# Motor-CAD EMag

Combined 2D finite element environment and analytical algorithms for fast calculation of electromagnetic performance.

Quickly perform a range of electromagnetic performance tests on prototype designs with Motor-CAD EMag, including calculation of torque, power, losses, voltages, currents, inductances, flux linkages and forces. Input and optimize designs easily with the module's extensive range of parameterized templates and geometries.

Key Features
- Provides an extensive range of parameterized templates and geometries.
- Automatically sets up calculations for different performance tests.
- Enables calculation of torque, power, losses, voltages, currents, inductances, flux linkages and forces.
- Powered by embedded 2D transient or magnetostatic FEA solvers with meshing and boundary conditions automatically set up.
- Enables advanced calculations, such as eddy current in magnets, or induction machine rotor bars and calculation of AC winding losses.
- Offers DXF and scriptable geometries, custom current waveforms and multi-slice rotor skewing.
- Combined 2D finite element and analytical modelling approach means designs can be input and calculated in minutes, enabling users to account for complex electromagnetic effects early in the design process.
- Can integrate with Motor-CAD Therm to solve thermal calculations iteratively.
- Links to ANSYS Maxwell for detailed FEA analysis.
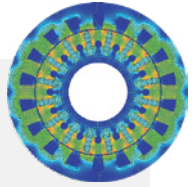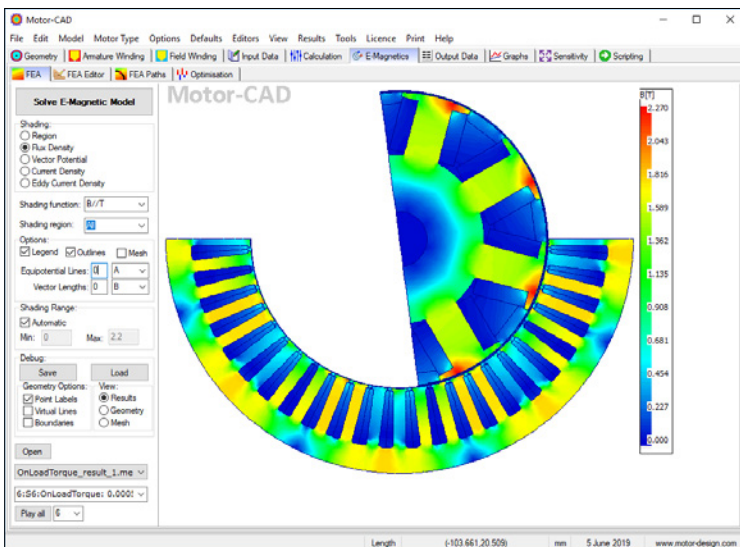
Workflow

STEP 1 | DEFINE YOUR MOTOR

Input Geometry
- Input geometry using the EMag parameterized template editor, where parameters —such as number of slots, number of poles and tooth width — can be specified.
- View and modify the geometry from a radial and axial perspective, draw the 3D geometry and easily export to other CAD packages.

Specify Winding
- Lay out coils using the EMag winding editor. Specify a custom winding pattern or allow EMag to automatically generate a winding pattern based on the specified number of phases, turns coil, coil pitch and layers.
- View the cross section of conductors in the slots.
- Define wires by slot fill factor or by wire dimensions, with an option to specify rectangular wire.

Input Materials Data
- Choose materials from our comprehensive materials database or specify your own material properties, such as B-H curves.

STEP 2 | CALCULATE RESULTS
- With the motor defined, choose from a range of performance tests, such as Back EMF, Cogging Torque and On Load Torque for BPM machines, or Single Load Point and Standard Tests (Locked Rotor, Synchronous Speed) for induction machines.
- Automatically mesh and handle boundary conditions and symmetry — you do not need in-depth knowledge of numerical simulation techniques to get highly accurate results.
- Couple with the Motor-CAD Therm module to solve thermal calculations iteratively.
- Export complete transient Maxwell design for detailed FE simulations.

STEP 3 | GENERATE OUTPUTS
- The EMag output tab displays numerical data calculated from the FEA solution, including voltages, inductances, torque ripple percentage, motor constants, short-circuit current and power factor.
- Loss components can also be analyzed, including DC and AC copper loss, magnet loss and iron loss.