Altair® FluxMotor® 2022.2

Release Notes

Updated: 12/08/2022

Contents

Introduction 1

This document gives the major information about Altair® FluxMotor® 2022.2. The main highlights of this new version are described below. For more detailed information, please refer to the user help guides. The list of documents to read is presented below.

This chapter covers the following:

1.1 Overview

Here are the highlights of the new version:

- Transient thermal computations for Reluctance Synchronous Machines

  Power step, Thermal time constants & Chart of temperature
- Computation of AC losses in winding – Hybrid method
- Induction machines – A new option for the SSFR test
- A new application "Materials"
- A new application "Script Factory"
- A new EXPORT/DOCUMENT/Script

  The full script for building a project, just a click away
- Export to Flux 3D – Synchronous Machines - Permanent Magnets
- Export to Flux 3D – Reluctance Synchronous Machines
- A new EXPORT / SYSTEM environment

  Export of Lookup tables (LUT) for Activate and PSIM
- Further new functions
  1. Special script functions for filling the slots
  2. A flag to raise non consistent winding architecture and/or slot filling
- Correction of issues

All the added new features are briefly described below followed by an update about issues and bugs.

FluxMotor 2022.2 – Highlights

1.2 Documents to read

> **Important:** It is highly recommended to read the user guides given below, before using FluxMotor®. Each user help document can be downloaded from the online user help

Below, here is the list of documents which are available.

1. General user guides for any type of machine:

- Installation_guide_en.pdf (Installation for both Altair® Flux® and Altair® FluxMotor®)
- Supervisor_2022.2.pdf
- MotorCatalog_2022.2.pdf
- PartLibrary_2022.2.pdf
- PartFactory_2022.2.pdf
- Materials_2022.2.pdf
- ScriptFactory_2022.2.pdf
- MotorFactory_2022.2_Introduction.pdf
- MotorFactory_2022.2_3Phase_Winding.pdf

2. User guides dedicated to Synchronous Machines with Permanent Magnets – Inner and Outer Rotor

- MotorFactory_2022.2_SMPM_IOR_3PH_Design.pdf
- MotorFactory_2022.2_SMPM_IOR_3PH_Test_Introduction
- MotorFactory_2022.2_SMPM_IOR_3PH_Test_Characterization.pdf
- MotorFactory_2022.2_SMPM_IOR_3PH_Test_WorkingPoint.pdf
- MotorFactory_2022.2_SMPM_IOR_3PH_Test_PerformanceMapping.pdf
- MotorFactory_2022.2_SMPM_IR_3PH_Test_Mechanics.pdf
- MotorFactory_2022.2_SMPM_IOR_3PH_Export.pdf

3. User guides dedicated to Reluctance Synchronous Machines – Inner Rotor

- MotorFactory_2022.2_SMRSM_IR_3PH_Design.pdf
- MotorFactory_2022.2_SMRSM_IR_3PH_Test_Introduction.pdf
- MotorFactory_2022.2_SMRSM_IR_3PH_Test_Characterization.pdf
- MotorFactory_2022.2_SMRSM_IR_3PH_Test_WorkingPoint.pdf
- MotorFactory_2022.2_SMRSM_IR_3PH_Test_PerformanceMapping.pdf
- MotorFactory_2022.2_SMRSM_IR_3PH_Test_Mechanics.pdf
- MotorFactory_2022.2_SMRSM_IR_3PH_Export.pdf

4. User guides dedicated to Induction Machines with Squirrel Cage – Inner and Outer Rotor

- MotorFactory_2022.2_IMSQ_IOR_3PH_Design.pdf
- MotorFactory_2022.2_IMSQ_IOR_3PH_Test_Introduction
- MotorFactory_2022.2_IMSQ_IOR_3PH_Test_Characterization.pdf
- MotorFactory_2022.2_IMSQ_IOR_3PH_Test_WorkingPoint.pdf
- MotorFactory_2022.2_IMSQ_IOR_3PH_Test_PerformanceMapping.pdf
- MotorFactory_2022.2_IMSQ_IR_3PH_Test_Mechanics.pdf
- MotorFactory_2022.2_IMSQ_IOR_3PH_Export.pdf

List of new features

2

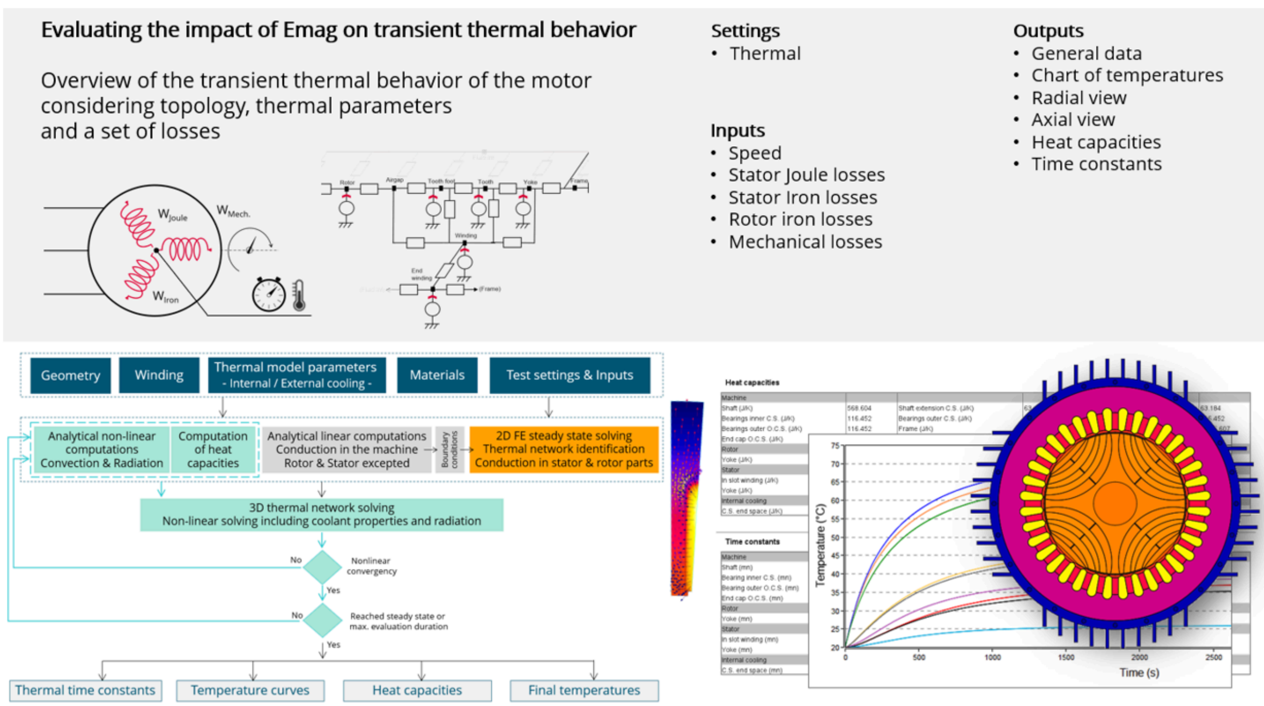
This chapter covers the following:

2.1 Transient thermal computation for Reluctance Synchronous Machines

A new test is available for characterizing the transient thermal behavior of the Reluctance Synchronous machine while applying a power step.

The aim of "Characterization – Thermal – Motor & Generator – Transient" test is to evaluate the impact of electromagnetic performance on thermal behavior of the machine in a transient mode.

The thermal working point defined by the speed and a set of losses can be considered to compute the temperature charts and the main thermal parameters, like the heat capacities and the thermal time constants.



Transient thermal computation – Power step, thermal time constants & chart of temperature

2.2 Computation of AC losses in winding – Hybrid method

From now on, while running the test to characterize the behavior of machines, operating at a targeted "working point" by considering the "Accurate mode" of computation, there will be three options for computing or ignoring AC losses in winding:

None: AC losses are not computed. However, as the computation mode is "Accurate", a transient computation is performed, but without representing the solid conductors (wires) inside the slots. Phases are modeled with coil regions. Thanks to that, the mesh density is lower with a lower number of nodes and a lower computation time.

FE-One phase: AC losses are computed on one phase. Only one phase is modeled with solid conductors. The two other ones are modeled with coil regions. One gets AC losses in winding, but with a lower computation time than if all the phases were modeled with solid conductors. However, this can have a little impact on the accuracy of results.

FE-All phase: AC losses are computed on all the phases. All the phases are modeled with solid conductors. This computation method gives the best results in terms of accuracy, but with a higher computation time

With the current version, a new method is available:

FE-Hybrid: AC losses in winding are computed without representing the wires (strands, solid conductors) inside the slots.

Since the location of each wire is accurately defined in the winding environment, sensors evaluate the evolution of the flux density close to each wire. Then, a postprocessing based on analytical approaches computes the resulting current density inside the conductors and the corresponding Joule losses.

The wire topology can be "Circular" or "Rectangular".

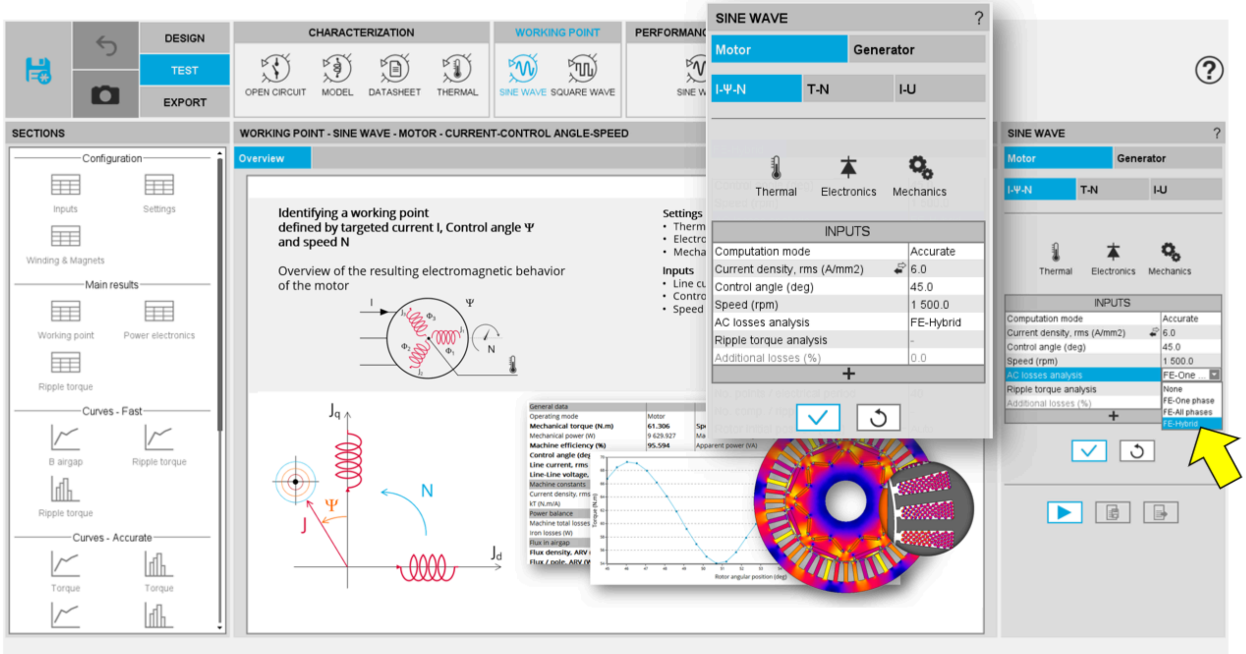
There can be one or several wires in parallel (in hand) in a conductor (per turn).

