Flux V10.4: How to Get Meaningful Simulation Results in an Efficient Way.

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A new version of Flux will be released this February, integrating the latest modelling and solving technologies, leading to always more precise simulations. The coming Flux V10.4 version also brings user-interface improvements for a more efficient every-day use of the tool.

Solving acceleration

In this version, a special attention has been paid to improve the speed of solving. Some key elements of the solvers have been optimized, such as the pre-resolution stages or the sparse matrix construction algorithm. A new parallel-processing technique has also been introduced that can utilize all the cores of a single computer. All of these new technologies bring great computational time savings, especially when considering larger 3D models or when using the Flux strong-coupling method between magnetic and electric circuit equations.

Thin conductive region

Because the performance of the solving process alone is not sufficient to deal with the modelling of complex physical phenomena, Flux has always brought unique techniques for efficient modelling. A new generation of shell elements has been introduced and offers the possibility in 3D steady-state AC magnetic simulations to consider thin conductive regions which are connected to an external electric circuit. This allows us to address modelling situations that were nearly impossible to simulate before, and now opens the doors to new applications, the modelling of EMC phenomena in cars or in the aerospace field for instance.

New geometry imports

To tackle more complex 3D geometries and to face the evolution of CAD software, the CAD import capability have been re-worked, greatly enhancing the processing that provides solid assembly and automatic healing of the model. These capabilities support the latest versions of classical CAD tools such as Pro/E and Catia, leading to a better and closer collaboration between mechanical and electrical departments, in a common mechatronic approach.

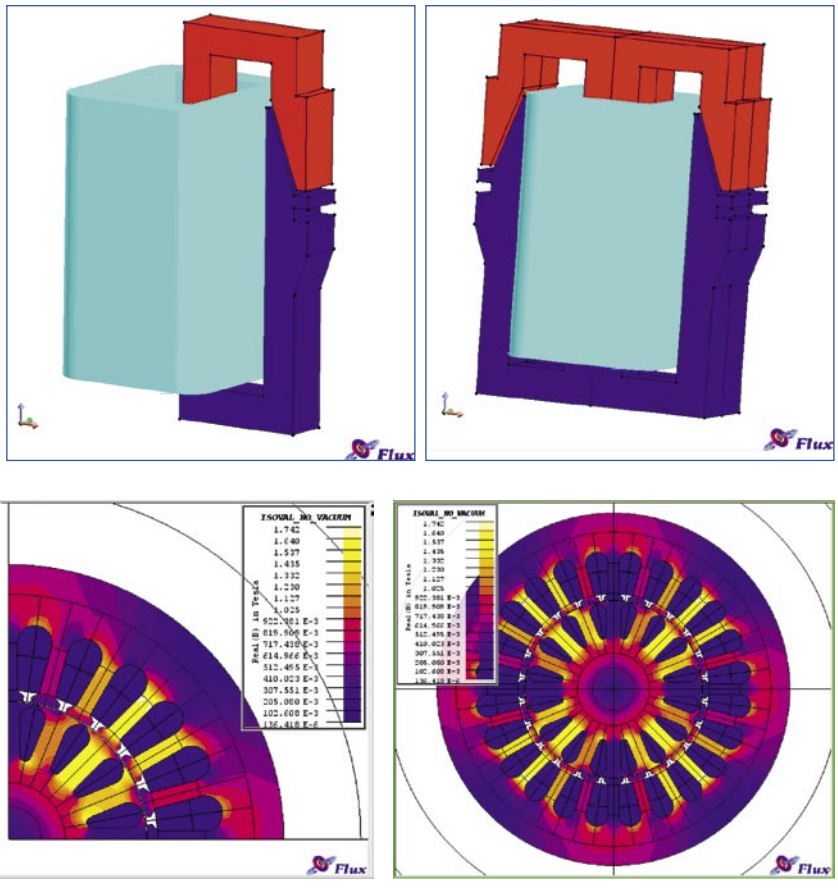
The new version also comes with very helpful tools for post-processing. Easy access to global quantities, the dynamic change of the number of isovalues or shaded colors with a slider, the import and superimposition of 2D curves are some examples of useful features. Animations and 3D curves allow us all to take full advantage of the parametric modelling capability of Flux. When using symmetries or periodicities, the reconstructed geometry can now be displayed for a better understanding of the results. For the user to get more meaningful results, they can now choose the unit of measure for each quantity which is presented. Standard unit systems are proposed by default but the unit of each quantity can be controlled separately.

Error criterion display

It is now possible to display local error maps which indicate where the mesh should be refined in priority. Depending on the application, different criteria can be chosen. In particular, advanced energy-based criteria are proposed to inspect the quality of the mesh in regions with eddy currents [1]. Both local and global indicators are provided, giving necessary feedback to the user on the quality of the solution obtained. This is a first step towards supplying an auto-adaption of the mesh.

Toward 2D/3D environment unification

All these new features are integrated into a unified 2D/3D environment.
Flux is fully scriptable, which enables the advanced users to automate their modelling tasks, and drive Flux from external codes and environments. In this



In 2D and 3D pre- or post-processing, reconstructed views of geometries and displayed results when using symmetries and periodicities.

