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Flux

Data Sheet

Flux® is a Computer Aided Engineering package designed for electrical engineering. It is built around a solver, which calculates the electric, magnetic and thermal fields using the finite elements method.

It can be used to process the following applications:

- **Environment:** It includes a parameterised geometric descriptor, a mixed mesh generator, a circuit descriptor, a physical properties data entry, a parametric solver and a result analysis module.
- **Magneto Static:** Direct current, non linear soft magnetic materials, magnets.
- **Electric Conduction:** (Included with Magneto Static application) Conductors, potential and/or current fixed at the boundary, electrical conduction.
- **Steady state AC Magnetic:** Harmonic steady state, alternating current, non linear soft magnetic materials, conductors.
- **Transient Magnetic:** Transient states, time dependent currents, non linear soft magnetic materials, conductors, magnets. It can be initialized with a magneto-static computation.
- **Coupling with Circuit Equations:** Used with **Steady AC magnetic** and/or **Transient Magnetic** to describe external electrical circuits description regarding electricity supply, load or connection.
- **Rotating Motion:** Used with **Transient Magnetic** to describe motion of a part in rotation (rotating moving-airgap) as a rotor.
- **Translating Motion:** Used with **Transient Magnetic** to describe motion of a part in translation (linear moving-airgap) as in a plunger.
- **Free Motion:** Used with **Magneto Static** to describe a set of positions and directions of a part. This feature is available when both Rotating Motion and Translating Motion applications are present.
- **Skewed model for Rotating Machine:** Account for the skewing of the stator or rotor slots of rotating machines thanks to the model: 2D “n slices” (a 2D computation is done on every slice). The computations are lead from a 2D description. The creation of the “n slices” model is done automatically.
- **Electro Static:** Electric charge density (or fixed potential), dielectric materials.
- **Steady state AC Electric:** Harmonic steady state, non-perfect dielectric materials, applied alternating potential, high resistive dielectric materials.
- **Electrolysis:** Computation of magnetic field created by circulating currents, computation of corrosion currents.
- **Steady Thermal:** Density of power dissipated, materials with thermal conductivity, convection or radiation exchange coefficient at surfaces.
- **Transient Thermal:** Study of transient states, same source and material characteristics as for steady state thermal and materials with specific heat coefficient.
- **Magneto Thermal:** Coupling a **steady AC magnetic** study with a **transient thermal** study, all properties (magnetic, electric and thermal) depending on the temperature: induction heating.
- **Electric Conduction coupled to Transient Thermal:** Coupling an **electric conduction** study with a **transient thermal** study, all properties (electric and thermal) depending on the temperature: conduction heating.
- **Steady state AC Electric coupled to Transient Thermal:** Coupling a **steady AC electric** study with a **transient thermal** study, all properties (electric and thermal) depending on the temperature: heating through dielectric losses.
- **Superconductivity:** Supra model delivered as a material. **Transient magnetic** needed for its use.
- **Iron Losses (LS Model):** Advanced model for Hysteresis losses. Model requires to be used in old postprocessor.

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- **Flux to Portunus:** Co simulation between **Flux Transient Magnetic** in 2D and 3D including circuit coupling applications with Portunus. Motions can be also taken into account. Requires Flux and Portunus licenses.
- **Flux to Simulink:** Co simulation between **Flux 2D or 3D Transient Magnetic** and circuit coupling applications with SIMULINK. Motions can be also taken into account. Requires Flux and SIMULINK licenses.
- **Overlay:** The 4 Overlays below (BPM, IM, DCM and SRM) are included:
  - » **BPM Overlay**: Preprocessing overlay (geometry, mesh and windings) dedicated to Brushless Permanent Magnet machines. It includes as well the import of all corresponding parameters from a SPEED PC-BDC file.
  - » **IM Overlay**: Preprocessing overlay (geometry, mesh and windings) dedicated to Induction Machines. It includes as well the import of all corresponding parameters from a SPEED PC-IMD file.
  - » **DCM Overlay**: Preprocessing overlay (geometry, mesh and windings) dedicated to Direct Current Machines. It includes as well the import of all corresponding parameters from a SPEED PC-DCM file.
  - » **SRM Overlay**: Preprocessing overlay (geometry, mesh and windings) dedicated to Switch Reluctance Machines. It includes as well the import of all corresponding parameters from a SPEED PC-SRM file.
- **Multiphysics:** Allow to run a co-simulation with any other simulation software (based or not on the finite element method) in any physical domain (thermal analysis, fluidic, systems…). This can also be applied to the co-simulation of 2 applications in Flux.
- **Native translators:** Various separate readers or writers of native files are available:
  - » CATIA V5 Reader, CATIA V5 Writer
  - » Pro/Engineer Reader
  - » Inventor Reader
  - » SAT Acis Reader, SAT Acis Writer
  - » STEP Advanced Reader, STEP Advanced Writer
  - » IGES Advanced Reader, IGES Advanced Writer

Tools included in all configurations

Flux® includes an interactive environment within a preprocessing module (data descriptor) and a postprocessing module (display of results):

- » a **parameterised preprocessor**: automatic mesh generator capable to combine tetrahedral, brick, prismatic and pyramidal elements in 3D, triangles and rectangles elements in 2D ; CAD import (DXF; IGES; STEP); mesh import (UNV, PATRAN, NASTRAN, MED); material description module; physical properties, sources and boundary conditions descriptor
- » a **parametric solver** (geometric dimensions ; mesh size ; materials ; electrical circuits_)
- » a **post-processing** providing the numerical or graphic results which can be presented as isovalues and colour maps, curves of evolution with space or time, local and global values.

Flux® allows also the description of user-defined models of physical properties, sources and boundary conditions thanks to user subroutines. A Fortran compiler is needed to create these subroutines.

Different formulations are usable in 3D which allows to optimise the size of the problem. Surfacic regions are available as well to consider effects in thin volumes without to mesh their thickness. An “infinite” region is available to consider opened boundaries problems.

Flux® is a user-friendly software thanks to its permanent graphic interaction, controls and visualising tools. It is fully documented including the user’s guide (on-line and paper versions), tutorials, technical papers and examples.

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