This new method of computation is available for all the machines:

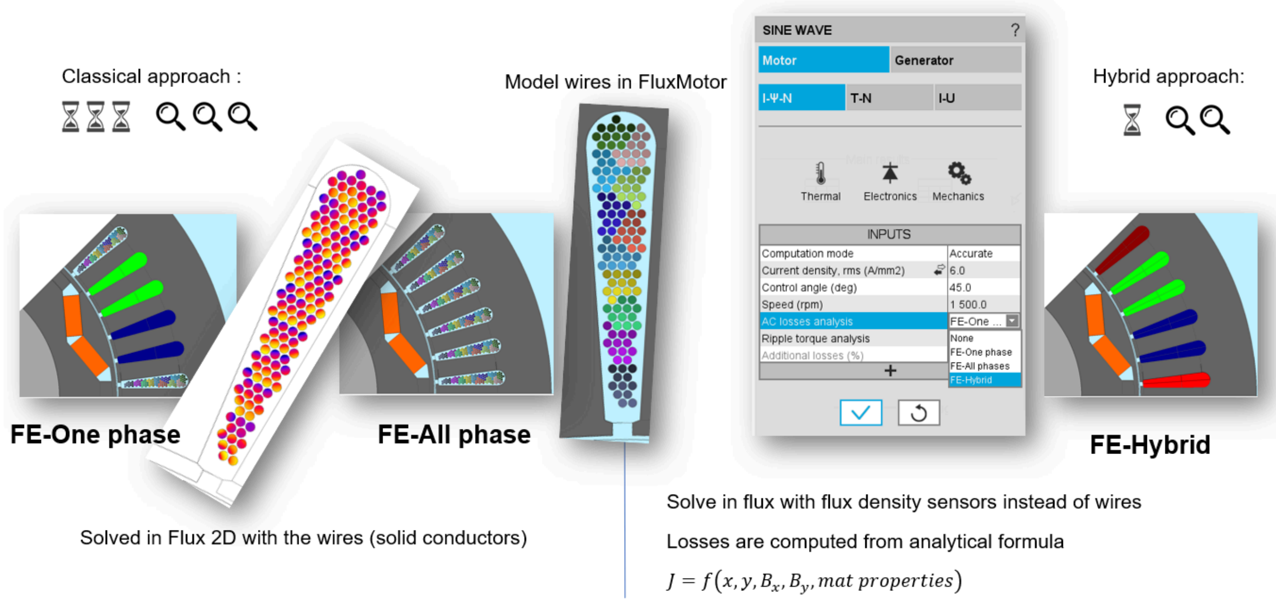
Synchronous Machines with Permanent magnets – Inner and outer rotor or Reluctance Synchronous Machines – Inner rotor, when running the test "**Working point – Sine wave – Motor – I, Ψ, N**" to characterize the behavior of the synchronous machines, operating at the targeted input values I, Ψ, N (Magnitude of current, Control angle, Speed).

Induction Machines with squirrel cage – Inner and Outer rotor, when running the test "**Working point – Sine wave – Motor – U, f, N**" to characterize the behavior of the induction machines, operating at the targeted input values U, f, N (Line-Line voltage, Power supply frequency, Speed).

This method leads to more accurate results with lower computation time. This is a good trade off between accuracy and computation time.



Mode of computation "Accurate" with Hybrid method of computation for AC losses in winding



Computation of AC losses in winding – Classical and Hybrid methods are embedded

2.3 A new option for characterizing the equivalent scheme of induction machines

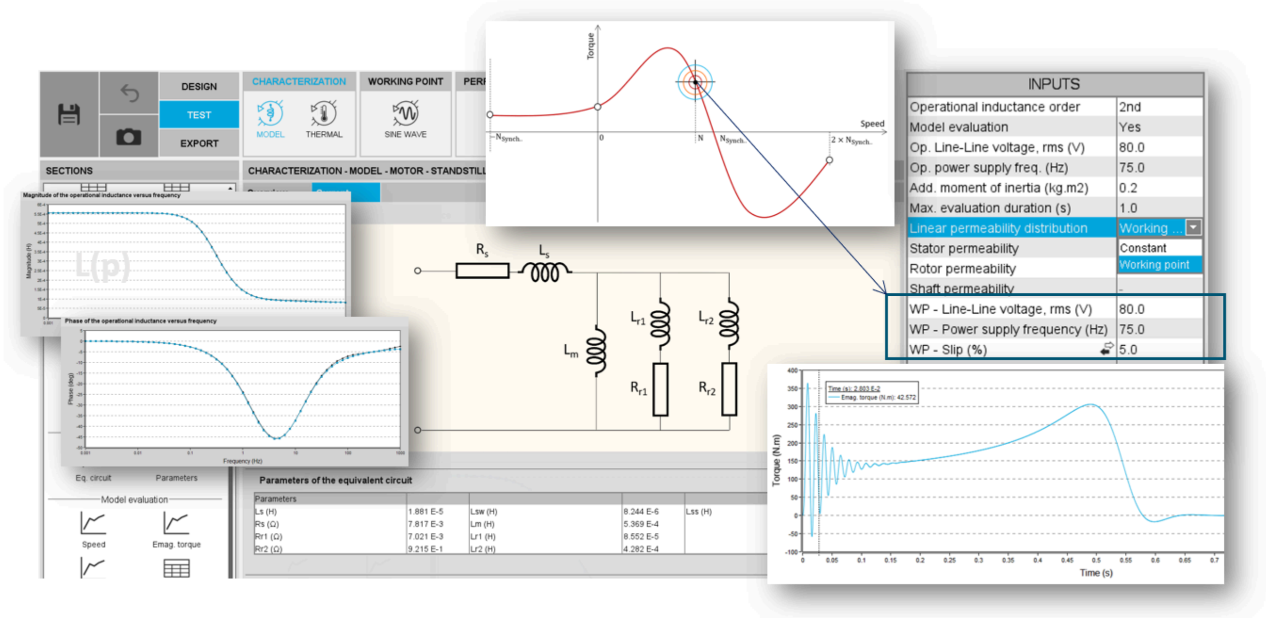
The characterization of the equivalent scheme for induction machines with squirrel cage has been improved with one additional option.

The frequency analysis to compute the operational inductance - L(p) – can be based on a working point defined with the Line-Line voltage U, the power supply frequency f and the speed N.

Indeed, the magnetic permeability mapping of a motor is done at the selected working point (U, f, N).

The resulting map of permeability is then applied to the model while performing the frequency analysis. This is what known as the frozen permeability method.

This must lead to even more accurate results.



Equivalent scheme of induction machines - An even more accurate approach

2.4 A new application "Materials"

The application "Materials" has been entirely rebuilt. This leads to a streamlined and consistent usage with all the other applications of FluxMotor.

Note that this modification is due to an evolution of our software architecture to get even more reliability, robustness, and performance.

All the functions to create and manage the materials are implemented in the new user-oriented GUI.

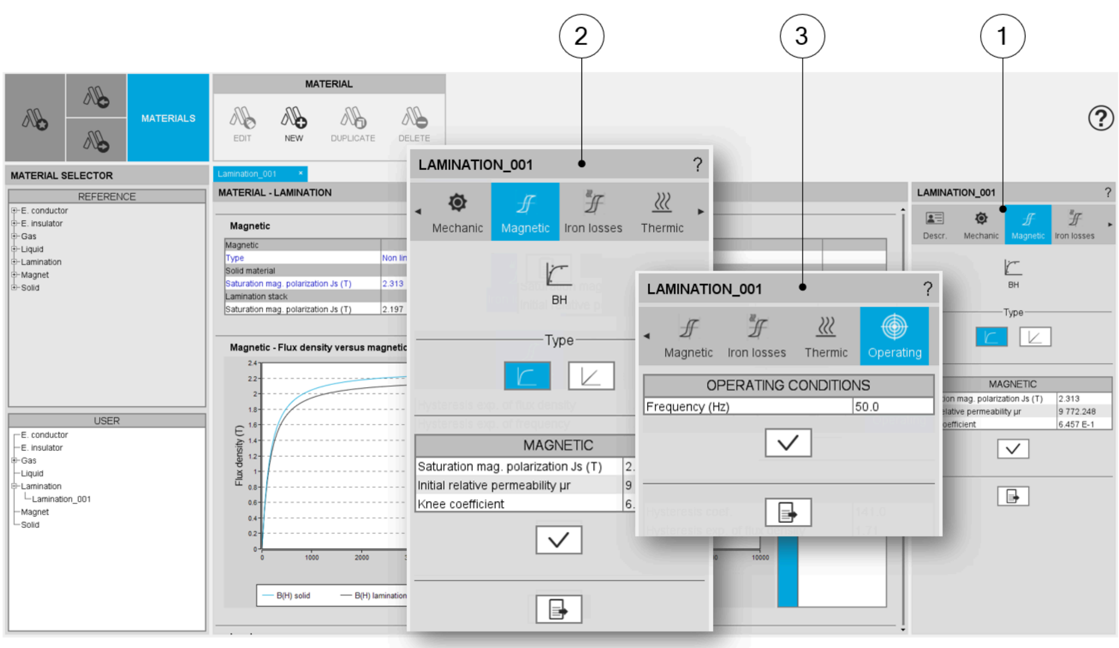
A scrolling selection bar helps to choose the sections (1, 2, 3) in which one can define the material property settings.

The material properties can be defined step by step.

