

Flux[®] 11.1: entering a new generation.

Vincent Leconte - CEDRAT.



Version Flux 11.1 is to be released in early summer, providing great new features for efficient use of the software. The very first step when using a finite-element software is to enter the geometry. It is an important stage in the process since it serves as a base for the modeling. Of course, CAD import can help to go fast and to avoid re-entry of data, but it usually prevents users from parameterizing. To allow a fast entry of geometries, **Flux 11.1 introduces an embedded 2D sketcher, keeping the capability to parameterize**, which is key when designing and optimizing. This is a turning point in Flux's history since version 11.1 fully integrates 2D, 3D and Skew applications, from pre- to postprocessing with the same interaction for the user regardless of the application, the same scripting technology and an easier way to change modeling dimension. The integration goes even further, giving access to **a one-of-a-kind environment for skewed models: pre-processing and solving are done in 2D**, with easy data entry and short solving times, and **post-processing is in full 3D**, providing all the tools to evaluate the effect of the skewing. As in every Flux version, **new advanced numerical methods** are also introduced, allowing to perform accurate simulations in less time. Especially in 3D, it means that more complexity can be handled in the models, and more configurations can be simulated for the design.

■ The new 2D embedded sketcher

One major feature of the new version is the 2D sketcher. It is highly intuitive and will enable 2D users to enter **their geometries in just a few mouse-clicks**. Generating geometric shapes, copying, moving, repeating them and creating chamfers or fillets is all easily done. The user is guided throughout the process with previews and alignment options on a grid or on shapes, really speeding up the modeling process. In addition, this new technology still gives access to parameters, taking **full advantage of Flux's parametric capabilities** and keeping full compatibility with geometries created in a previous version.

■ New skin-depth mesh definition

How about getting a skin-depth mesh within a few mouse-clicks? The previous version of Flux brought the capability to automatically adjust the mesh to the geometry. In Flux 11.1, this has been improved and enhanced "mesh assistance". The **mesh can be globally controlled** and local adjustments are accessible. As shown in figure 2, with this new technology, the user can easily specify small elements near the contour of a region and larger elements when more remotely. With Flux, 2D and 3D mesh generation has never been so simple and mesh size fine-tuning so powerful!

■ Speeding-up the solving process

CEDRAT is continuously working on numerical methods to increase the **speed and robustness of Flux solver**. Once again, this version offers the fruits of those efforts. The most visible gains in computation time will be for 3D users when dealing with steady-state AC or transient magnetic applications. Speed-ups of 5 times can be experienced when comparing V10.4 and V11.1 on such applications, but it may be much higher! Flux solver includes **new parallel solving technologies** based on external solvers, namely Pardiso (Intel[®]) and MUMPS (<http://mumps.enseiht.fr/>). These codes have already proven their efficiency in other calculation software and offer the best the market has to offer in parallel linear solving.