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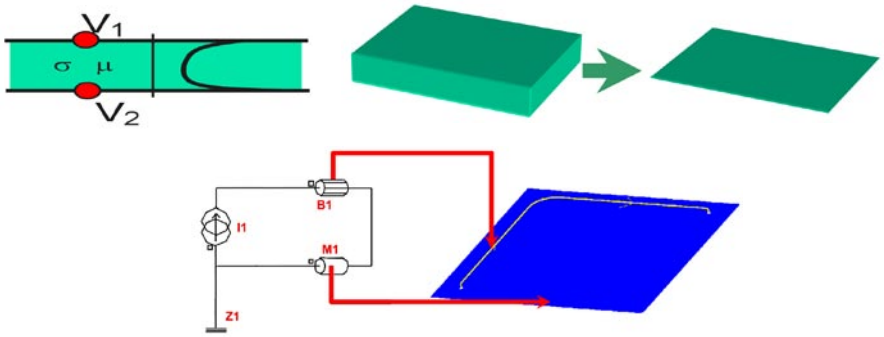
context, a new Matlab-Simulink coupling technology is now available for the co-simulation of 2D, 3D and skewed models. Allowing the concurrent simulation of an electromechanical device and its associated control scheme.

New post-processing

The new post-processing capabilities of Flux provide very efficient ways to get meaningful results that can be synthesized in an automatic report. Together with the speed-up of the solving, the new version really brings a better efficiency in the use of the tool, allowing more time for the designers to explore the design space. Flux V10.4 is a first step towards high performance computing with its new multi-threading capabilities.

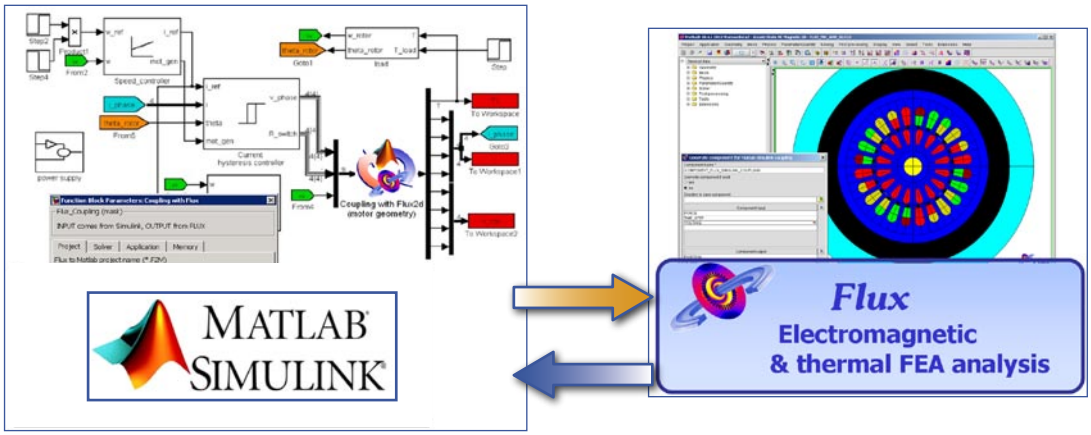
Future versions will continue in this direction, always striving for shorter computation times and bringing the ability to deal with bigger models. All these advances in modelling technologies lead to more realistic simulations, and the option for users to take into account more complexity in the geometries or in the physics.

[1] Rondot L. , Mazauric V., Wendling P., « An Energy-Compliant Magnetodynamic Error Criterion for Eddy-Current Calculations », IEEE Trans. Magn., June 2010, Vol. 46 issue 6 - p. 2353 – 2356.



Using surface regions to represent conductive regions in 3D steady-state AC magnetics and considering them as part of an external electric circuit.

Extended capabilities of the new Flux-Simulink co-simulation feature: now available for 2D, 3D and skewed models. Both magnetic and thermal applications are accessible.



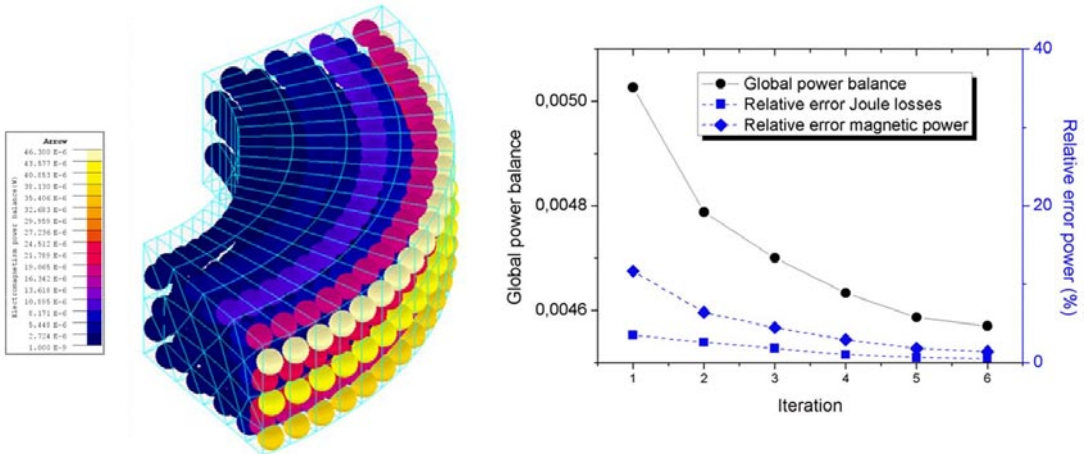


Illustration of a 3D error map in conductive part. The brighter colors indicate where the mesh should be refined. In this case the skin-depth is clearly localized. A convergence is found when refining manually the mesh.