New solution for cost-effective electromagnetic analysis

EnginSoft's contribution recognized in the F4E Technology Transfer Program

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On the 25th of March 2021, EnginSoft participated as an exhibitor in an important webinar hosted by Fusion for Energy (F4E), called: "Fusion technology applications in advanced simulation and modelling". This event was part of a wider F4E initiative - The Technology Transfer Program - which aims to promote the transfer of fusion technologies to European industry.

In the webinar EnginSoft was able to talk about its long-standing collaboration with F4E in the broad area of Electromagnetic FEM Analyses for the ITER components. EnginSoft's presentation covered many of the technical details of its acknowledged "Solution for cost effective electromagnetic analysis".

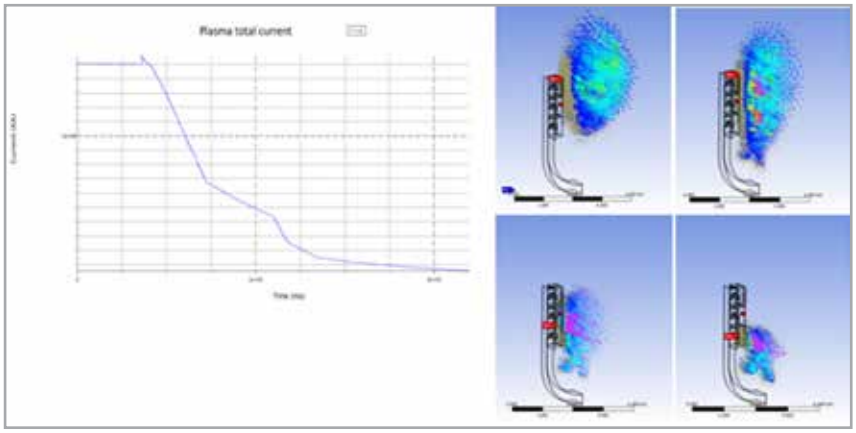

Fig. 1 – A typical plasma disruption VDE III Down event in ITER: (left) the graph of the total plasma current evolution vs time; (right) four images of the plasma current density at different times

The main problem with a large Tokamak design is how to properly evaluate the Lorentz forces that form as a result of the coupling between the high intensity magnetic field and the currents that develop inside each metal component after a plasma disruption and/or the failure of the Coil System.

A disruption is a violent event that terminates the magnetic confinement of plasma. One of the magnetic effects of a disruption is the generation of large magnetic forces in the metallic structures surrounding the plasma. This phenomenon is associated with the sudden loss and displacement of the net plasma current, which induces an eddy current in the metallic structures.

EnginSoft's cost-effective solution was successfully created in collaboration with F4E's expert teams after numerous years spent developing and testing tools, algorithms and customized interfaces in each phase of the Electromagnetic FEM analysis workflow.

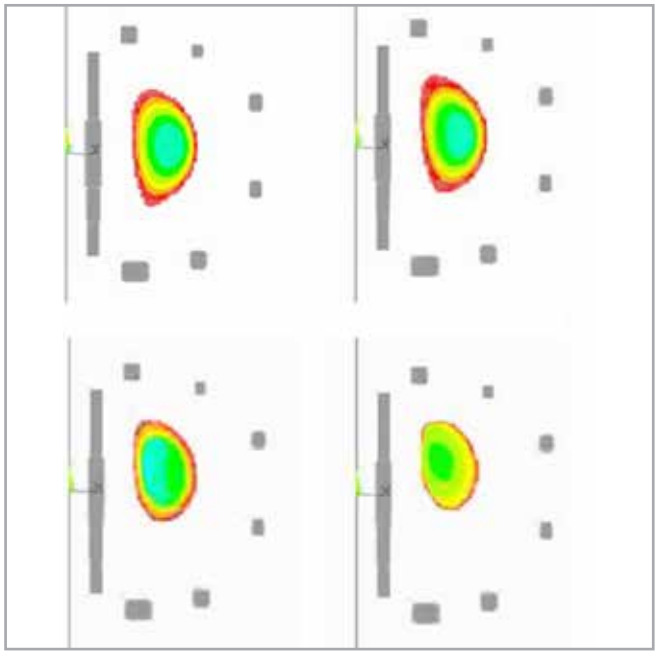

Fig. 2 – Sequence of plasma current density at 4 different time instants during a VDE II UP rapid plasma disruption event. The mapping algorithms from the "Current Filaments" from the DINA files to any mesh domain is one of the most important outputs for the quality of each result.

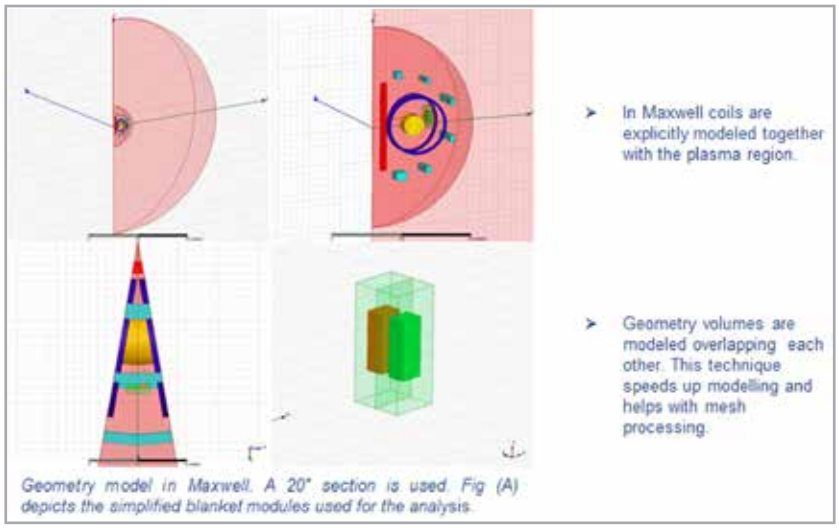

Fig. 3 – Custom and intuitive parametric user interface for Ansys Electronic Desktop for quick configuration of the geometry and loads

