About JMAG

JMAG is simulation software for electric device design and development. It accurately models the complex electromagnetic phenomena in a wide range of equipment.

Since being released in 1983, JMAG has been used in industries and universities world-wide and has contributed to the development of thousands of products. Continuous communication with our users has made JMAG a world class analysis tool.

It is our wish that JMAG continues to grow and develop with its users.
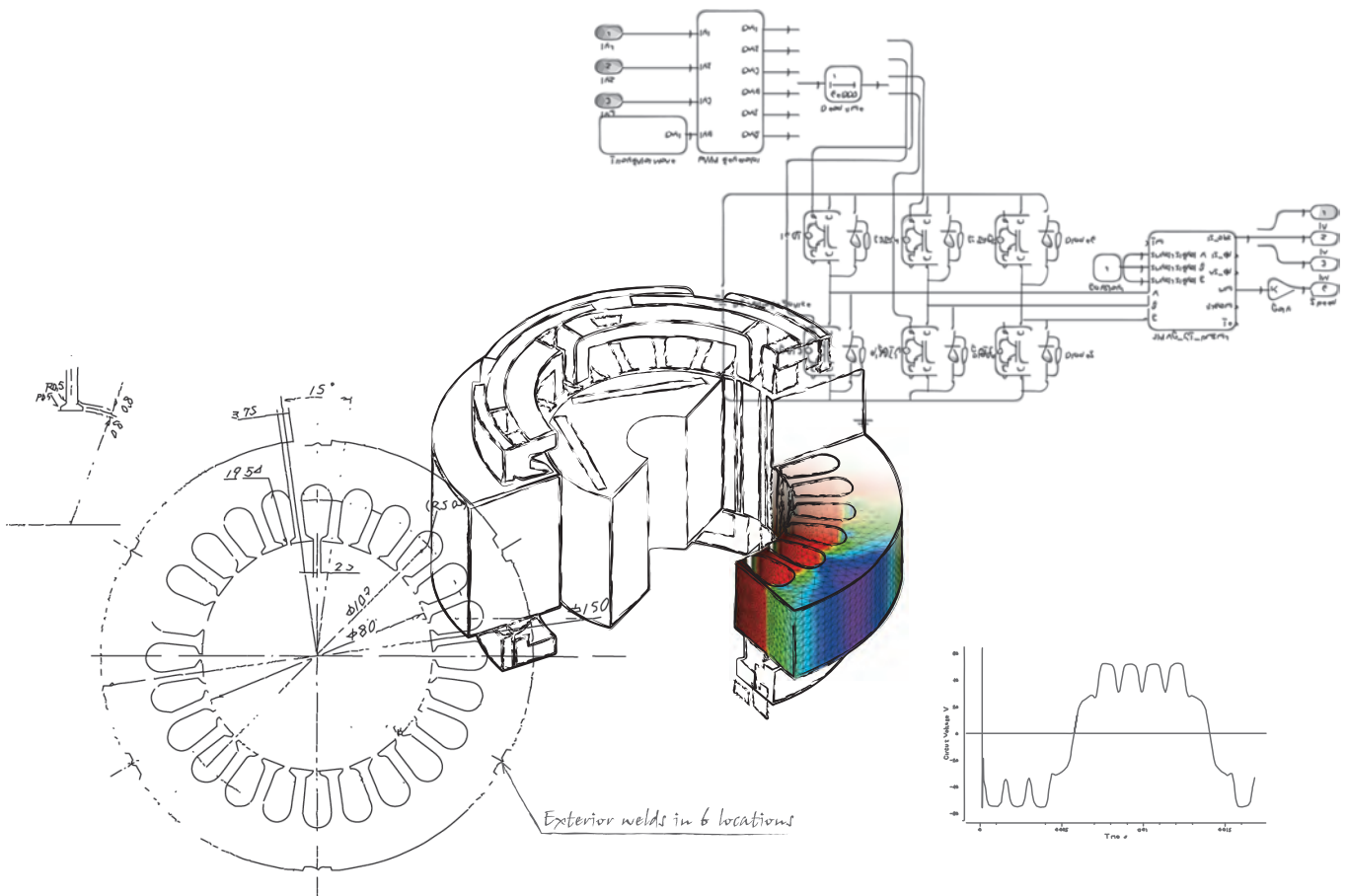
Applications

- Motors
- Generators
- Transformers
- Reactors
- Solenoids
- Actuators

etc.

