Simcenter MAGNET

Engineering innovation with low frequency electromagnetic field simulations

Simcenter MAGNET offers the engineer the opportunity to replicate laboratory experiments for their device with virtual prototyping. Collecting performance data without physical prototyping allows the engineer to comfortably make the same critical value judgements for the features of the device and to produce a suitable design, but in a fraction of the time and cost.

Simcenter MAGNET™ uses the finite element technique for an accurate and quick solution of Maxwell's equations. It can simulate different types of electromagnetic and electric fields in both 2D and 3D.

Engineering challenges tackled with Simcenter MAGNET

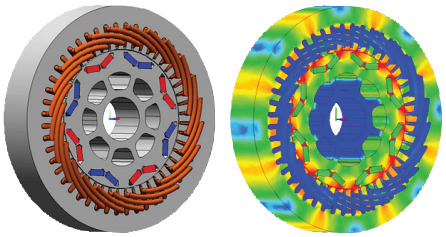
- Gain insight with realistic simulation in order to improve performance and efficiency of electromagnetic devices
- Nondestructive testing in the inspection industry that covers the manufacturing, mining, metals processing and other industries
- Design electromagnet devices for renewable, hybrid and conventional power grids
- Digital twins of electromagnetic devices for product life management

Features

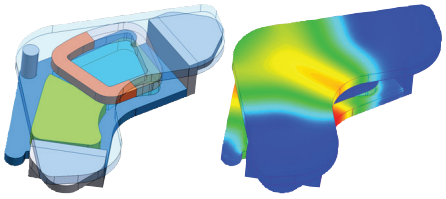
- Complete motion solver – arbitrary movements, such as in levitation problems, can be precisely simulated due to full freedom of movement of rigid bodies
- Smart Mesh for initial design verification, adaption and precision where needed in order to solve very large 3D field problems efficiently
- Maximizing mesh element quality to ensure stable and accurate solutions
- Automatically detects the current path and direction within the solids of interest
- Tight optimization-electro-thermal coupling
- Parametric modeling for ranging, tolerance or "what if?" analysis
- Demagnetization prediction for permanent magnets

Numerous design applications

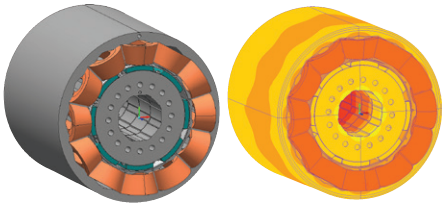
- Electric motors/generators
- Transformers
- Actuators
- Sensors/NDT
- Induction heating
- Loudspeakers
- Magnetic levitation
- MRI/medical
- Inductors



Traction motor



Voice coil actuator



Coupled thermal analysis

Transient or time-varying electro-magnetic fields

- Non-linear analysis
- Second-order time stepping
- Resume feature: pause at a particular time step for inspection
- Core losses, proximity effects and eddy currents
- Demagnetization prediction
- Motion
  - Supports rotational, linear and general (multiple degrees of freedom) motion
  - Velocity and load driven motion problems
  - Computes induced currents due to motion
  - Supports multiple moving components

AC or time harmonic electromagnetic fields

- Analysis based on a single sinusoidal frequency
- Eddy currents, displacement currents, skin effects and proximity effects

Magnetostatic fields

- Non-linear analysis
- Specified currents may flow through any type of conducting material, including magnetic materials

Electrical 2D/3D

Uses the finite element method to solve for the electric field strength, forces, capacitances and other quantities. Electrical can simulate static, AC and transient electric field and current flow problems.

Thermal 2D/3D

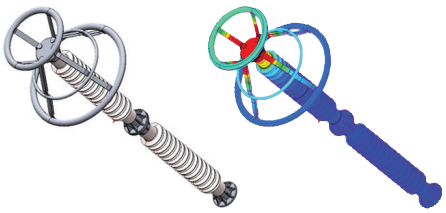
Geometry, materials and mesh details are all seamlessly exchanged between MAGNET for electromagnetic or electric fields. Coupling allows the materials to be updated based on local temperature distributions within each component. Solve for either the steady state or the time-varying temperature distributions caused by the conductor and magnetic losses. Various forced convection fluid cooling options can be added to the simulation to assess performance.

Object optimization

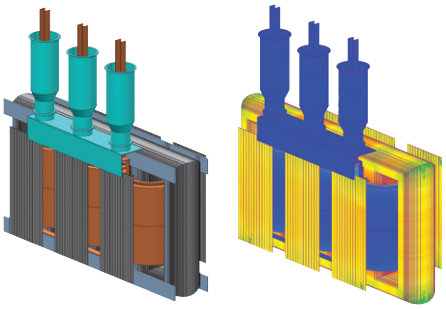
Automated design optimization option to Simcenter MAGNET; including Electrical 2D/3D and Thermal 2D/3D. Object optimization software can find optimal values for different design variables within a specified design space.

Advanced material modeling

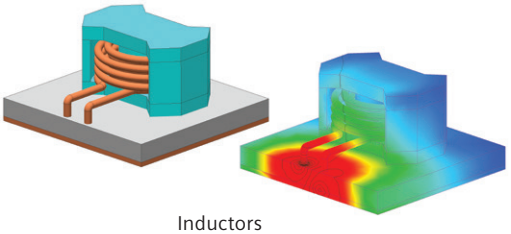
Accounts for nonlinearities, temperature dependencies, demagnetization of permanent magnets, hysteresis, anisotropy, and smart boundary conditions.



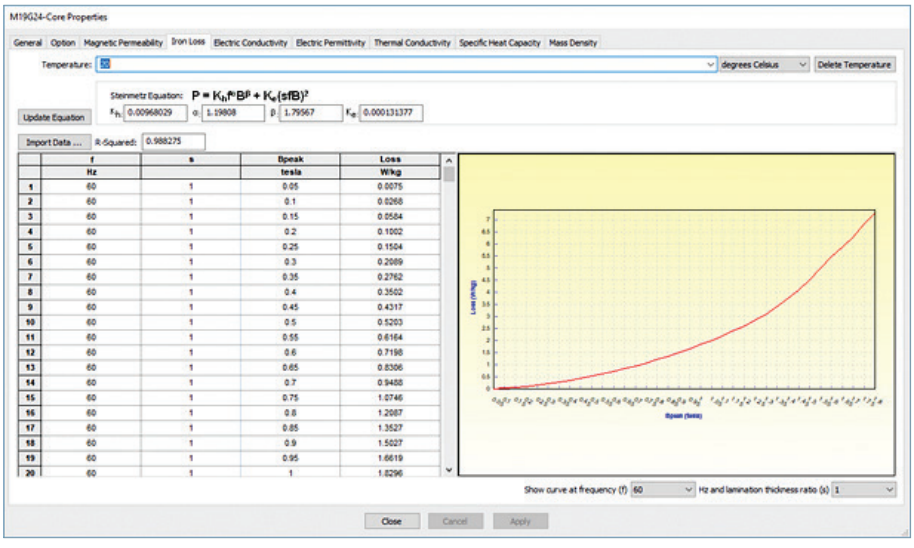
Electric field analysis



A 3-phase transformer



Inductors



Advanced material handling

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