in Opera 2D 2021 and 2023:
    - **JB:** Most post-processing analysis functions (e.g., CIRCLE command used for harmonic analysis)
    - **AV:** CLINE command
    - **AV:** Sub command of DRAW not working

Presentation: "What could OOP and GIT do for you?"

- **LvF:** AV work demonstrates that GIT is a valuable tool for collaboration plus version control and TE-MSC-NCM should setup a repository for various analysis scripts.
    - Notes that he has tried using GIT in the past as a collaboration tool but struggled to make it work effectively due to lack of user experience.
    - Therefore, training or input from competent (software engineer) colleagues may be needed.
- **KG:** Highlights that exchanging work-in-progress converted COMI scripts via email is not sustainable. A managed GIT repository is much more suitable, especially for managing a library of models.

Strengths and Weaknesses of Opera 2D [compared to alternative packages]

- Opera 2D has additional functionality compared to free alternatives (i.e., FEMM)
    - **TZ:** Hysteresis solver
    - **TZ:** Non-steady state transient solver (i.e., triangular waveform excitation rather than sinusoidal)
    - **LvF:** Quadratic FEA elements
- **LvF:** Opera 2D often has a high barrier to entry for fresh users. This can dis-incentivise new people from investing the time to learn how to use it.

  - **Example:** The Opera hysteresis solver documentation is low quality. Therefore, LvF decided that learning to use the ANSYS Maxwell package instead would be a better use of his time.
  - **AV:** Poor documentation makes learning more challenging, but it is not an impossible task.
- **Note on FEMM licencing:** LvF clarifies that FEMM (which can be python scripted) is not "open source", rather it is "free to use".

Group Discussion

A – Immediate needs

- **TZ:** There are many existing COMI scripted models at CERN - personally he has at least 50. For some projects there is no formal written documentation, only COMI scripts. For a long period, we will need to retain access to Opera 2D 2018.
  - **Consensus:** Until there is a long-term solution colleagues need continued access to an Opera 2018 licence so that they can continue developing COMI scripted models.
  - **LE:** Will pursue this with Opera but warns that there may be a gap between the current licence ending (25/07/23) and the new one being available.

B – Longer term solutions

- **TZ:** Reliance on large library of COMI scripts applies pressure to find a long-term solution (for CERN and Opera).
  - **JB, TZ:** Need to assess cost-benefit when finding a long term modelling tool solution.
  - **LF:** Even if we start using another software package then we still need to convert the COMI library.

- *Potential solution 1: retaining some Opera 2018 licences on a longer-term basis (and using this to run COMI scripts)*
  - **TZ:** It is not good practice to run (and rely on) unsupported software. If/when OS becomes obsolete, then this is an issue.
- *Potential solution 2: creating an in-house COMI parser for converting COMI scripts to Python*:
  - **JB, TZ:** Very difficult or impossible to do due to different styles of existing COMI scripts.
  - **AV, KG:** Should be possible but challenging.
  - **Consensus:** May require 1-2 years of labour. Difficult to justify CERN resource as this should be core functionality of Opera's commercial software.
- *Potential solution 3: manual translation of COMI files:*
  - **JB:** We could collect exiting models from colleagues and store them in a GIT repository.
  - **AV:** Useful to survey Opera users to understand numbers of existing models (and therefore workload).
- *Potential solution 4: Using op2 (model solution files) instead of model scripts*
  - **LvF, MA:** Could we avoid needing to translate COMIs by generating op2 (model solution) files which are forward compatible and then storing those?
    - **AV:**

        - Can use op2 files to generate DXF files.
    - **KG:**
        - Does not retain parameter studies (neither understanding nor capability to repeat)

- **Consensus:**
    - Best solution is to engage with Opera and specify improvements to COMI parser in Opera 2D 2023+ so that legacy COMI files can be run and debugged.
        - Improving documentation is also highly desirable.

C – Engaging with Opera

- **LE:** Not yet sure on best way to make Opera listen to CERN concerns and needs. Will work with colleagues in procurement who have experience dealing with software suppliers and exerting CERN leverage.
    - **Action on LE, CG:** Set up internal meeting with procurement and representatives from the user community to agree strategy.
- **LvF:** Opera 2D may be small part of company's business model, potentially limiting how much resource they invest in fixes and improvements.
    - **LE:** Annual cost to CERN of Opera 2D licences is approximately 30 kCHF/year
    - **RK:** This value seems small, but CERN receives a major discount as a non-commercial customer. In such cases software suppliers typically receive tax write-offs. Potentially this means that the value to Opera is worth significantly more than 30 kCHF/year.
- **LE:** Depending on how successful we are at making Opera understand issues, in the future we could reach out to users at other institutes who have similar frustrations.

Actions:

- KG:
    - Create video recordings of the different demonstrations.
    - Survey Opera 2D magnet designers at CERN to understand size and nature of COMI file library.
- LE, CG
    - Setup meeting with procurement and representatives from the user community to agree strategy for positive engagement with Opera.

Any other business:

- TE-MSC-NCM should investigate using a GIT repository to share scripts (Opera 2D and otherwise).