For laminations, one can access the different sections by clicking on the following buttons:

- "Desc." to give the general information and memos
- "Mechanics" to set the mechanical properties
- "Magnetics" to define the B(H) curve parameters
- "Iron losses" to define the model iron loss parameters
- "Thermic" to define the thermal properties of the material
- "Operating" to adjust the environment parameters for evaluating the material properties inside the application "Materials"

  In this example, the operating conditions deal with the frequency to be considered for evaluating the iron losses inside the application "Materials"



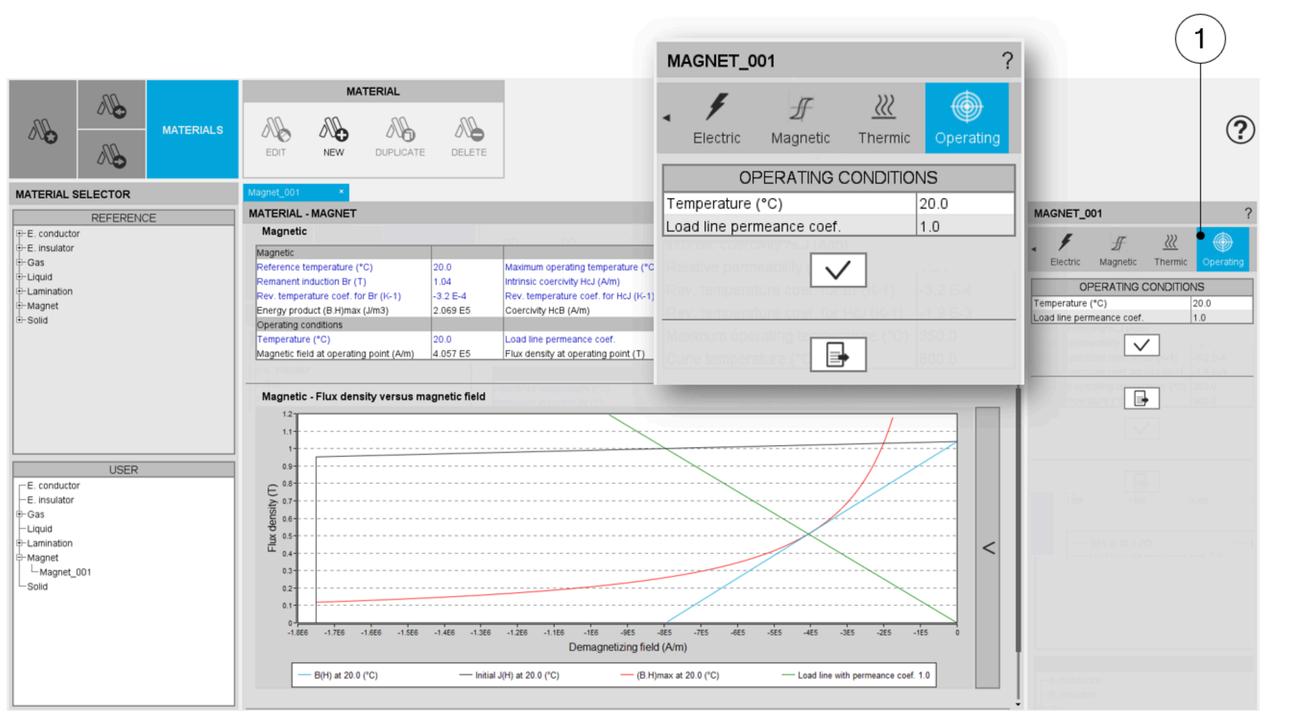
New GUI of "Materials" / Selection of sections – Example for laminations

Another example, for the magnets, one can access the different sections by clicking on the following buttons:

- "Desc." to give the general information and memos
- "Mechanics" to set the mechanical properties
- "Electric" to define the resistivity parameters
- "Magnetics" to define the B(H) and J(H) curve parameters
- "Thermic" to define the thermal properties of the material
- "Operating" (1) to adjust the environment parameters for evaluating the material properties inside the application "Materials".

In this example, the operating conditions deal with:

- The temperature to be considered for evaluating the remanent flux density and the intrinsic coercivity field
- The load line permeance coefficient

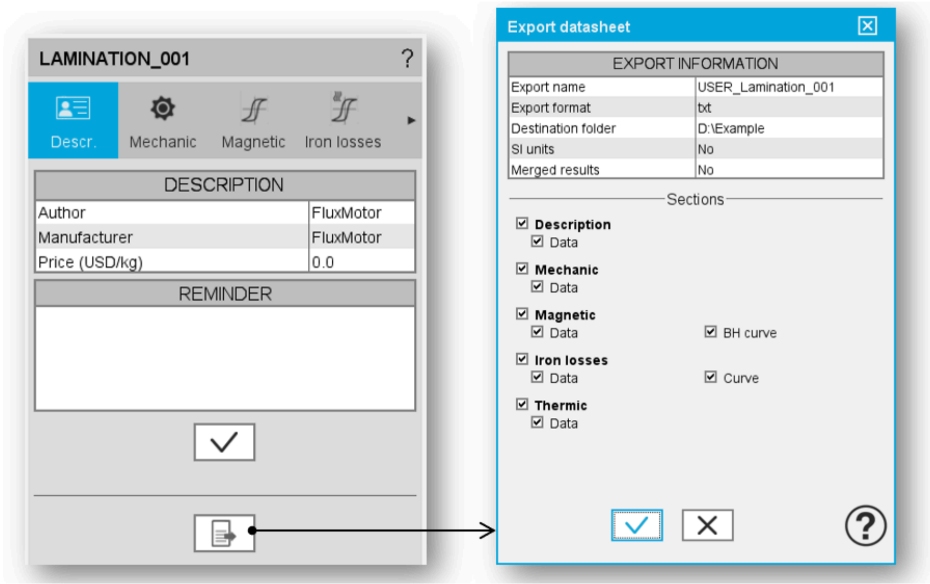


Selection of sections in which one can define the material property settings – Example for magnets

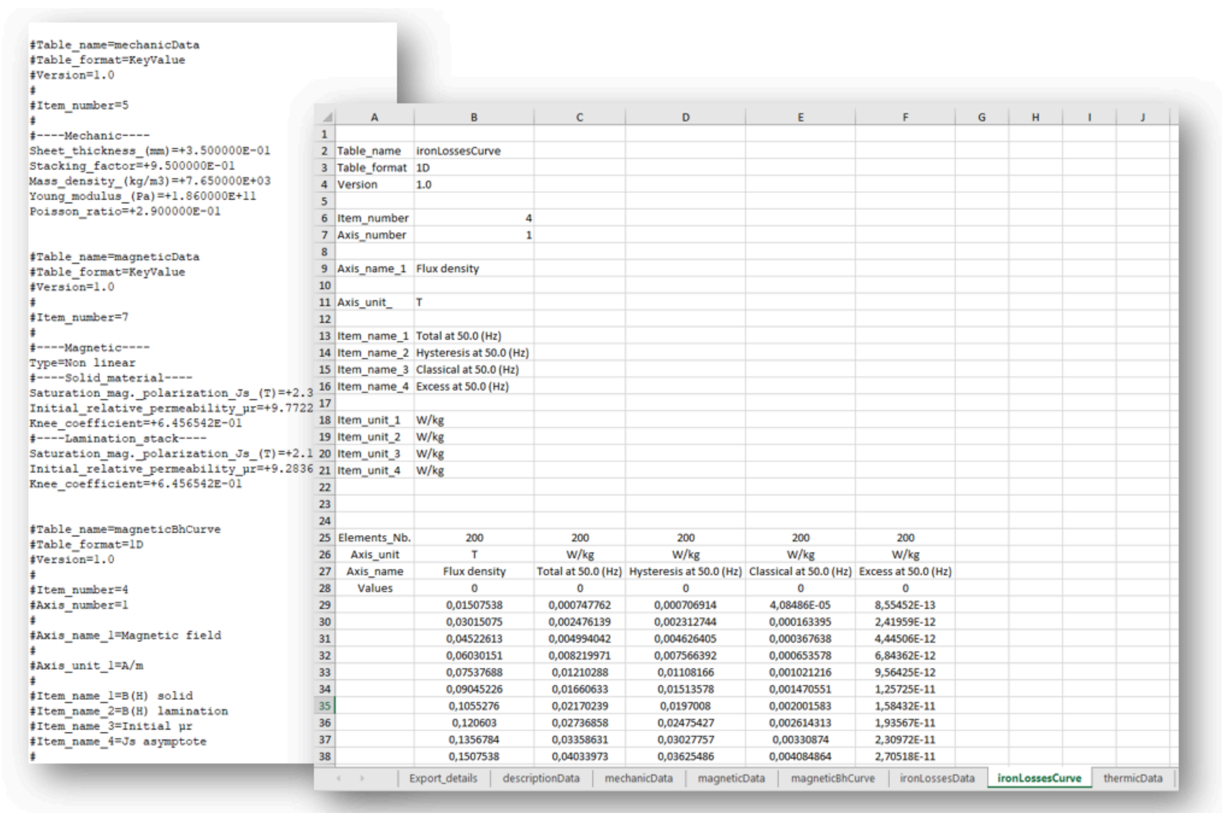
For all the materials, it is possible to export the datasheet of a material which is being displayed.

Material properties are classified in different categories depending on its family. It is possible to choose one or several of these categories to be exported.

Data can be exported either into *.txt or *.xls files. The results can be merged or not, which implies that these can be written in one single file or that a file can be provided for each category of result.