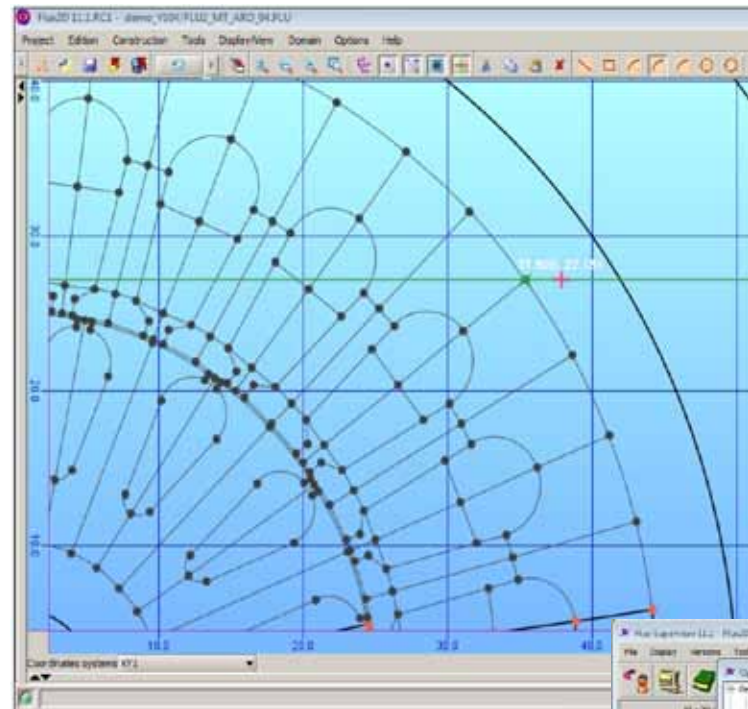


Fig. 1: Flux 11.1 new 2D sketcher. Its use will enable 2D users to create their geometries in few clicks.

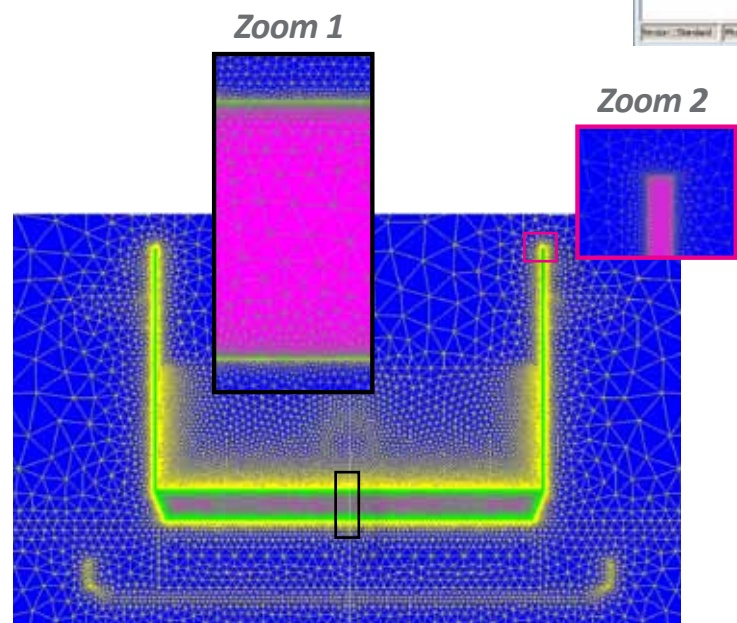


Fig. 2: Mesh of the pan using Mesh_SkinEffect macro.

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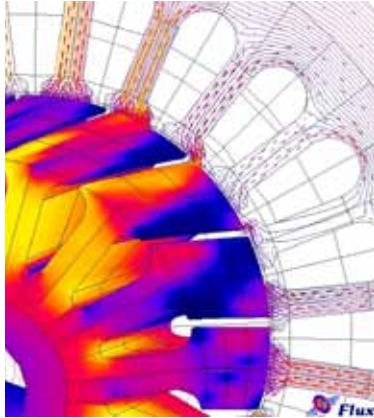


Figure3: View of a skew result in the new Flux 11.1.

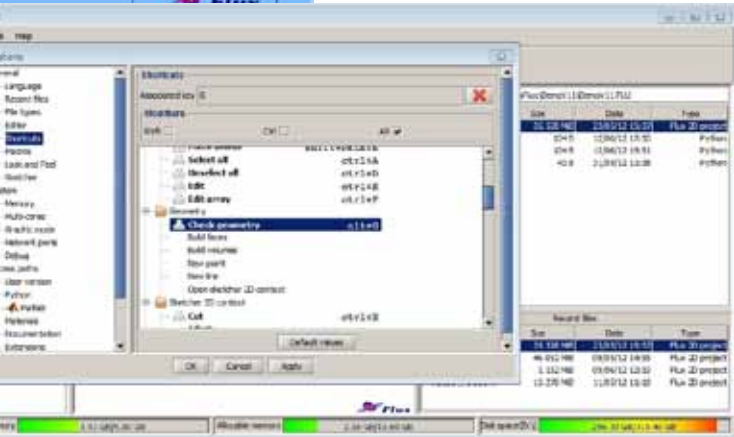
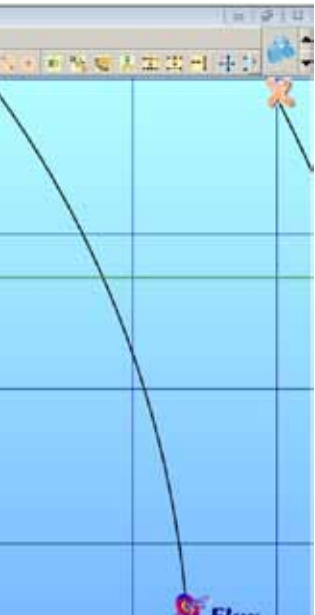


