Simcenter SPEED

Rapid electric machine design software

Simcenter SPEED offers a complete solution for electric machine design motoring and generating, covering a wide range of electric machines types

Simcenter™ SPEED includes all the necessary theoretical and physical models for a rapid e-machine design with a flexible approach. It combines the following methods to balance calculation speed and accuracy:

- Analytical methods for almost instantaneous results, making it attractive for those using design exploration programs (for example, HEEDS™ software) or performing what-if studies

- Quick and smart usage of 2D finite element (FE) magnetostatic analysis to more precisely model magnetic saturated regions

The Simcenter SPEED suite supports the following e-machine types in its various individual programs:

- **PC-BDC:** Synchronous machine; permanent magnet (PM) surface, PM bread-loaf, IPM, spoke PM, PM inset, reluctance, wound field, interior and exterior rotor, single-, 2-, 3- and multi-phase machines

- **PC-IMD:** Induction machine; all standard bar types, wound field, interior and exterior rotor, single-, 2-, 3-phase

- **PC-SRD:** Switched reluctance machine; all standard rotor types, interior and exterior

- **PC-DCM:** Brushed PM-direct current (DC) machines; all standard PM brushed rotor types

- **PC-WFC:** Wound-field commutator machines; all standard wound-field brushed rotor types

- **PC-AXM:** Axial flux machines; all standard PM axial flux rotor types along with claw-pole and double radial PM flux machines
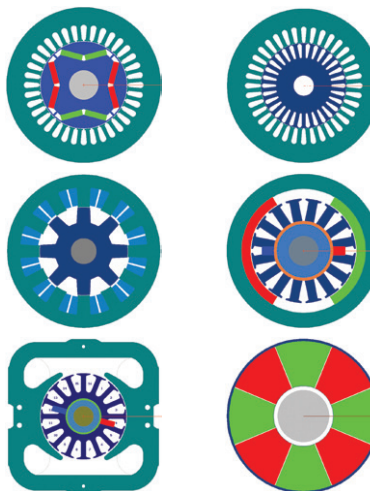

The radial or axial cross section of the machine is shown in the graphical **Outline editor** enabling interactive geometry modifications through the parameter list on the left side.
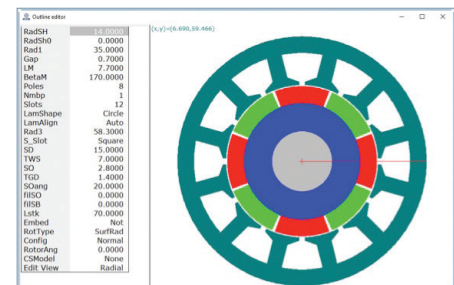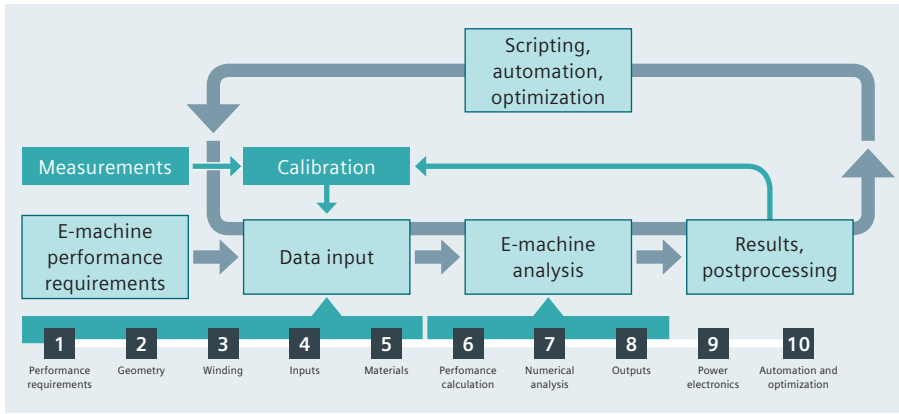

Material databases are available in SPEED including steel, magnet and brush data.