These include:

1. Robust, tested algorithms for extracting plasma current values from DINA files and mapping the corresponding plasma current densities to a generic mesh with no data loss.
2. The intuitive custom parametric user interface for Ansys Electronic Desktop for quick configuration of the geometry and loads
3. Auto-adaptive mesh algorithms for Ansys Maxwell to cross-check FEM accuracy
4. Powerful Ansys APDL macros to quickly and accurately extract results from millions of electromagnetic DOF FEM models.

Over the past two decades, EnginSoft has achieved a high level of specialization in the analysis and design of a range of electromagnetic and electromechanical devices:

- Electromagnets & Permanent Magnets
- Electromechanic Actuators & Sensors
- Electric Motors
- Electric Generators
- Electric Transformers
- Power Electronic Components and Devices

In all these applications, the tools developed with F4E as part of the "Solution for cost effective electromagnetic analysis" are particularly useful for:

- increasing the capability to perform Multiphysics Analysis
- improving ease of use of the basic tools
- reducing overall simulation process times

Conclusion

There are many uses for the technologies and the FEM techniques that have been developed within this context in the broader universe of SBES for Electronics and so EnginSoft is proud to have been selected by F4E as one of its partners for the "Technology Transfer Program".

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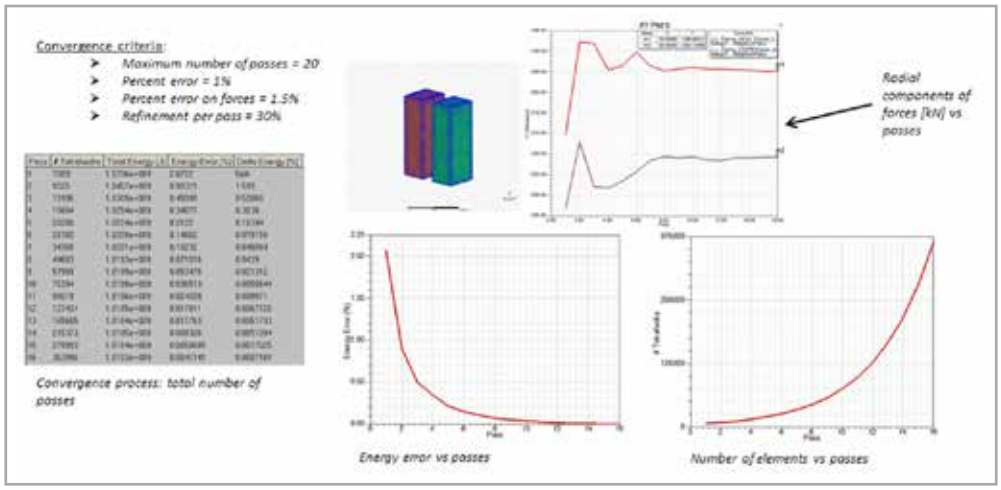

Fig. 4 - Auto-adaptive meshing algorithms for Ansys Maxwell to cross check FEM accuracy

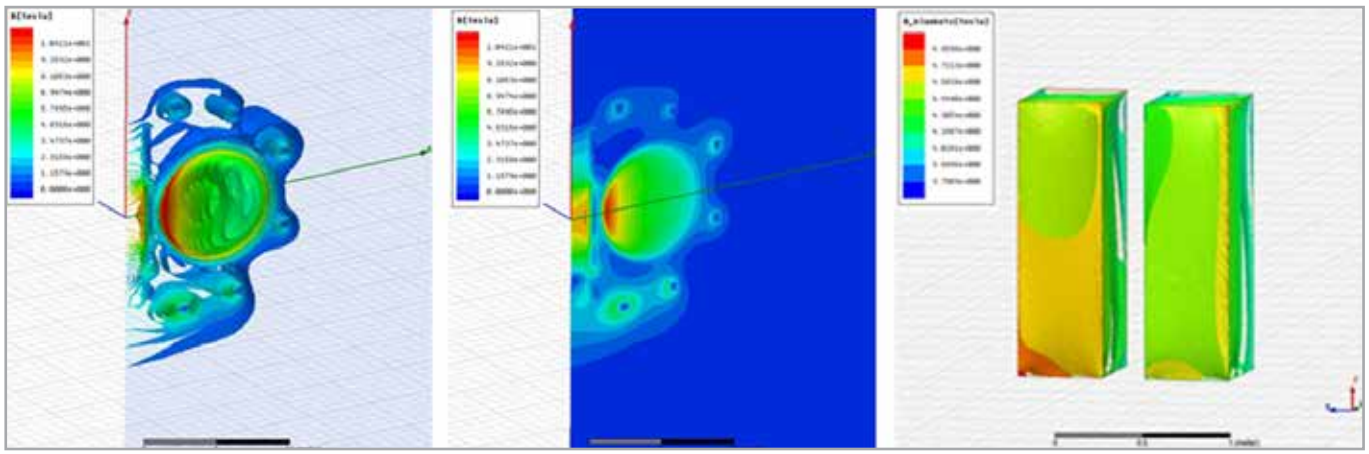

Fig. 5 – High quality post-processing tools in Ansys Maxwell