A dialog box for exporting material datasheet

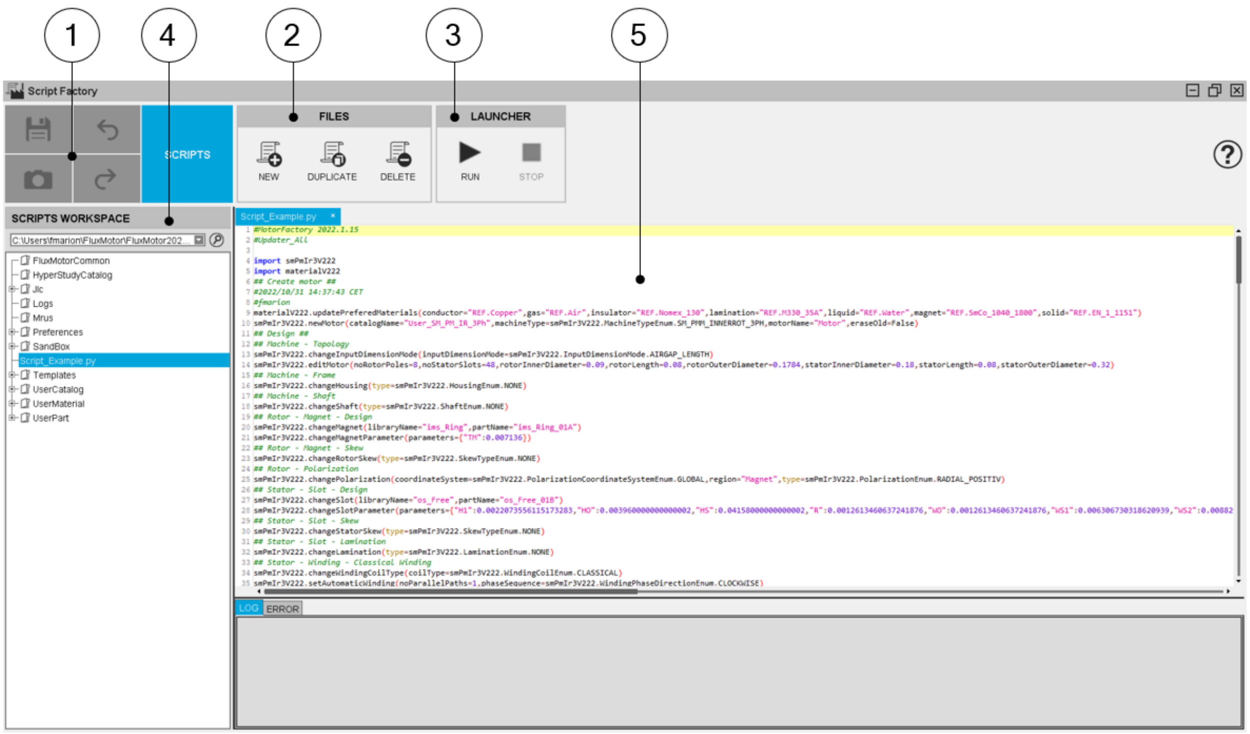


Material datasheet can be provided either into *.txt or *.xls files

2.5 A new application "Script Factory" in standard mode

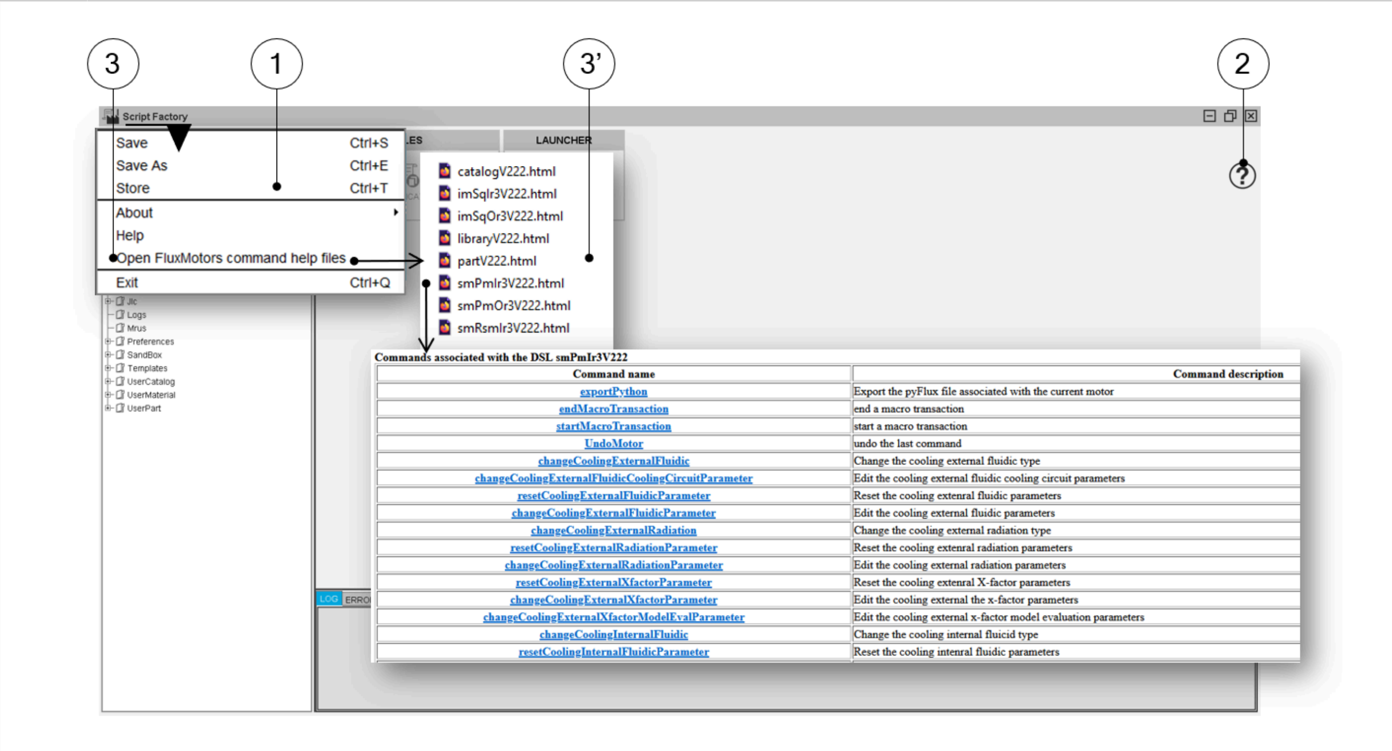
The application "Script Factory" has been entirely rebuilt. From now on, it will be available in standard mode with a new user-friendly editor for driving the FluxMotor via python script files.

Note that this modification is due to an evolution of our software architecture to get even more reliability, robustness, and performance.



The Script Factory – A new workspace organization

1	Buttons for actions on files currently edited (Edit, Store, Undo, Redo)
2	Actions for operating on available files
3	Buttons to Run or Stop the execution of a python file
4	Access to the files to be edited (Scripts workspace). Python files are well identified and visualized.
5	Editor area to display the selected python file

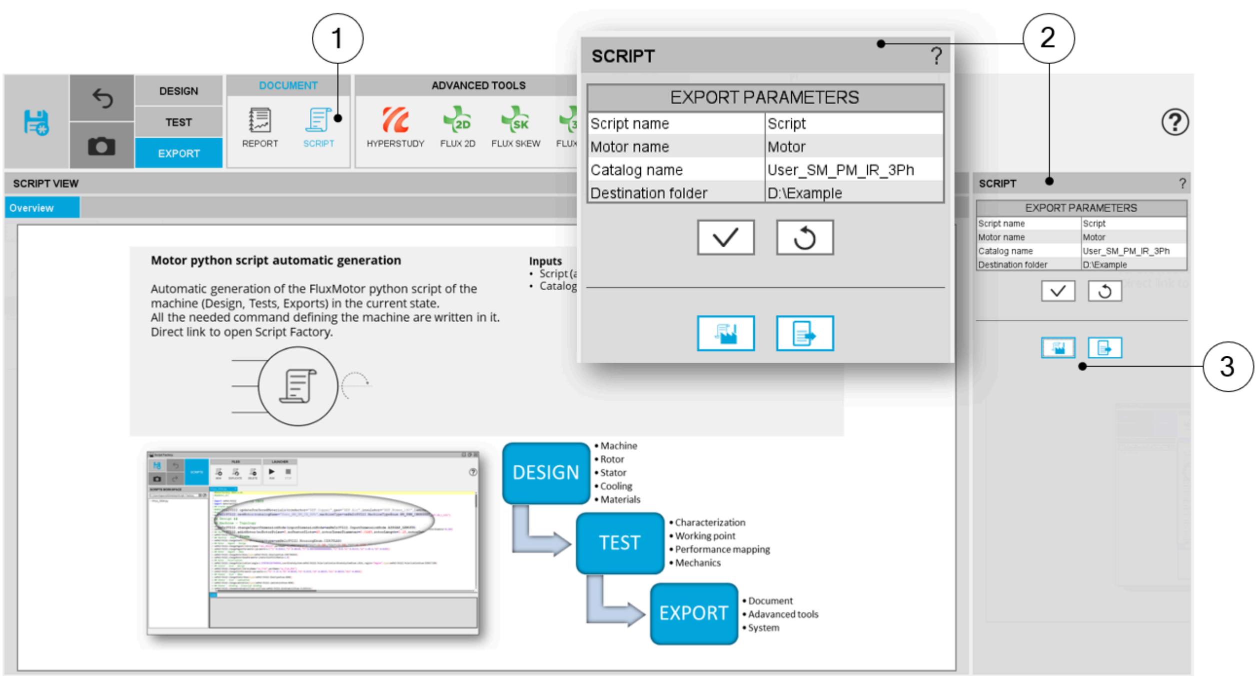


The Script Factory – User help guide and glossary of commands for helping the users	
1	Actions available in a drop-down menu
2	Help link to reach the user help guide dedicated to the Script Factory
3	Buttons to open the glossary of FluxMotor commands
3'	Html files in which are displayed all the available commands for each FluxMotor application

2.6 A new Export / Document / Script file

A new function is now implemented in Motor Factory / Export / Document area. Next to the Report, the Script function gives the capability to export a script file in which all the needed command lines are written to rebuild the considered motor.

The script is generated with all the needed sections and sub-sections in Motor Factory, dedicated to the design, to the test, and the exports

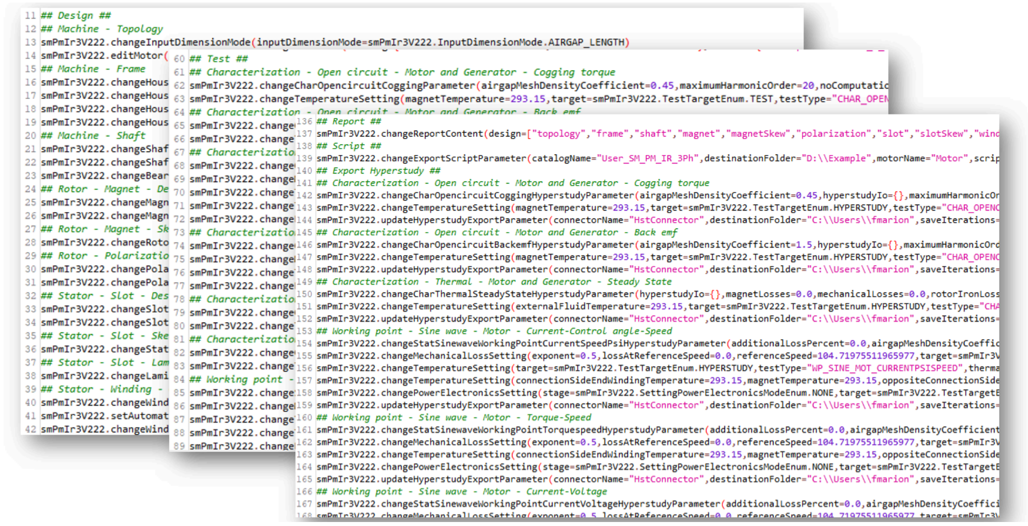


The full script for building a project, just a click away	
1	Button “Script” in the Export / Document area to build and export a script file dedicated to the considered motor.
2	Export parameters allow defining the script name, the motor name, the motor catalog, and the folder in which it must be stored.
3	Buttons to export the resulting python file and/or to directly open it in Script Factory

Concerning the process, either you get the script (python file) or you can get into “Script Factory” directly and instantaneously to work on it.

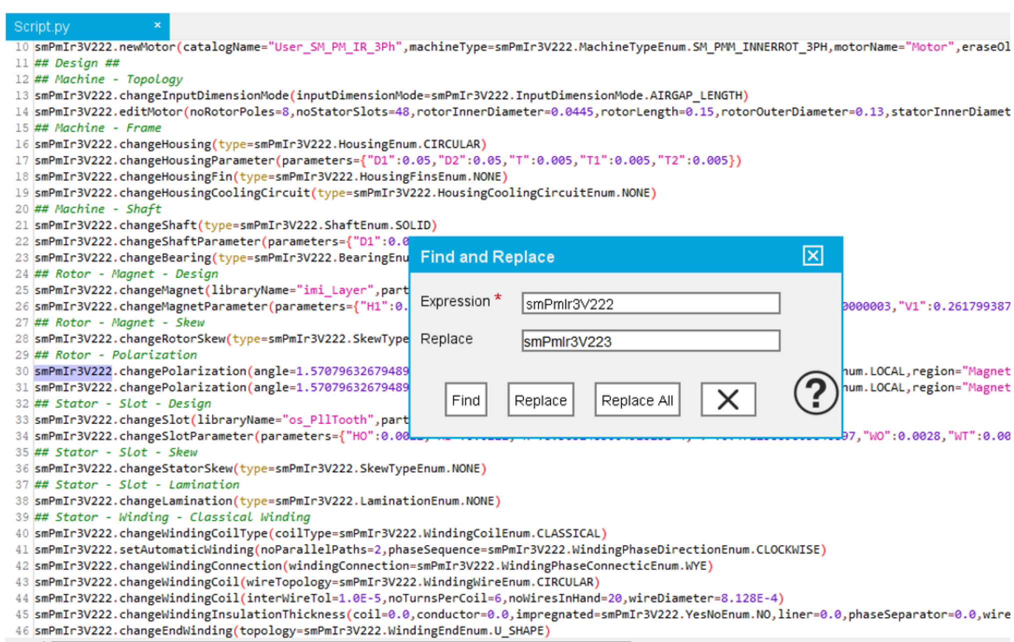
Here an example is shown below for the provided python script in which are described all the sections to define the design of the motor, the tests and the exports which can be performed.

This is a very powerful way for keeping all the information for rebuilding motors, whatever will be the used version of FluxMotor.



