Flux™

Low Frequency Electromagnetic Analysis for Electrical Engineering

In the global context of design process optimization and time-to-market reduction, Flux brings innovative solutions capitalizing on 35 years of electromagnetic simulation experience all within an open and user-friendly interface. Flux is a finite element software for low-frequency electromagnetic and thermal simulations, in 2D, 3D, and Skew. Flux can easily be used with other Altair software for multiphysics couplings and provides the most accurate analysis of your devices and systems.

Product Highlights

Powered by best-in-class numerical techniques, Flux provides fast and accurate results. Featuring extended multiparametric analysis capabilities, electrical circuit and kinematic couplings, it allows the user to analyze, design, and optimize a wide range of applications.

Numerous Applications

- Rotating machines
- Linear actuators, solenoids
- Transformers & inductances
- Induction heating processes
- Sensors
- Cables, electric connections
- Electromagnetic compatibility

Learn more:
altairhyperworks.com/flux

Benefits

Accurate

Flux generates accurate results you can trust and will let you concentrate on innovation. It is based on the most advanced numerical methods and specific well-adapted modeling techniques, providing precise results in a very efficient way.

Flux solvers are constantly evolving in order to create the best solving speeds, allowing for the evaluation of thousands of design configurations.

Flexible

The software behavior can be customized depending on the user's preferences. With its embedded scripting tools and the ability to write macros, Flux allows the user to capture simulation processes and automate them, speeding-up the everyday use of the software. Flux can be easily coupled with any software, enabling high productivity and giving access to non-specialists.
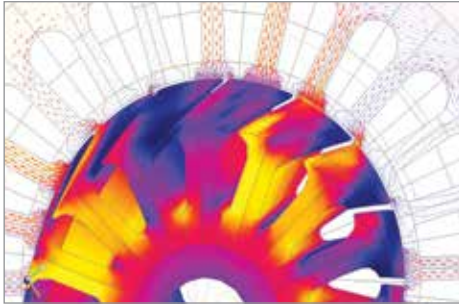
Parametric Simulation

Using a parameter to define a geometric dimension or a physical characteristic is natural in Flux, it is one of the fundamentals of the tool. Linking several parameters together through equations is also very easy. The influence of any parameter can be explored in a very intuitive way, visualizing the results through multidimensional curves and animations of color shades or arrows.

Interoperable

Flux can be coupled with other software 3D analysis software considers multiphysics to create the most realistic representation of phenomena. Considering a device as a component of a larger system or designing its control strategy is also possible by linking Flux to system level simulation tools. Different levels of interaction are possible, ranging from reduced model extraction to full co-simulation.
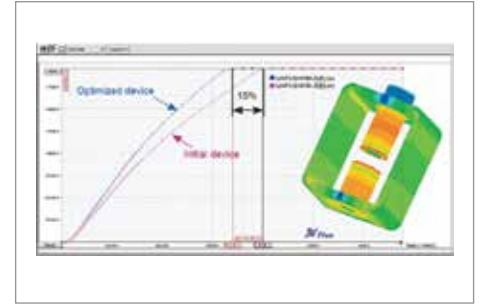
Flux density in an induction machine with Skew rotor
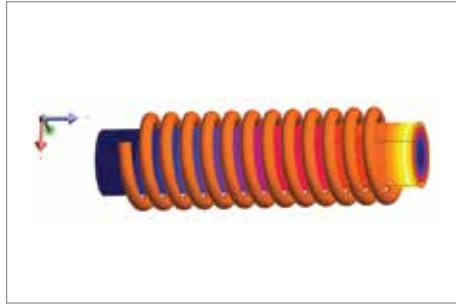
Flux induction heating application

15% gain on response time - Actuator response time optimization

Capabilities

A Wide Field of Use
- Magnetic, electric, and thermal fields
- Magnetic/dieletric/thermal coupling
- Mechanical coupling
- Multiphysics coupling
- Static, harmonic, and transient analysis
- Parameterized analysis
- External circuit connection

A powerful geometric description
- An easy sketcher of 2D geometry, including parametric capabilities
- Embedded 3D modeler with fully parametrized modeling constructs
- Advanced CAD import & export functions
- Defeaturing and simplification capabilities
- A dedicated environment for electric rotating machines designed in 2D and 3D

An Easy and Flexible Mesh Generator
The Flux® mesh generator provides different mesh types and meshing technologies that can be mixed in both 2D and 3D situations:
- Smart automatic mesh generation based on geometry & physics
- Fine manual control of mesh size and distribution
- Mapped mesh and linked mesh
- Auto-adaptive mesh refinement during solving in 2D & 3D

Advanced Modeling Techniques for Accurate and Fast Results:
- Infinite box for open boundary problems
- Non-meshed coils
- Thin regions represented by surface models
- Fast evaluation of geometry skewing effect
- Non-linear anisotropic material behavior
- Hysteresis modeling
- Skin and proximity losses in windings

Solving process: A fast and robust solver
Fully parametric solver allowing geometrical or physical parameter sweeps

- Several iterative or direct linear solvers with multiprocessing
- Robust non-linear solvers
- Distributed parametric studies across several cores or machines
- Auto-adaptive mesh and time-step parameter sweeps

Results Post-processing
Flux® gives access to various quantities such as:
- Electric and magnetic fields temperature
- Magnetic flux, inductances, energy
- Iron losses and Joule losses
- Position, velocity, force, torque, speed
- Skin effect visualization
- User defined quantities
- Maps, isovalues, and vector plots
- Animations
- 2D and 3D curves
- Spectral analysis
- Cutting planes
- Look up tables for system simulation
- Export capabilities (Excel, text, etc.)

Multiphysics

Flux provides fully cabled solutions to set up co-simulations and exports with specialized tools focusing primarily on magnetothermal and magneto-vibro-acoustics analysis.

Magneto Thermal Analysis
Coupling Flux's capabilities with CFD simulation tools like AcuSolve, CD-Adapco STAR-CCM+ or ANSYS Fluent makes results even more powerful by taking into account fluid dynamics and enhancing the accuracy of the thermal analysis. Efficient and accurate design is possible with Flux thanks to all the available thermal couplings!

Vibroacoustics Coupling to Reduce Noise and Vibration
Electromagnetic forces are the source of noise in electromagnetic structures.

Flux is able to accurately compute them with the addition of vibration analysis tools such as OptiStruct, LMS Virtual.Lab, MSC Nastran or ANSYS Mechanical.

Advanced system integration

Considering the component in its mechatronic environment is key to really optimizing its performance. Flux offers multiple couplings with system-level tools:
- Flux-Activate and Compose or MATLAB® Simulink for drive & control
- Flux-LMS Imagine.Lab Amesim for complex mechanical loads
- Flux-Portunus for mechatronic systems

Simulation Process Automation

Flux® allows the user to define its own macros and interfaces to simplify its work, from generating geometry through post-processing solution results by using command language derived from Java and Python object oriented languages. Thanks to its API, it can also be driven by any kind of software.

GOT-It optimization

Boost your Flux capabilities using GOT-It, a powerful and reliable optimizer, even without being an expert in optimization methods. Well adapted to drive FEM models, GOT-It goes beyond simple parametric studies, which allows for significant gains in your designs.

High Performance Computing (HPC) solutions

Affordability of computers with multiple processors or clusters now brings new possibilities to simulate many design configurations concurrently. The distribution of parametric calculations is directly available in Flux and can be used for any type of application.