

New Functionalities in Flux® 12 with Macros

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Macros have been available with Flux since 2008, they make possible to add new functionalities to Flux. The goal of a macro is to automate tasks, making flux easier to use. Macros allow sets of commands to be executed using PyFlux command language, after questioning the user. The questions can include the possibility to graphically select Flux components such as points, face regions, etc. as well as existing files opening a windows explorer.

Flux is delivered with a list of ready-defined macros around 150. You will find new macros on the CEDRAT gate (<https://gate.cedrat.com>).

We propose to show in this paper some of the available macros:

- How to create a rotating sine Flux density along a line in 2D?
- How to create Faulhaber type coils?
- How to extract a 3D cut plane in order to create a 2D project?
- How to minimize starting current?
- How to create meshed coils for 3D motors?

How to create a rotating sine Flux density along a line in 2D?

For some specific applications, it can be use to represent only the rotor or the stator part, even in 2D (for computing eddy current losses in magnets, for instance). It is possible to do it with Flux by the mean of line region, by assigning the vector potential along the arc of a circle. The goal of this macro is to provide a dedicated interface, to automatically create all the data, using parameters for each input value. The interface and the result are represented in simple geometry.

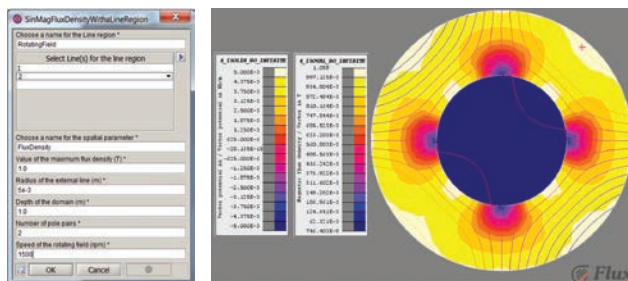


Figure 1: Rotating sine Flux density along a line.

How to create Faulhaber type coils?

When mass is an important criterion, it can be wised to use coils with no magnetic part around them, meaning a very specific coil winding design. Coil shape can become quite complex, but is hopefully repetitive. Having created the first one, creation can become automatic with this dedicated macro. The macro asks for geometric data (diameter, height, conductor diameter and starting angle), physical data (number of turns, number of coils, etc.).

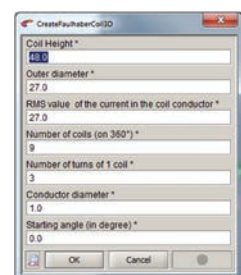
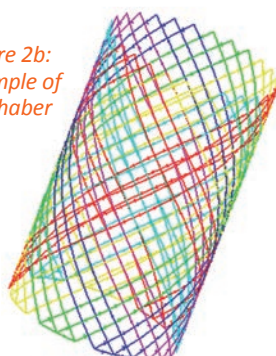


Figure 2a: Interface box of CreateFaulhaberCoil3D macro.

Figure 2b: Example of Faulhaber Coil.



Another benefit is that the macro can be run several times, to represent different conductor layers. The interface and result are displayed. Furthermore, all input data become parameters accessible for parametric computation.

How to extract a 3D cut plane to create a 2D project?

It is often useful to directly create a 2D project from an initial 3D project. We propose using this macro to directly create the geometry by extracting the points and lines in the cut plane. Having run the macro, a specific *.STP file will be created, which can be imported in 2D.

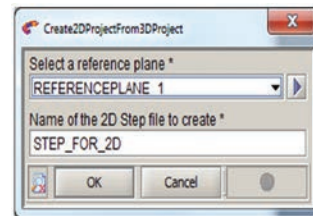


Figure 3a: Interface of Create2DProjectFrom3DProject macro.

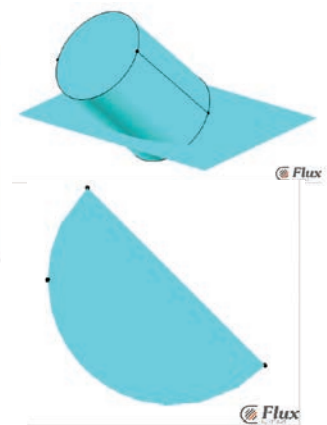


Figure 3b: Example of initial geometry and extracted plane.

How to minimize starting current?

Starting a device supplied with voltage supply often involves a high level of starting current. The idea is to reduce initial voltage during a limited electrical period time. This can be done by applying a specific formula of type $V(t) * (1 - \exp(-t/\text{Tau}))$. The goal of this macro is to automatically create this formula having answered some basic questions. This functionality was applied to an induction motor for testing. It shows the starting voltage and the starting current. The method is quite efficient to limit starting current.