Example of python script in which are described all the sections to define the design of the motor, the tests and the exports which can be performed

Functions are implemented for helping the management of python files like “Find and Replace”, Edit, Copy, Paste, Delete,...



Function “Find and Replace” is available

2.7 Export to Flux 3D is available

The export of project from FluxMotor to Flux 3D is now available for both types of machines, Synchronous Machines with Permanent Magnets - Inner rotor and Reluctance Synchronous Machines – Inner rotor.

The aim of this export is to provide a python file which allows to get a full parametrized model ready to be used in Altair® Flux® 3D environment or to directly get into Flux 3D for solving and postprocessing the resulting 3D project.

Export project to Flux 3D environment – Export information

Note: In the current version one basic model (with a current source) can be provided for static application, without solving scenario.

While exporting the project from FluxMotor to Flux 3D, after having defined the project name and the folder in which it must be stored, the user has two possible choices to make:

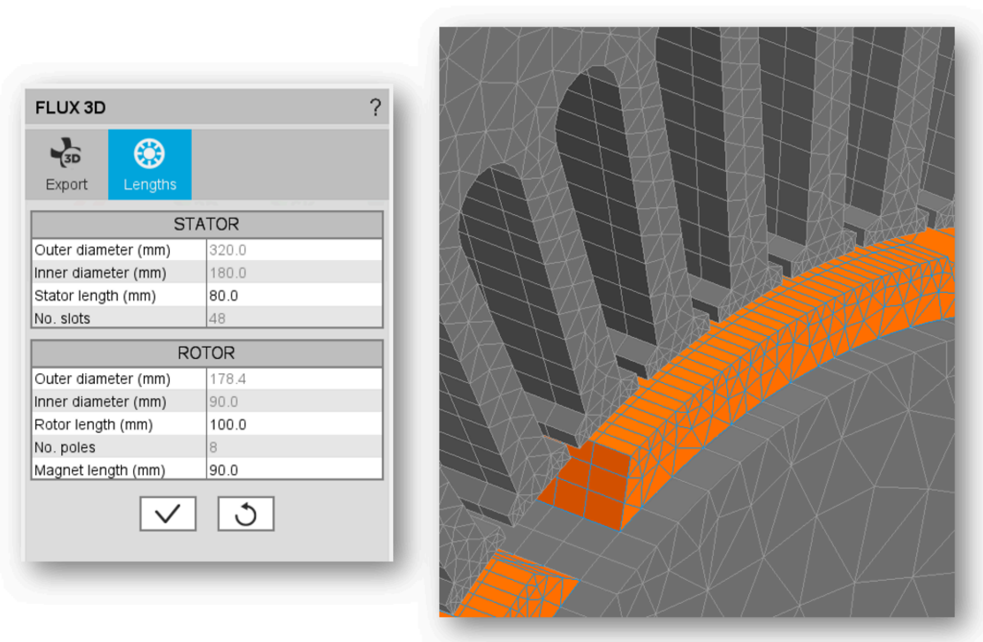
- Export a full geometry or not. If the answer is "No", the resulting project in Flux 3D is a reduced one in terms of periodicity based on the number of poles and the number of slots.
- Consider half the topology along the axial direction or not. If the answer is "Yes", only half of the topology is represented.

Note: This is possible only when all the dimensions are equal on both sides of the machine (Connection Side and Opposite Connection Side), especially regarding the end winding dimensions.

If the answer is "No" the whole machine is represented along the axial direction. This allows to consider the differences there can be on both sides of the machines especially regarding the end winding dimensions.

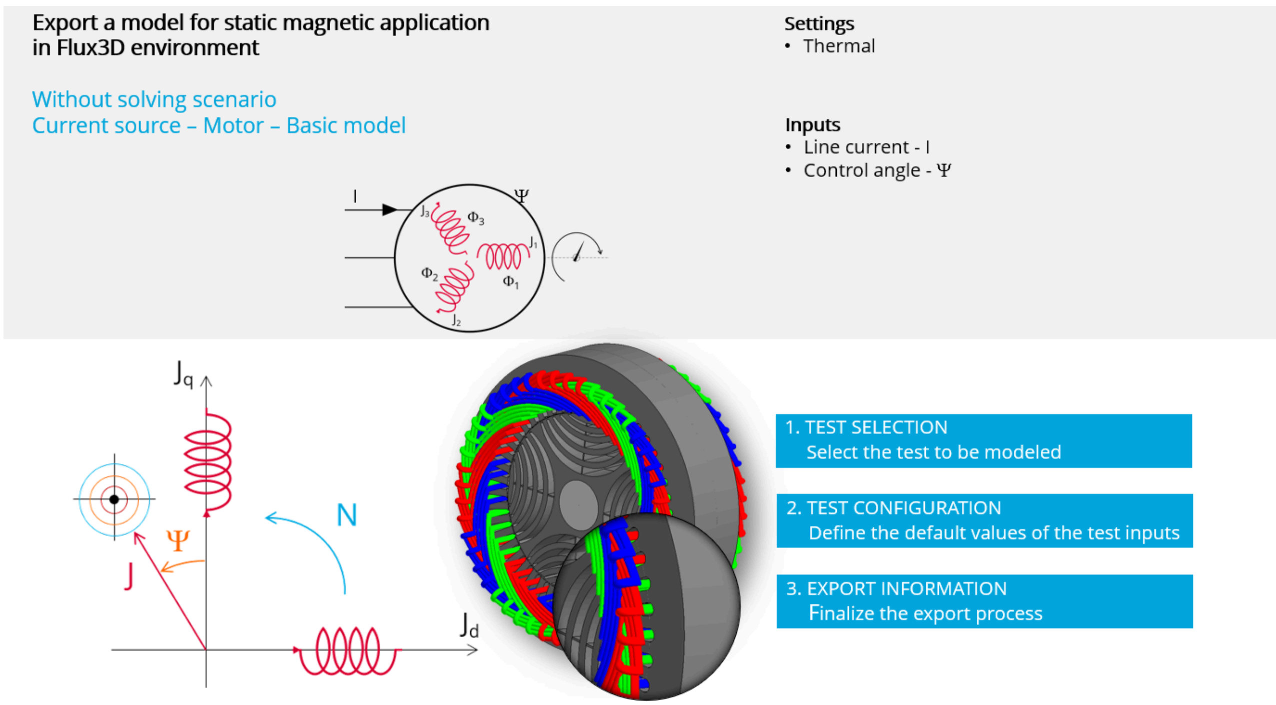
A dialog box is provided for defining the lengths of the stator, the rotor, and the magnets. These three lengths can be different.

The illustration here below shows the resulting topology in Flux 3D environment where the three lengths are different. This is automatically managed and built from the export area of FluxMotor.



Export project to Flux 3D environment – Stator, rotor, and magnets with different lengths

> **Note:** The export to Flux3D is also available for Reluctance Synchronous Machines.



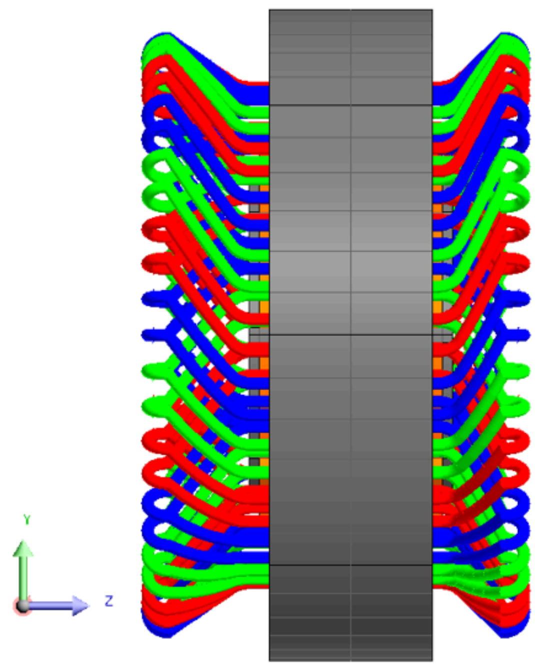
Export project to Flux 3D environment available for Reluctance Synchronous Machines

Warning:

When a motor with a skewed topology is considered, on rotor side or stator side, the export to Flux 3D is not possible. In that case, only the export to Flux Skew is accessible.

When the machine topology is not symmetric, especially, with the end winding lengths, the whole the machine must be modelled in Flux 3D. The choice Symmetry "Yes" is not available

In that case, end-windings can be represented with different dimensions on the "Connection Side" and the "Opposite Connection Side" like what is represented in the picture below.



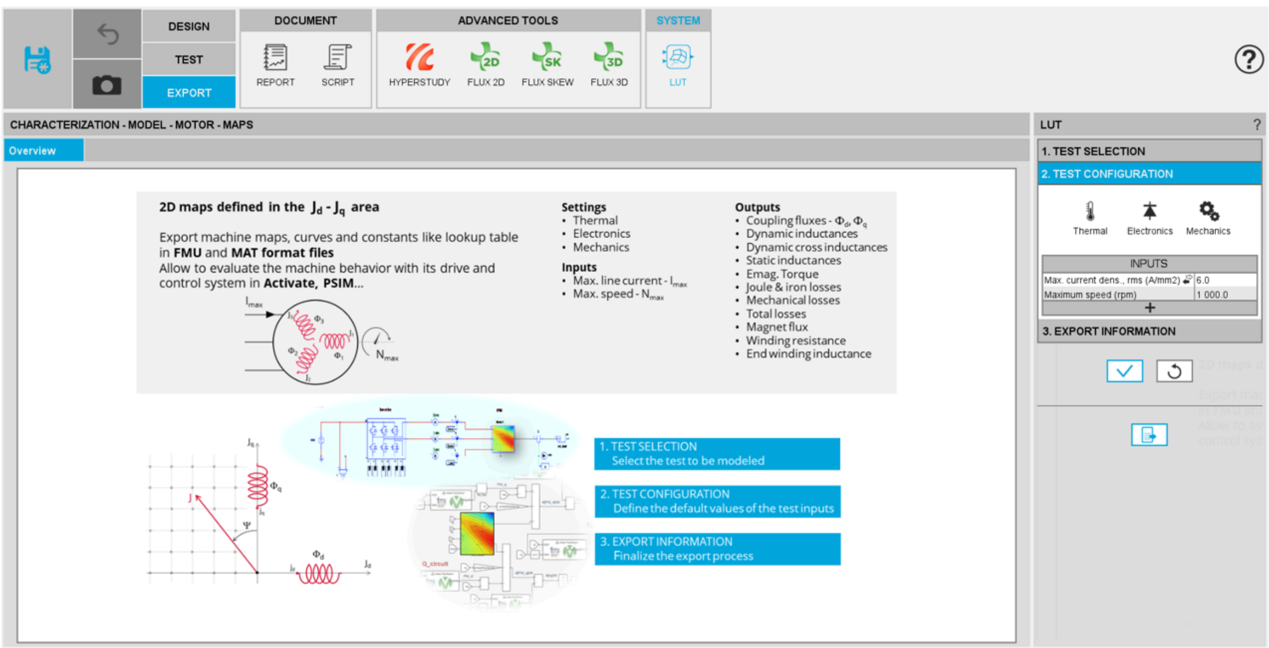
Different end-winding dimensions in Flux 3D on both machine sides: Connection Side and Opposite Connection Side

Note: A warning message is provided in the "Design environment" each time an asymmetric topology is defined. This is for warning the user, that the default value of the export inputs dealing with the symmetry has been set to "No". This also occurs when the asymmetry is due to the end shafts, even if the end-shafts are not represented in the 3D environment.