Analysis Functions

- Magnetics
- Electrostatics
- Structural
- Thermal
- Multiphysics

Industries

- Automobiles
- Household appliances
- Digital equipment
- Factory automation
- Electrical equipment
- Educational institutions

Interface

- Major CAD systems
- Drive/control simulators
- Optimizers
- Other CAE tools

JMAG Advantages

Fast

JMAG is the fastest electromagnetic finite element analysis program available.

Incredible speed has facilitated analyses of large-scale models that were impossible before. This analysis speed allows you to accurately model complex phenomena as well as perform detailed parametric analyses with hundreds or even thousands of cases. Analysis time is reduced through a combination of better software operating on more powerful hardware. JSOL is constantly updating and improving its solvers as well as working with hardware manufactures to take advantage of the latest computational methods.

Accurate

JMAG is capable of analyzing and quantifying phenomena that were once only observable during real-world testing. Virtual modeling allows you to dig deeper into the phenomena and explore more detail about the design. Virtual testing can also eliminate design problems ahead of production, which can significantly reduce testing costs.

Through customer feedback and internal testing, JMAG's accuracy is constantly tested and challenged in some of the most demanding electromagnetic applications.

High-Productivity

Results obtained using a large-scale model and from a large volume of parametric calculations can be stably and reliably file transferred and imported, allowing stress-free evaluation of the results.

JMAG contributes to the efficiency of analysis work by improving the performance of a series of analysis workflows from geometry creation and condition settings to results evaluation.

Open Interface

The Electromagnetic Analysis domain is only one of many domains that customers work within. A typical device analysis includes everything from noise and vibration simulations to circuit and control models. Each analysis domain has multiple programs that can create simulations within that domain. JSOL recognizes that each user has preferences on what programs work best for their model. JSOL has built partnerships with many of the leading software analysis programs so that JMAG users can work with programs that they are most comfortable with. This freedom allows JMAG users to seek out the best possible results across multiple analysis programs.
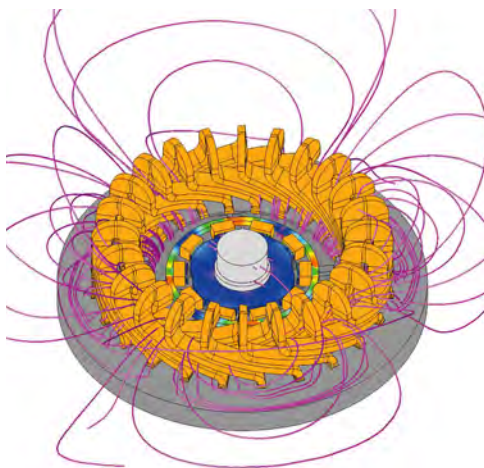
Solver

Solver speed is directly related to model accuracy and reliability. Finite element analysis comes down to solving very large matrices. JSOL has developed advanced techniques to solve these matrices faster and produce more consistent results.
JMAG users have some of the most advanced solver algorithms at their fingertips, and can be certain that JSOL will continue to adopt the latest calculation architecture within JMAG.

Parallel Computing

High speed processing and scalability are the two main goals of parallel processing. JMAG supports both shared and distributed memory processing and can incorporate the graphics processing unit (GPU) into calculations.
From the desktop to clusters and cloud computing, JMAG's parallelization technologies can be used in a wide range of environments. Utilizing these architectures means that analyses with over 10 million elements as well as models with hundreds of thousands of elements can be incorporated into a design cycle.

Resolver analysis

While resolver analyses taking into account leakage flux from the motor is required for its reliable design, the simulation model tends to be large. This particular case requires 35 million elements.
The JMAG's massively parallelized solver using 512 cores realizes approximately 125 times speedup compared with the non-parallelized calculation.