The **Winding editor** shows:

- Single and multiple phase coil distribution

- Magnetomotive force (MMF) waveform and its harmonics

- The Görges diagram

- The winding scheme and the wire distribution in the slot
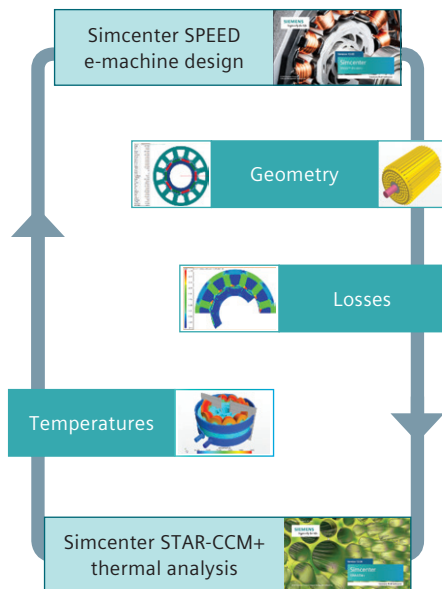

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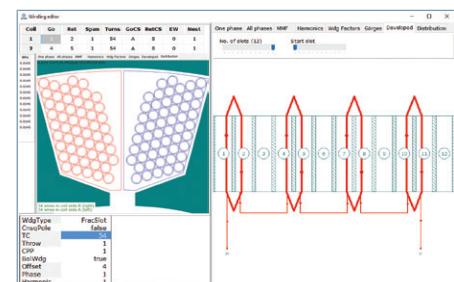
The workflow for Simcenter SPEED is straightforward from the electric machine performance requirements through data input and analysis until achieving the final results.

The **Template editor** collects all input parameters, whereas the **Design sheet** provides all the output data in numerical format and the various **Output graphs** visualize the results in a graphical manner, e.g. current, back EMF, torque or efficiency map (below).
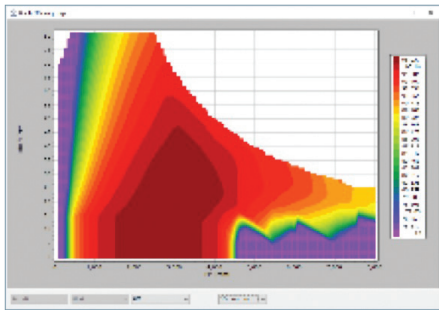

Simcenter SPEED links to several general-purpose 2D and 3D electromagnetic finite element solvers such as Simcenter STAR-CCM+™, Simcenter MAGNET or to the Simcenter SPEED dedicated 2D magnetostatic program, PC-FEA. These enable modeling and study of the electric machine more precisely if needed, for example in cases of high saturation, under fault conditions, and non-SPEED template based geometries.

In general, users can connect Simcenter SPEED with other tools required for the complete electric machine solution using various scripting or programming languages. More specifically, automation makes use of the scripting capabilities as driving Simcenter SPEED on its own or together with other programs, such as STAR-CCM+. This automated workflow follows the scripting approach and uses STAR-CCM+ and its multiphysics solvers for electromagnetic, thermal (full 3D conjugate heat transfer) and mechanical stress analysis along with Java scripts to provide and feed back additional information to Simcenter SPEED.

HEEDS is a powerful software package in the Simcenter portfolio that automates the design space exploration process. Simcenter SPEED provides a built-in graphical user interface to access HEEDS in two ways: as a full HEEDS installation and as an integrated add-on tool. In both cases, Simcenter SPEED is linked to HEEDS via a Python script using the generic facilities within HEEDS.
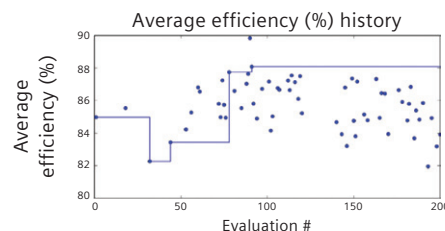
In many applications, the electric machine is embedded in a complex system that must be properly designed as well. Simcenter SPEED supports Simcenter Amesim™ software for system simulation by creating data files that can be exported from SPEED directly as:

- A simple linear parameter list or
- Flux linkage with iron loss 2D maps for the enhanced e-machine models within Simcenter Amesim
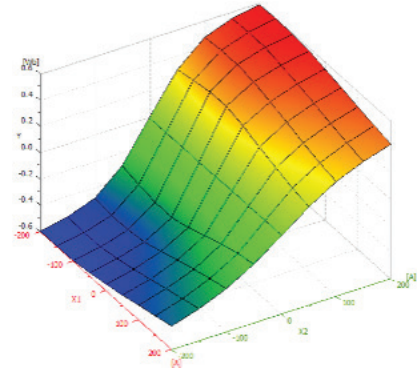
To learn more about Simcenter SPEED and its linking capabilities, request a web-based demo or trial copy of any of our Simcenter products.

Average efficiency (%) history