2.8 A new Export / SYSTEM environment for providing LUT

In the current version, and in near future, one big target is to develop and export more and more machine models, like lookup table (LUT), from FluxMotor to Activate and PSIM.

A new area is now dedicated to export LUT using both FMU or MAT format files to be used in Activate, PSIM or other system software.

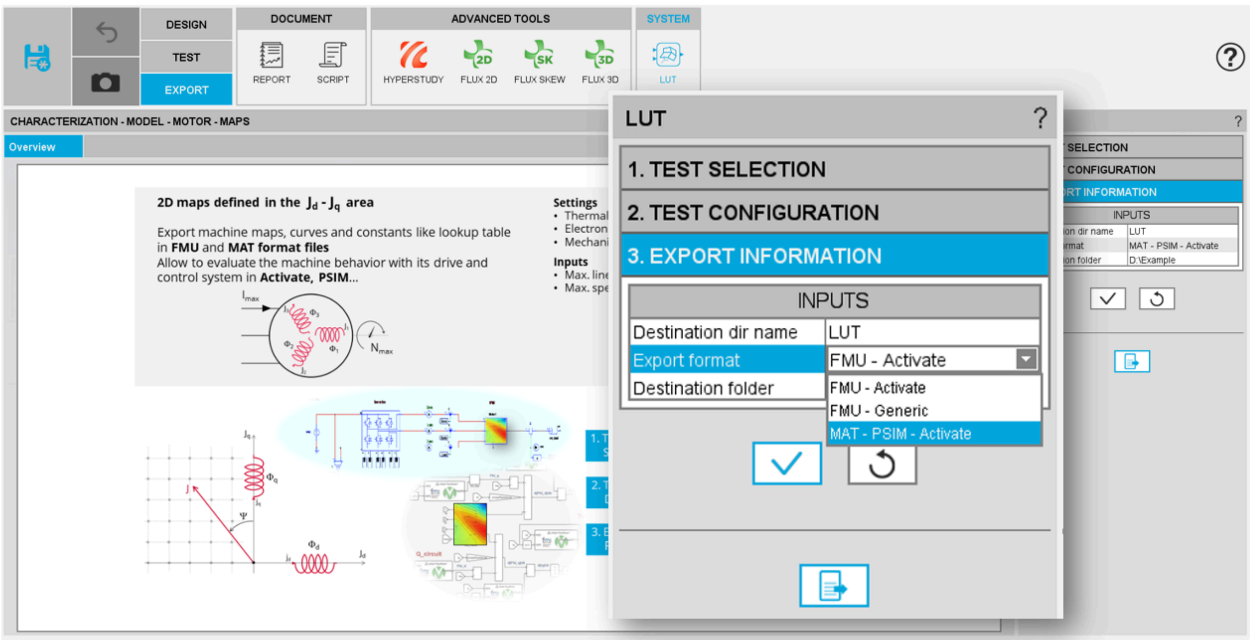


A new area is now dedicated to export LUT

In the EXPORT / ADVANCED TOOLS environment, "FORMAT/ FMU" has been removed and replaced by the new one: "SYSTEM / LUT".

Like in the previous version, the users can export FMU format files dedicated for Activate® by selecting the input "FMU – Activate" or compatible with other system simulation tools with the input "FMU – Generic".

But now these can also export MAT format files dedicated to Activate as well as PSIM by selecting the input "MAT – PSIM – Activate"



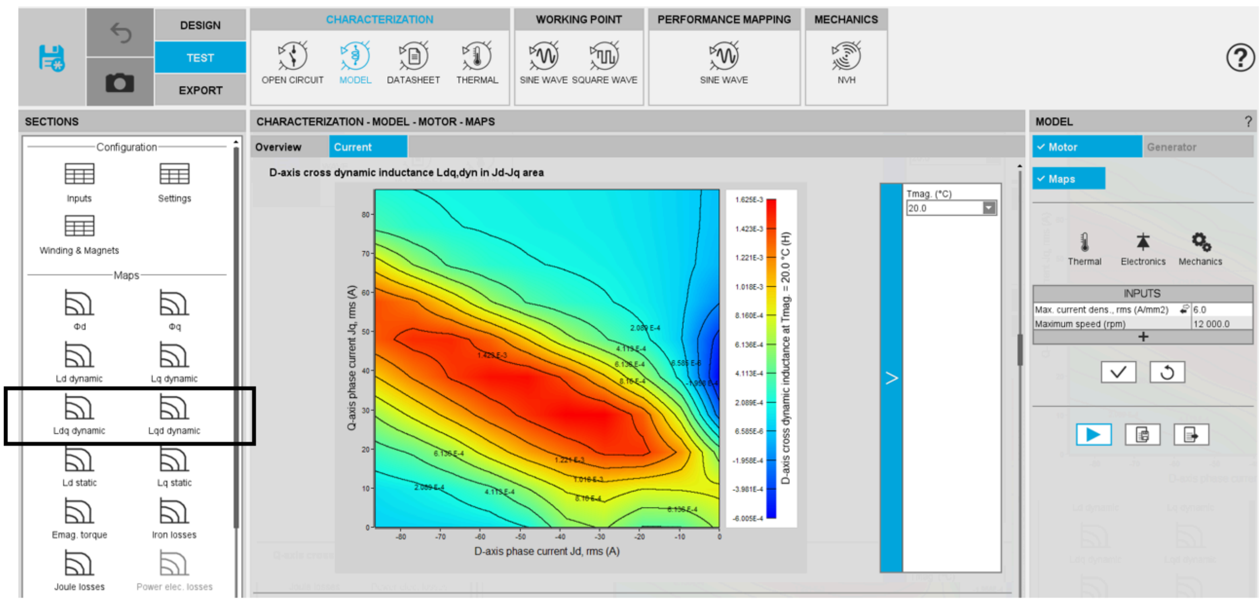
Export formats which are available for exporting LUT

Warning: The new area dedicated to export LUT is not yet available for Reluctance Synchronous Machines.

The data which can be exported are mainly based on what is computed in the test Characterization / Model / Maps.

In fact, the user inputs to describe the test configuration are the same than the ones which are in the test Characterization / Model / Maps.

Note: New outputs have been implemented in this test: The D-Axis and Q-Axis cross dynamic inductances in Jd, Jq area. This output can be displayed in function of the magnet temperature.



D-Axis and Q-Axis cross dynamic inductances are computed and displayed in the test Characterization / Model / Maps

Note: D-Axis and Q-Axis cross dynamic inductances are computed and displayed for Reluctance Synchronous Machines as well.

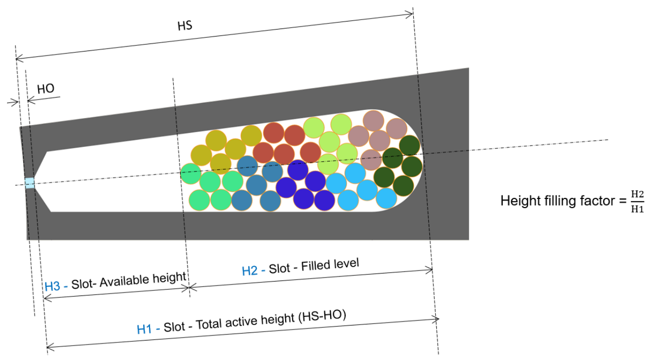
2.9 Further new functions

2.9.1 Special script function for filling the slots

1. From the drop-down menu available from the left top part of Motor Factory, it is possible to open a "Debug" dialog box, in which script commands can be written and executed.

   A new command dedicated to the slot filling has been implemented. It allows to define and apply a geometric slot filling (height filling factor).

   Here is the definition of the geometric fill factor = Height filling factor

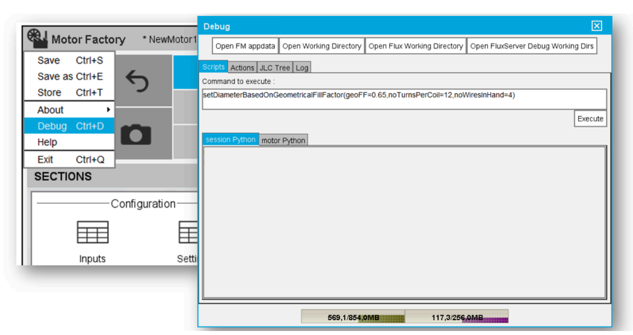


Definition of the geometric fill factor = Height filling factor

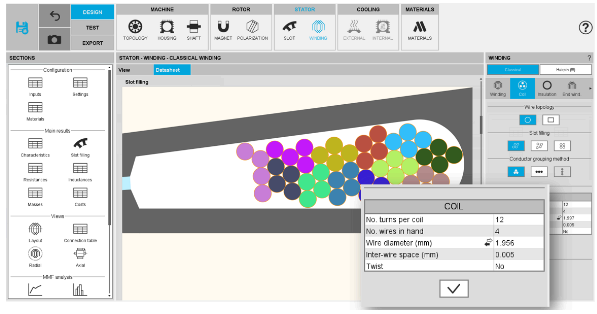
The script command is:

setDiameterBasedOnGeometricalFillFactor(geoFF=0.65,noTurnsPerCoil=12,noWiresInHand=4)

In this example, the goal is to find the wire diameter, which allows to define a geometric fill factor equal to 0.65 by considering a coil built with 12 turns and 4 wires in hand (in parallel).

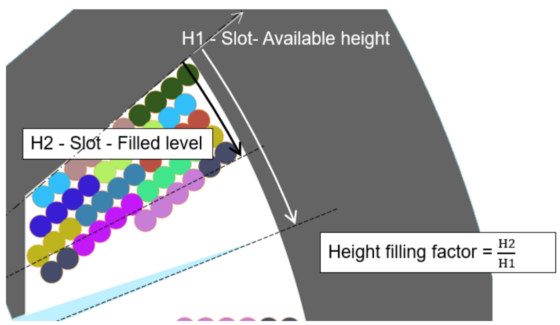


Debug dialog box to execute script commands

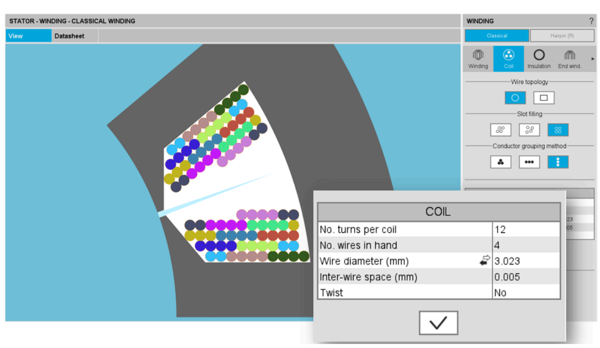


Result one gets while applying the command below:
setDiameterBasedOnGeometricalFillFactor(geoFF=0.65,noTurnsPerCoil=12,noWiresInHand=4

Note: This script command can run for tooth winding slot a well. In that case the definition of the geometric fill factor = Height filling factor, can be illustrated as below:



Definition of the geometric fill factor for the tooth winding = Height filling factor



Result one gets while applying the command below:
setDiameterBasedOnGeometricalFillFactor(geoFF=0.55,noTurnsPerCoil=12,noWiresInHand=4)

List of fixed issues and major improvements 3

This chapter covers the following:

3.1 All machines

1. Tests with the solid conductors in slots - Current in parallel paths is wrong

While computing a working point with elementary wires modeled with solid conductors, the computed electrical current in the branches in parallel is wrong, if the following conditions are met (ref.: FXM-14728):

- There are parallel paths
- The “Accurate mode” of computation is selected
- The “AC losses analysis” in “One” or “All phases” are selected
- The resulting finite element model doesn’t represent the full geometry

This issue has been corrected.