Fig. 4: Flux reworked supervisor including user preferences to customize Flux environment.

Advanced methods

Other advanced methods for efficient solving are also available with 11.1 version, extending existing 2D capabilities to 3D. This is the case of the **evolutionary start-up**, which allows **initialization of the transient model** with a DC, a steady state AC or a time-step of another transient simulation. This is especially useful for simulating induction machines but can also be applied to magneto-thermal applications.

In addition, a new auto-adaptation algorithm is provided and is able to **decrease or increase the time-step value during a transient simulation**, according to physical quantity variations. High accuracy can be then reached with a reduced number of **time-steps** when considering models with stiff time evolution in the physics. It avoids numerical transients and useless time-steps to reach a steady-state situation. It leads to less computation time, more stability and allows the simulation of complex transient situations. This is especially useful to simulate induction machines. It can also be applied to magneto-thermal applications in which heating and cooling processes can be considered and linked together, with an adaptation of the power supply for each phase of the process.

Full integration of thermal applications

The induction-heating-user community will also find a great benefit in this new version. **Magneto-thermal and electro-thermal applications in 2D are now fully integrated** into the unified Flux environment. It offers easy access to full parametric and scripting capabilities allowing complex heating and cooling processes to be simulated.

The coupling of magneto-thermal models with our system-level simulator Portunus is also available and this is key for the design of induction heating systems to consider electricity supplies and controls.

And much more

Many more discoveries lie in wait in the new version and a lot of features will make the everyday use of the software easier. The most impressive part will be seen in the post-processing section, in which the menus have been reworked, for better navigation and quicker access to quantities when computing values or drawing curves. Browsing the simulation results from a parametric analysis is made very clear and easy. Finally, user preferences are extended to customize Flux to user needs or habits. It goes from shortcut keys for usual actions to the mesh or solver settings. New macros are also provided with the software, helping the automation of complex tasks. The usual commands and icons of Flux can be augmented by the macros the user has selected, hence automatically bringing into the interface all the dedicated tools he needs.

Welcome to Flux® new generation !

This is really a new generation for Flux and this is evident to the user as soon as the software and the 2D sketcher are fired up. 11.1 version also uses proven external solving technologies and opens the door to distribution of calculations in the future. Connected to CEDRAT optimization software GOT-It, this is a great tool to analyze, experiment and design, delivering greater speed and comfort to the overall simulation process.

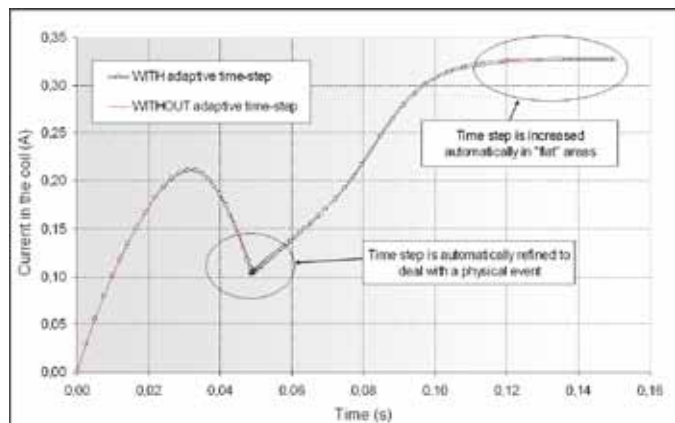


Fig. 5: Time-step adaption allows to reach good accuracy when simulating transient phenomena with an optimal number of time-steps, reducing the step when necessary and relaxing it when the physics is smooth.