MOTOR-CAD®

Thermal Optimisation of Motors

Motor-CAD is the most advanced motor design software specifically designed to simplify the complexity of 3D thermal analysis. Motor-CAD is fast and accurate and extensively validated with measurements and CFD computations. It is suitable for brushless permanent magnet, induction and switched reluctance motors analysis.

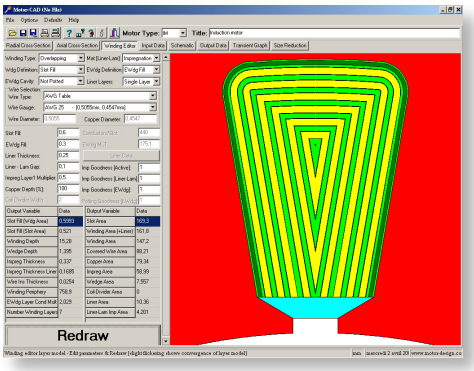
Fast and accurate analysis

The thermal models developed are based upon lumped-circuit analysis providing near instantaneous calculation speeds. The modules for each motor type feature efficient, accurate and robust mathematical algorithms for forced and natural convection, liquid cooling, radiation and conduction. An extensive library of proven laminar and turbulent convection correlations are used to give accurate models for all internal and external surfaces.

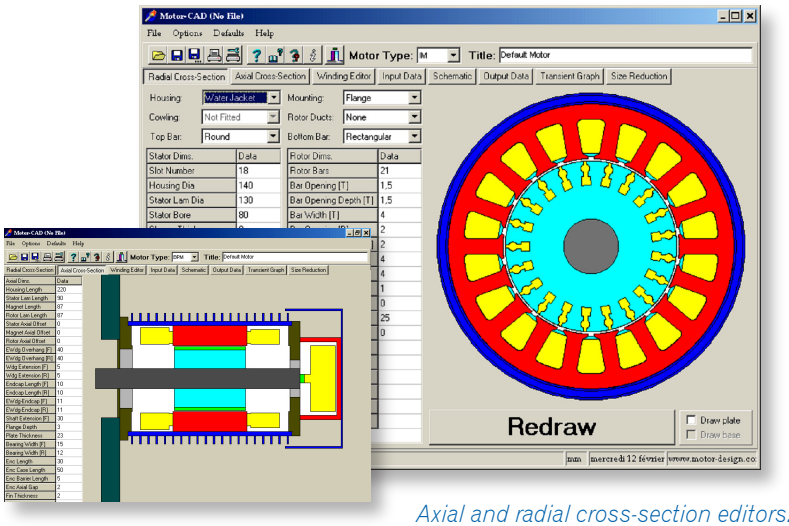
Easy data input

Motor-CAD features a clear and valuable visual feedback when inputting radial and axial cross-section data. It makes input error spotting easier and enables the user to view the preliminary concept for the initial design flaws. The user can also determine whether the motor is flange or foot mounted and whether a feedback device is fitted. Through ventilation ducts, cowling, axial or radial fins can also be modelled to improve the thermal performances of the motor.

The winding is automatically divided into several layers so that the temperature differential between inner and outer sections of the winding can be calculated. The layer details depend on the type of winding, slot-area, slot-fill/conductor-number and wire size used. Overlapping or non-overlapping winding types are modelled.



Winding editor (layer model).



Axial and radial cross-section editors.

WEB LINKS

Motor Miniaturisation

Energy efficiency

Cooling system optimisation

Transient duty cycle

Manufacture weak points identification

Robust design

Improved material selection

MOTOR-CAD®

Thermal Optimisation of Motors

WEB LINKS

3D calculation

Static and transient results

Clear graphical feedback

Multiple cooling methods

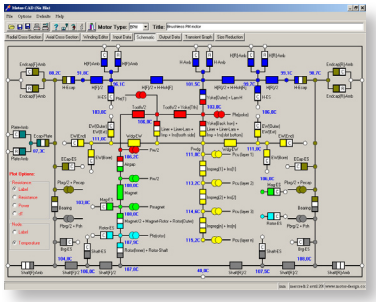
Various housing types

Multiple motor types

Instantaneous results

Efficient data output

For analysing the steady-state output data, Motor-CAD features a complete schematic output. The components are colour-coded, matching those shown in the cross-section editors. It enables a quick and efficient way to check, among other quantities, the temperatures, power dissipated and temperature drop for the static calculation.

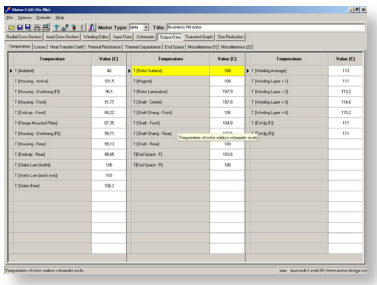


Schematic output.

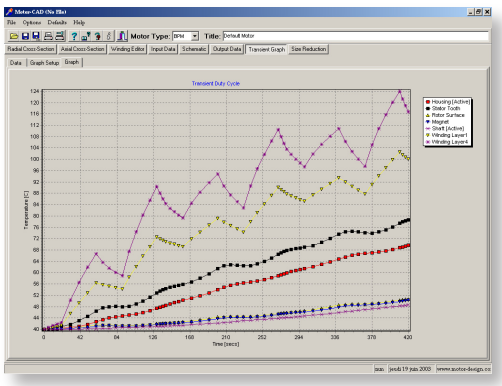
Alternatively, the user can view the output data in tabular form via a complete numerical output editor.
Finally, the thermal transient of the motor can be calculated and the output viewed as a graph or in tabular form. It is essential to carry out detailed thermal transient analysis when using complex duty-cycle loads if the motor is to be driven to its full potential.

Examples of use

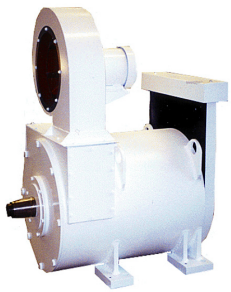
- Thermal design of a 1150 hp motor,
- Integrated hydraulic pumps motor design,
- Flight actuation motor with wet rotor cooling,
- Traction motor analysis.



Numerical output.



Transient duty-cycle analysis.



1150 hp motor designed with Motor-CAD (Courtesy of Mawdsley's Ltd, UK)

References

Thermal optimisation of motors is the priority of organisations such as:

Airscrew, Atlas Copco, Auxitrol Muirhead Aero', Delphi, Eaton Aerospace, Dupont de Nemours, Globe Motor, Norcroft Dynamic, Parker Hannifin, Picanol, Politecnico di Torino, Robert Bosch, Rolls Royce Aerospace, RPI, Schindler Lifts, Sew Eurodrive, Siemens, S2M, TRW Aerospace, University of Bristol, University of Glasgow, University of Nottingham, University of Oxford, Valeo, WEG…

Motor-CAD is developed by Motor Design Ltd, United Kingdom.

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