2. Inner slots with 2 layers winding and a liner can be infeasible

Sometimes, while adding a liner in an inner slot inside of which there are 2 layers can fail (ref.: FXM-14100).

This issue has been corrected.

3. Issue with report generation

Sometimes, the report generation freezes

This is mainly due to the management of memory. An increase in the allocated memory for Motor Factory can solve the problem (ref.: FXM-13585).

This issue has been corrected.

4. Save motor doesn’t work

Sometimes, saving a motor doesn’t work.

This is mainly due to the management of memory. Increasing the allocated memory for Motor Factory can solve the problem (ref.: FXM-13584).

This issue has been corrected.

5. Building and export of a report failed

While adding multiple new tests, and simultaneously executing the previously saved tests (12) along with assigning material in the report and saved test (12), the building and the export of the resulting report can fail (ref.: FXM-11574) + (ref.: FXM-14117).

These issues have been corrected.

3.2 Synchronous machines – Motor Factory – Test environment

1. Duty cycle with many working points fails

Running a computation of a duty cycle with many working points via scripting crashes (ref.: FXM-14435).

This issue has been corrected.

2. FMU LUT data Export: Flux_D and Flux_Q are incorrect

The flux linkage related to the end winding inductances on FMU side is not considered, as it is done on the test map side (ref.: FXM-14041).

This issue has been corrected.

List of warnings

4

This chapter covers the following:

4.1 All machines

1. Natural convection for end winding

While choosing a model, where the end spaces are cooled with natural convection, FluxMotor® model uses a quite low rotor tip speed ratio (a value of 5) to describe the fluid velocity far from the rotating components. This may lead to overestimation of the cooling of the end winding on high-speed machines.

When a tip speed ratio of 5 seems to overestimate the end winding cooling, it is advised to switch to forced convection mode. This mode allows forcing some higher tip speed ratios for areas far from the rotor, but reduces the efficiency of the cooling on the end winding.

This model will be improved for future versions.

2. Transient thermal computations - Displaying of iso-temperatures

In the test "Performance mapping – Sine wave – Motor – Efficiency map", when a cycle is considered with a transient thermal solving, the representation of the temperature isovalues inside the machine can be visualized all along the cycle with an animation.

The animation can run for the axial and radial views. However, both the animations are not well synchronized. Therefore, there can be troubles while using both at the same time.

3. Modification of units

To take the change of units into account in a test, the user must reopen Motor Factory. The modification is not considered instantaneously in the applications of Altair FluxMotor® like Motor Factory.

4. Preferences – Beta level mode

In the tab “Advanced Preferences”, Altair® FluxMotor® “User Level” can be: Standard or Beta. By default, the user level is Standard. In Beta Level, the entire qualified features are not available for evaluation.

The FluxMotor® Beta level mode allows performing NVH computations for induction machines – Inner rotor, and gives access to the application “Scripting Factory”.

5. Export a model into Flux® environment with represented elementary wires

1. **Building time of the model in Flux®**

   When slots are filled out with a lot of elementary wires, and all the phases need to be represented with solid conductors inside Flux® 2D model, the resulting python file can be very long. Therefore, the process for building the corresponding model into Flux® environment can take a long time.

2. **Export into Flux® Skew**

   Export a model with represented elementary wires into Flux® Skew environment is not yet possible.

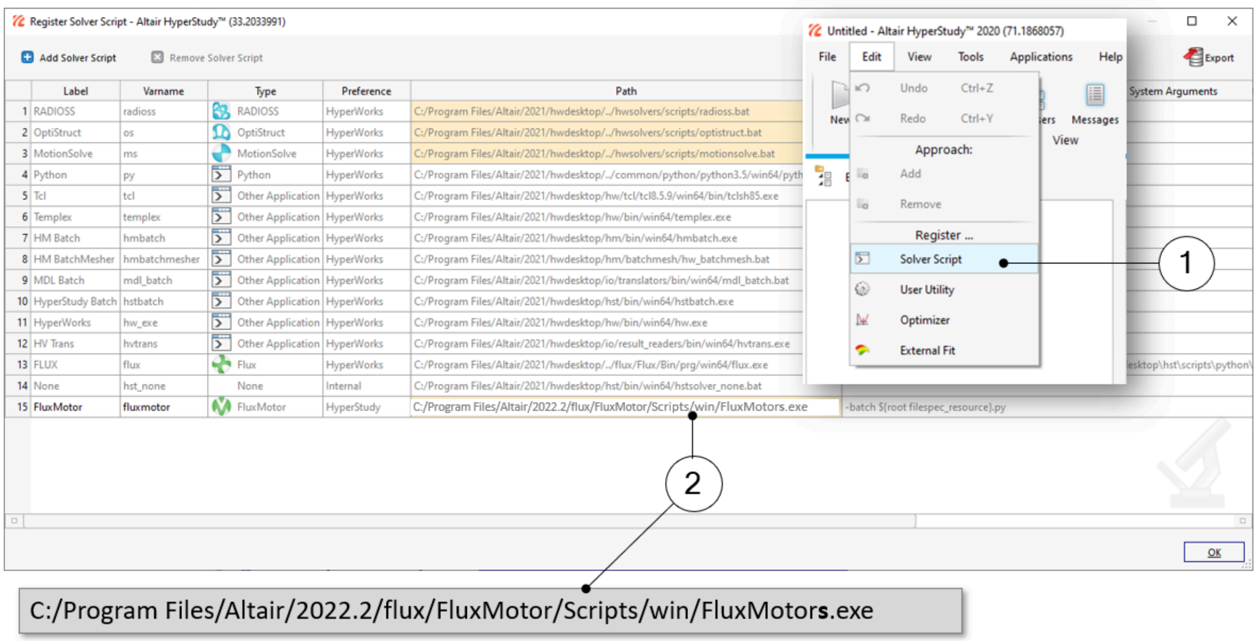
6. Browse function

Sometimes, opening a folder from FluxMotor® applications via browser function requires a longer time (several seconds).

7. Export environment – HyperStudy®

1. New solver script to be registered

Before starting new studies in Altair® HyperStudy® by using connectors exported from Altair® FluxMotor®, FluxMotor® must be registered as a new solver script in HyperStudy®. This must be defined only while using the coupling for the first time



Connection between Altair® FluxMotor® and Altair® HyperStudy®	
1	Open the area in HyperStudy® to register FluxMotor® 2022.2 script
2	Path where FluxMotors.exe must be selected to be registered as a new solver in HyperStudy®. **Note:** FluxMotors.exe with an "s" at the end of FluxMotors. This must be defined only when using the coupling for the first time.

> **Note:** Note: With the version 2022.1 of HyperStudy, the FluxMotor solver script is automatically registered when the default path installation is selected while installing Flux and FluxMotor.

2. New test and connectors for HyperStudy®

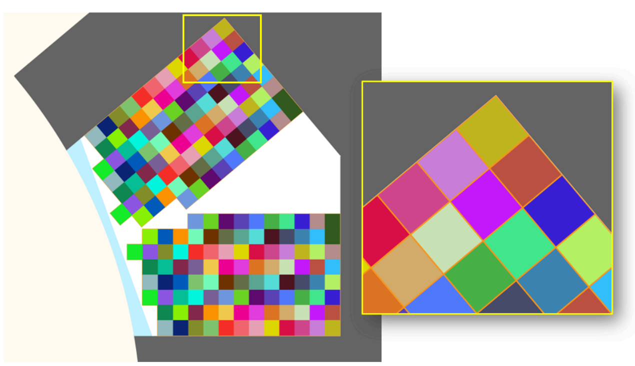
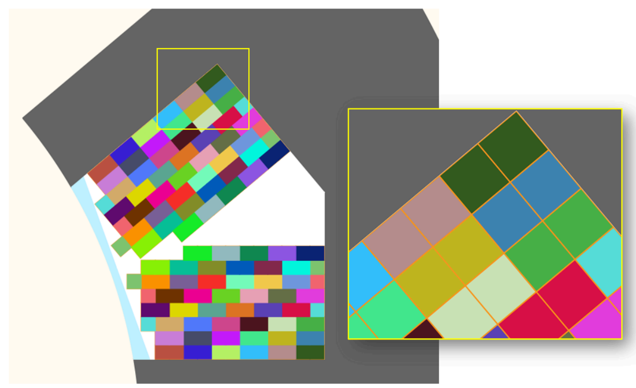
Connectors for coupling FluxMotor® and HyperStudy® are not yet available for the new implemented tests, like those with transient thermal computations.

8. Problems with slot filling

1. The slot filling is not yet possible with a non-symmetric parallel slot.
2. When a toothed winding design is considered with rectangular shape wires the conductor grouping method "horizontal" doesn’t work properly leading to wrong visualization of conductors. In that case, it is recommended to select the conductor grouping method "vertical".

   All works well with circular shape wires

   Example with a toothed winding design (i.e. the coil pitch = 1) and with 2 wires in hand.

	
Horizontal filling – wrong visualization, but the total number of wires is right	Vertical filling – good visualization

4.2 Synchronous machines – Motor Factory – Test environment

1. Working point – Square wave – Forced I – and delta connection

When running the test "Working point – Square wave – Motor – Forced I" with a delta winding connection, two electrical periods are considered for reaching a steady state behavior of the motor. However, sometimes two periods are not enough to get a good convergence of the process, and therefore, the displayed results may not correctly represent the steady state.

Motors built and tested with previous versions can be loaded with the current version. The existing "current tests" are removed and transformed as "saved tests" with reference to the original version (All the previous versions).

Sometimes results of the current tests are removed. The test must be executed again to get the corresponding results.

2. Delta winding connection

When a delta winding connection is considered, the computation doesn't consider circulating currents. This can lead to a different result than what expected in transient computation for the test "Characterization - Open-circuit - back-emf".

In such case, it is recommended to perform a transient computation in Altair® Flux® environment. The application "Export to Flux®" thereby allows exporting this kind of model with the corresponding scenario ready to be solved.

3. Evaluation of the maximum achievable speed

The aim of this result is to give a rough estimation of the maximum reachable speed, which can be achieved by the machine. This computation is performed by considering a MTPV command mode. However, when the resulting control angle is low (no saliency in the airgap of the machine), the evaluation of the maximum achievable speed may be far away from the maximum speed given by the "Performance mapping – Sine wave – Motor - Efficiency map" test.

4. NVH computations - Advice for use

The modal analysis and the radiation efficiency are based on analytical computation, where the stator of the machine is considered as a vibrating cylinder.

The considered cylinder behavior is weighted by the additional masses like the fins or the winding and the subtractive masses like the slots and the cooling circuit holes.

This assumption allows getting faster evaluation of the behavior of machine in connection to NVH. But, in no way this can replace a mechanical finite element modeling and simulation.

