

# Motor-CAD & SPEED: 1<sup>st</sup> step to motor design before using Flux<sup>®</sup> Finite Elements advanced tool.

## Motor-CAD V7.1 Release. Julien Vayrette - CEDRAT.



**C**EDRAT is pleased to announce the release of Motor-CAD version 7.1 for thermal analysis of electric motors/machines and the optimization of motor cooling.

Motor-CAD enables motor designers to optimize their designs for energy efficiency and size and cost reduction, providing the crucial link between the electromagnetic design and thermal analysis of motors. It makes it quick and straightforward for non-heat-transfer-specialists to evaluate different cooling options during the design process for a wide range of machines. Motor-CAD allows quick and easy steady state and transient thermal analysis of electric machines. The development of Motor-CAD V7 was driven by user requirements. There are many new features that will be of interest to new and existing users of Motor-CAD.

### Motor-CAD V7.1 new features

Each subsystem can be represented with different mode levels.

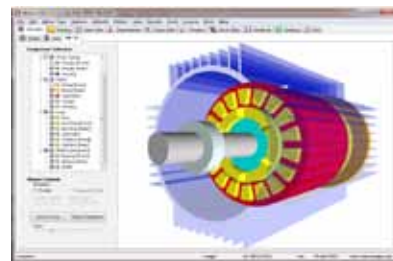
A range of new features has been added including:

- **Improved loss models** including Copper, Iron, Magnet, Proximity, Windage and Bearing loss models.
- **Flow visualization** for better understanding of machine cooling mechanisms.
- **Finite Element slot calculation** allowing accurate calibration of the slot thermal model.
- **Improved winding definition**, custom conductor placement and side-by-side or interleaved conductor positions.
- **Loss distribution model** allowing uneven copper losses to be specified for stall and fault conditions and in multiphase machines.
- **Validation interface** to allow the model results to be easily verified against test.
- **3D model view** for visualization of the machine.

### Improvements of existing features

In V7, other improvements have been made to take new user requirements into account:

- **New Geometries** - including rotor arc ducts, BPM spoke magnets and spider shaft.
- **Extra duty cycle starting options** added for machine components starting at different temperatures.
- **Blown over interface improvement** with examples given for different machine sizes.
- **Transient results saving and reload** allowing detailed analysis.
- **New cooling options** including linked cooling mechanisms, slot water jacket flow between conductors and variable rate endcap inlet flow.
- **Increased modeling** of internal radiation paths.
- **Improved interface gap user interface** with typical values given for surface contacts.
- **New linked parameter multiplier option** for sensitivity analysis.
- **Improved output data sheets.**



## SPEED new version. Julien Vayrette - CEDRAT.



**S**PEED software allows users to design electric machines such as **induction** motors (polyphase/1-phase); **brushless permanent-magnet** motors (square wave/sine wave); **DC brush** motors; **switched reluctance** motors; and **synchronous reluctance** motors. Many of the new features in SPEED are intended for generators as well.

The highlights of SPEED version 2011's new features are:

#### - Automotive (Hybrid & Electric Vehicles and Commercial, Industrial, Agricultural & Mining Special Vehicles)

SPEED's finite-element GoFER and embedded solver combined with comprehensive analytical models covering all aspects of the design of all these machines. Enhancements have been made to all aspects of design calculations, improving accuracy and covering an even wider range of machine geometry. The SPEED suite of programs is now structured to give seamless design capability over the entire range of permanent-magnet machines and alternatives including hybrid combinations.

#### - Refrigeration, Domestic Appliances & Water

Efficiency requirements are driving these industries towards continual technological evolution, in a context of extreme cost pressure and material supply issues. SPEED is used as the main design tool in several leading companies manufacturing compressors, washing-machine drive motors, pumps and fans worldwide. SPEED's ability to characterize products and not just concepts is one of its main assets in serving this sector. Improvements have been made in all programs in relation

to machine geometry, loss calculations, drive control.

#### - Aerospace

High power-density, high speed and fault tolerance are key requirements in aerospace applications.

Brushless PM machines and switched reluctance machines are the main technologies.

In both of these areas SPEED has new features improving the range of machine geometry, and the calculation of electromagnetic and thermal performance.

#### - Industrial

SPEED is behind the design of some of the world's most efficient AC variable-speed drives, using brushless SPM and IPM motor configurations. Not only in high-efficiency industrial drives, but also in precision servomotor systems. Special efforts have been made to extend SPEED into generators, with a new embedded finite element solver to cope with a wide variety of load specifications, and automatic calculation of generator characteristics for wound-field synchronous generators. The doubly-fed induction machine has been added to the range.