“Macro offers the possibility to automate task, customize your application, make your Flux environment easier to use according to your habits.”

(see continued on page 11)

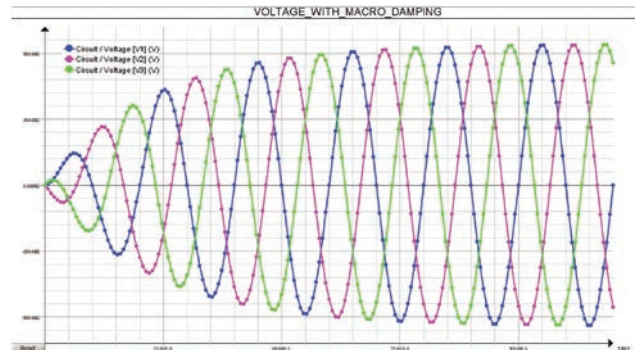
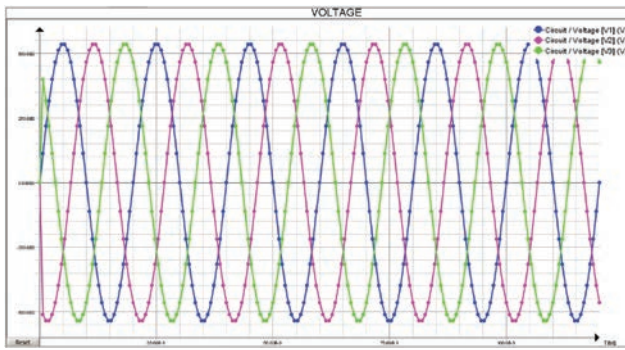


Figure 6: Voltage supply (initial and modified by the macro).

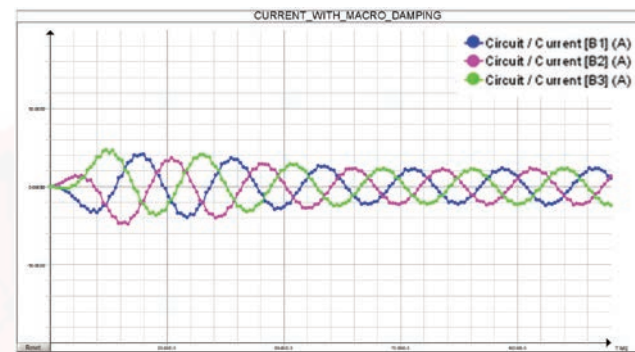
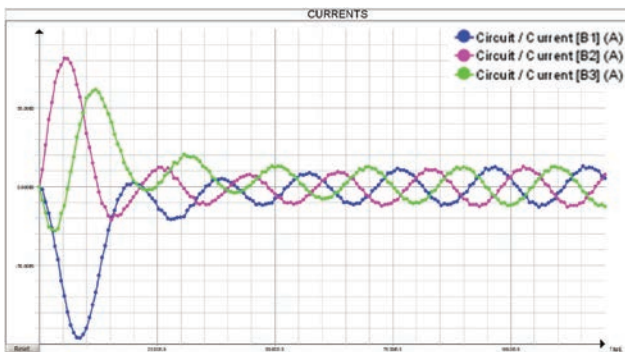


Figure 7 : Starting currents (initial (left) and with modification of supply (right)).

How to create meshed coils for 3D motor?

Non-meshed coils are usually recommended for 3D representing of coils. This is very efficient, since they do not all have to be represented and meshed. However, for thermal analysis, it appears that knowing where temperature hot spot are depends much more on the representation of the end winding part. Hence, this macro specifically represents the meshed coils and their insulation. From a limited number of parameters, the macro creates the full geometry with the mesh.

Conclusion

So, we have seen different macro applications. Macros can be used to create new functionalities simply with Flux. They can be activated at different levels of Flux use: geometry, physics, circuit, solving process and automatic post-processing. It is a great feature which can make your working life easier!

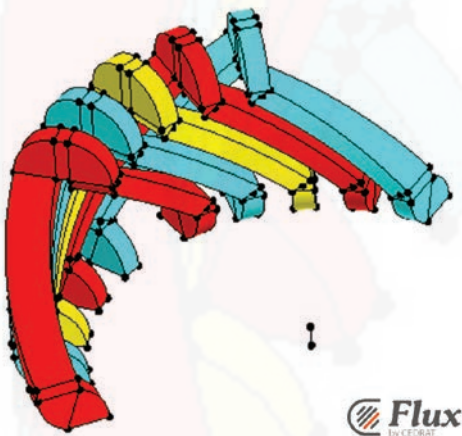


Figure 8: example of meshed coils. NB: each macro can be used as a model, and can be modified, to be customized to your need.