Possible reasons for deviations of results can be the following ones:

- The limits of the analytical model are reached or overpassed
- Unusual topology and/or dimensions of the teeth/slots
- Complexity of the stator-frame structure, when it is composed with several components for instance

- The ratio between the total length of the frame Lframe and the stack length of the machine Lstk. In any case, this ratio must be lower than 1.5:

$$\frac{L_{Frame}}{L_{stk}} \leq 1.5$$

4.3 Induction machines – Motor Factory – Design environment

1. Computation of inter bar impedance

For induction machines, inter bar impedance (resistance and inductance) is computed by considering characteristics defined in Motor Factory.

However, while exporting the model into Flux® 2D or into Flux® Skew, inter bar impedance will remain constant, even if a parametric study is performed in Flux® environment. The topology parameter as well as the temperature variations won't impact the inter bar impedance.

Moreover, when the ‘inter bar’ computation is done with the user mode, the reference temperatures are not updated while exporting the project in Flux® 2D /Flux® Skew environment.

4.4 Induction machines – Motor Factory – Test environment

1. Computation of tests for induction machines with skewing

When the squirrel cage or the slots are skewed for induction machines, the tests are computed with Altair® Flux® Skew at the back end of the FluxMotor®.

This leads to increase the computation time.

For the test "Performance Mapping – Sine wave – Motor – T(Slip)" and the test "Characterization – Model – Motor – Linear", the computation time can be greater than 45 minutes depending on the concerned machine, and is generally lower than 5 minutes when it is without skewing of squirrel cage or slot.

The computation time for computing a working point is generally close to 8 minutes with the skewing of squirrel cage or slots and lower than 1 minute when it is without skewing.

The required allocated memory is higher when Flux® Skew computations are performed at the back-end of the FluxMotor®.

By default, the maximum allocated memory for Flux® Skew software is equal to 8192 MB when the maximum allocated memory for Flux® 2D software is equal to 4096 MB.

In case, the user needs more memory, these values can be increased (user's preferences - Advanced tab)

Perhaps, it is required to allocate the memory from 10.24 GB to 15.36 GB to run tests without failure.

2. Computation of power density for induction machines

There was an issue in the process for computing or displaying the power density for induction machines.

The result was given in W/m3 while it is in W/kg for other machines SMPM, RSM.

This issue has been corrected.

However, it won't be possible to use a connector for HyperStudy®, generated with an older version, for driving the FluxMotor® 2022.2.

List of the main issues

5

This chapter covers the following:

5.1 All machines

1. Export script doesn’t work for machines with outer rotor

(ref.: FXM-15161).

2. Running tests fails with GUI is in Japanese

(ref.: FXM-15099).

3. Stator Joule losses are not displayed

In the tests dedicated to the computation of a working point (for synchronous machines or induction machines), if the mode of computation is fast the stator Joule losses are computed, but not displayed in the table of results. However, these can be deduced from the power balance information (ref.: FXM-15142).

4. Computation of forces on teeth is no more available

The computation of forces on teeth is no more available, since the workflow to compute forces on the teeth in NVH must be updated (ref.: FXM-15086).

5. Bad meshing while representing wires inside the slots

When exporting a project from FluxMotor to Flux 2D, the mesh in the slot can be sometime very bad in the region surrounding the represented wires inside the coil conductors (ref.: FXM-15151).

6. Issue with exported Flux Skew projects

After having exported a Flux Skew project, if you solve the project and delete the results and then solve again, the running of the project fails (ref.: FXM-15075).

7. Unable to export machine with squared lamination

Exporting a machine with squared lamination for specific winding architecture. Indeed, the parallel path manager cannot manage odd number of half coils in incomplete parallel path and flux cannot either (ref.: FXM-14956).

8. The slot filling with wires inside fails for inner slot

Sometimes, the slot filling with wires (solid conductors) fails for the inner slots (ref.: FXM-15150).

9. Twist of conductors cannot be considered with antiperiodic conditions

When the twist of conductors is selected in the winding area, if the motor presents an anticyclic periodicity, the twist of conductors won't be considered in the flux project (ref.: FXM-14935).

10. Removing of the housing is not well managed

Removing of the housing is not well managed with hairpin winding and potting are selected all together (ref.: FXM-14731).

11. Null values are not well managed while designing the Frame and shaft

Null values are allowed for designing the housing, bearing or shaft dimensions, but this leads to a wrong thermal analysis. It is highly recommended not to use null values for the considered inputs (ref.: FXM-14705).

12. Error while opening a motor (2020.1) with null shaft extension

Opening a motor built with the version 2020.1 (or older) with a null shaft extension leads to an error. With new versions, a null shaft extension is forbidden (ref.: FXM-14684).

13. The interwire space is not well defined

The resulting value of the interwire space applied in the finite element model is twice the value set in the user inputs (ref.: FXM-14672).

14. Transient thermal computation

Sometimes, there is an issue with nonlinear thermal resolution. The convergence criteria don't reach from a certain time iteration leading to non-physical results then making the physical properties interpolations impossible. This can occur for duty cycle inside of which there are a huge number of working points for instance (ref.: FXM-14570).

15. Air material properties are wrong for high temperature

This issue impacts our internal computation processes during transient thermal solving. Indeed, some iterations involve very high temperature (more than 3000 °K) according to Newton Raphson non-linear solving method. During the resolution, this can lead to negative conductivity and viscosity which may make the computation fail (ref.: FXM-14465).

> **Note:** in case of problem, an “Air material” with the right parameters can be provided.

16. Internal optimization processes can crash

Sometimes, when FluxMotor® launches an optimization in the back end with HyperStudy®, with an error in the internal process (evaluation of the objective functions), this makes FluxMotor® crash.

Moreover, without any log file to explain the issue one cannot understand the cause of system crash (ref.: FXM-13949).

17. When an IO cannot be loaded, the test results are not accessible

When an IO cannot be loaded, the whole process that loads all the test results is stopped. As a result, no test is visible although the issue may concern one result in a particular test (ref.: FXM-13941).

18. A wedge and/or inter-coil insulation region leads to a wrong slot equivalent thermal conductivity

The slot radial thermal conductivity, which is automatically provided by the FluxMotor® in "Cooling-Internal" context, and used in all thermal tests is wrong if the slot contains faces "wedge" or "inter-coil insulator" (ref.: FXM-13896).

19. Power electronics and coupling with HyperStudy®

For tests where settings "Electronics" is available, data like power electronics stage, maximum efficiency and its rated power can be selected for generating a connector for HyperStudy®, but it should not be (ref.: FXM-13726).

20. Management of multi-parametric settings with HyperStudy® coupling

Some configurations of parameterized topologies can be obtained manually in Motor Factory, but cannot be created from HyperStudy® for some connectors.

One must be able to manage the case of sequential input update in HyperStudy® connector, especially for topology definitions (ref.: FXM-13612).

21. Script Factory freezes temporarily when running a script

When running a script, script factory gives the impression of freezing (while still running in the background). The editing window of the script becomes unresponsive until the script is done executing (ref.: FXM-13138).

22. Winding environment – MMF computation

The Counter-Clockwise sequence (MMF computation) is not considered in the Altair® Flux® model which one can export. Only the clockwise phase sequence is considered (ref.: FXM-10280).Using "phase sequence" set to "Counterclockwise" leads to wrong results in tests (ref.: FXM-13358).

23. Flux density isovalues

When a skewed topology is considered (Synchronous machines or induction machines), the flux density isovalues, the vector potential isolines and the rotor bars current density isovalues are not displayed (ref.: FXM-12564).

The preferences that require a reboot are not updated after the reboot.

5.2 Synchronous machines – Motor Factory – Test environment

1. Working point – Square wave – Forced I – Average computation of quantities

The computation of average quantities like the iron losses, the Joule losses in magnets, torque is not done over a full electrical period. That can lead to wrong results (ref.: FXM-14091).

2. Wrong data in HyperStudy® export area

In the Export-HyperStudy® area, when the selected test is "Working Point, T-N", the settings of "Electronics" - "Max efficiency", and "Rated Power" - are exported even if the associated option is not selected (ref.: FXM-13726).

3. Maximum speed computation

The estimation of the maximum speed is wrong for the tests "Working point - Sine wave – Motor - U-I" and "Working point - Sine wave – Motor - T-N", when the control mode MTPA is selected (ref.: FXM-10916). The computation is always performed by considering a MTPV command mode.

5.3 Synchronous machines – Motor Factory – Export environment

1. The export of LUT doesn't consider skewed topologies (magnet or slot)

In such case, a Flux 2D computation is performed instead of a Flux Skew meaning the impact of the skewing is not considered in the computation results (ref.: FXM-15301).

5.4 Induction machines – Motor Factory – Test environment

1. SSRF test doesn't update inputs values while using the working point option

This means that after the first test based on a working point, the following tests give the same results whatever is the targeted working point (ref.: FXM-15262).

2. Defining the end ring reference temperature fails (Manual mode)

The reference temperature which is set to define the end ring - Impedance in manual modes is not considered for the tests solving (ref.: FXM-15147)

3. Power balance of No-load working point

Sometimes, computation of No-load working point (slip=0.1%) leads to a NaN (Not a Number) result. The computed amount of iron losses is not consistent with the power balance (ref.: FXM-12600).

4. Torque slip curve

Test results are not continuously consistent over a torque slip curve. This occurs with the test Performance mapping T(Slip) - induction machines with skewed squirrel cage. When the user targets a working point as an added value to be computed with the whole Torque-slip curve, sometimes this additional working point doesn't belong to the curve (ref.: FXM-12599).

5.5 Induction machines – Motor Factory – Export environment

1. Defining the end ring reference temperature fails (Manual mode)

The reference temperature which is set to define the end ring impedance in manual modes is not considered while exporting a project to Flux 2D or Flux Skew (ref.: FXM-15145).

2. End-ring impedance – Reference temperature is not well applied

While exporting a model from FluxMotor® to Flux® 2D or Flux® Skew environment, if the end-ring impedance has been defined with the "constant computation mode" (= user mode) instead of the automatic one, the reference temperatures set by the user are not used in the resulting Flux® project. Instead, the default values are automatically considered (ref.: FXM-13713).

5.6 Part Factory

1. Wrong management of part borders

An inner part with air region on the bottom border is not allowed (ref.: FXM-13445)

5.7 Script Factory

1. Script Factory does not stop correctly

Script Factory does not stop correctly, if FluxMotors has been killed (ref.: FXM-15140).

2. The find/replace dialog box has an issue

In Script Factory, the find/replace dialog box must be closed when the end of the file is reached. When the search reaches the end of the file, the only way to restart from the beginning is to close the dialog window, reopen and enter once again the data (ref.: FXM-15138).

3. Sometimes the store button status is bad

The store button is not enabled when a file is opened without modification (ref.: FXM-15136).

4. Script Factory freezes temporarily when running a script

When running a script, script factory gives the impression of freezing (while still running in the background). The editing window of the script becomes unresponsive, until the script is done executing (ref.: FXM-13138).

5.8 Supervisor – Preferences

1. Preferences and reboot

The preferences that require a reboot are not updated after the reboot (ref.: FXM-13121).

2. Reboot after changing language fails

While changing the language in Chinese, then in Japanese the automatic reboot of FluxMotor fails (ref.: FXM-15088).