Convergence Acceleration

JMAG uses highly-effective iterative calculation methods for the linear and non-linear solver. Cutting-edge acceleration technologies are continuously incorporated to obtain excellent convergence in all applications.
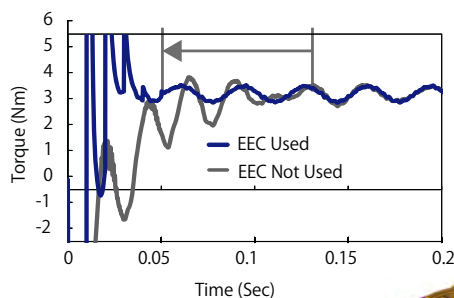
Time period correction method (EEC)

The graph shows the torque history of an induction motor. In an analysis model where time constant will be long due to the effects of inductance and eddy current, it will take time to reach a steady state. It is commonly known that EEC is effective in time reduction. JMAG's EEC makes effective use of the characteristics of magnetic field analysis and on top of the enhancements for the conventional EEC, time has been reduced for a wide model to reach the steady state.
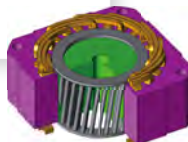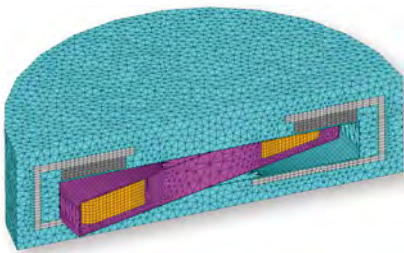
Mesh

It goes without saying that a high quality mesh is critical for a high precision analysis. JMAG gives users several options to create mesh: from automatic to manual mesh, users can choose the method that works best for them. The mesher within JMAG is both advanced and easy to use, which means that JMAG can generate optimal mesh for every type of analysis. We strive to develop automatic mesh generation technology by leveraging more than 30 years of FEA expertise and utilizing JMAG's unique geometry recognition technology.

Adaptation Technology for Mesh Generation

Every model's mesh is unique; JMAG must be able to recognize the different components and determine what type of calculation will work best. For example, current flowing in a magnet will alter the magnetic field and the necessary calculation method is different than if the magnet has no internal currents. JMAG allows for mesh generation that offers superior, efficient convergence by meeting these needs.

Misaligned slide mesh

A misaligned slide mesh allows analysis of various CAD and mesh models because it can tolerate mesh misalignment on the slide interface.
For example, even for an axial flux motor since there is no need to regenerate mesh at each step and since the solver performs interpolation between mismatched meshes, speed-up using MPP can be expected.

Geometry Recognition

A firm understanding of model geometry characteristics is required to generate optimum mesh. JMAG has unique technology which allows it to recognize critical aspects of a CAD model. By knowing what type of geometry is being modeled, JMAG can help speed up the model setup.

Noise Canceling

Mesh noise (discretization errors) degrades the accuracy of an analysis. JSOL works hard developing technologies to suppress mesh noise. This technology has allowed JMAG to achieve an even higher degree of precision and reliability.
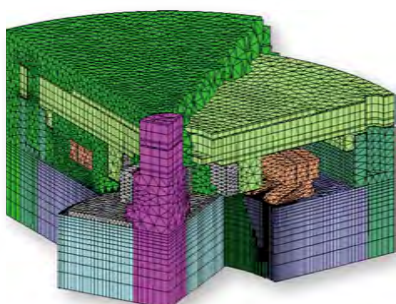
Rotating machine mesh

This figure shows a mesh for stray loss calculation for an IPM motor with an attached housing. With the geometry recognition technology, the number of elements is drastically reduced by generating the extruded mesh for both stacked stator and rotor core parts. For the coil end part, tetrahedral mesh is used but mesh is smoothly connected to the other parts. The housing has the thin layered mesh to represent for the eddy current. The gap part has the mesh highly controlled as regular grid reducing the numerical noise.

Modeling

Providing highly a reliable analysis requires faithfully implementing realistic physical mechanisms into simulation models as best as possible. We continue to develop modeling technology for JMAG to provide the best models at each stage, from micro behavior inside materials, to multi-physics phenomenon and control systems.
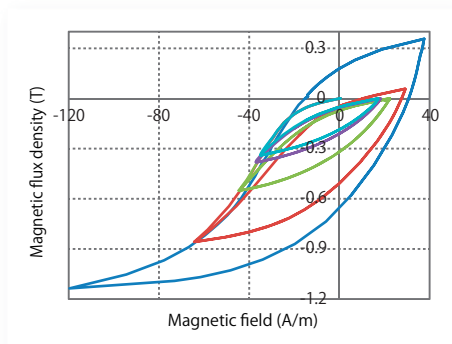
Material Database

JSOL has developed partnerships with material manufacturers to obtain the best possible data for JMAG's material database. Along with including stress dependent magnetic properties and iron loss properties of electromagnetic steel sheets, we also continue work with our partners to provide data needed in advanced analyses.
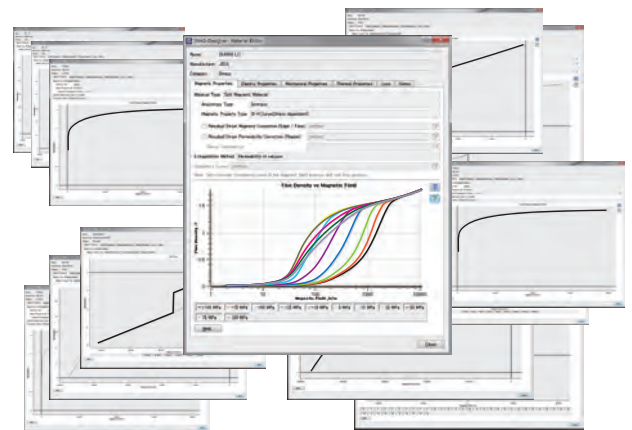
Material database with about 745 items of materials

Modeling Materials

JMAG leads the field in material modeling technology. Fast, detailed modeling methods are developed based on our understanding of characteristics for magnetic steel sheets, magnets, and powdered metals. Many companies use JMAG to help develop new materials, which ensures JMAG is always capable of capturing precise material responses.


Hysteresis modeling

JMAG performs accurate simulation accounting for both hysteresis including the minor loop and the eddy current inside the magnetic steel sheet. JMAG's highly-accurate material data needed in the calculation can also use data measured by the user.

Coercive force distribution

Dysprosium (Dy) diffused magnets can reduce Dy while increasing demagnetization heat resistance by distributing coercive force appropriately. JMAG can simulate these effects. For the case of uniform coercive force for IPM motors, a strong reverse magnetic field is caused on the magnet ends which result in demagnetization (left). By effectively distributing coercive force, demagnetization can be controlled (rigth).
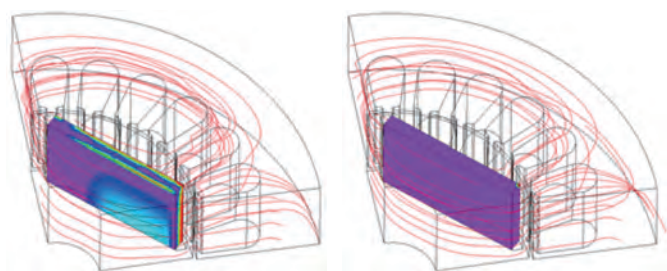
Uniform Coercive Force Magnet   Distributed Coercive Force Magnet

Demagnetization Ratio Distribution

Multiphysics

As computational power has increased, companies have started incorporating multiphysics models into their analyses. JMAG began offering this functionality to its users in 1994, when magnetic field/thermal coupled analysis functionality was implemented for induction heating device design. Since then, a considerable amount of development has taken place in the area of multiphysics.

With such a large variety of analysis domains and the complexity of modeling within each domain, JSOL has formed partnerships with CAE vendors in each analysis field with the goal of providing an easy to use platform from which to embark on multiphysics modeling.

High-frequency induction hardening of a gear

This is an example of high-frequency induction hardening of a gear. Heat is generated as eddy current is induced near the skin of the gear due to harmonic currents of the heating coil. Heat generation acquired through eddy current analysis is passed on to the element face of the thermal analysis model as heat source of the surface, after it has been integrated in the thickness direction. By using the conversion function from volume data to surface data, eddy current accounts for the skin effect and also avoids unnecessary mesh divisions near the surface for thermal analysis. As a result, the analysis has become more efficient.

Joule loss density
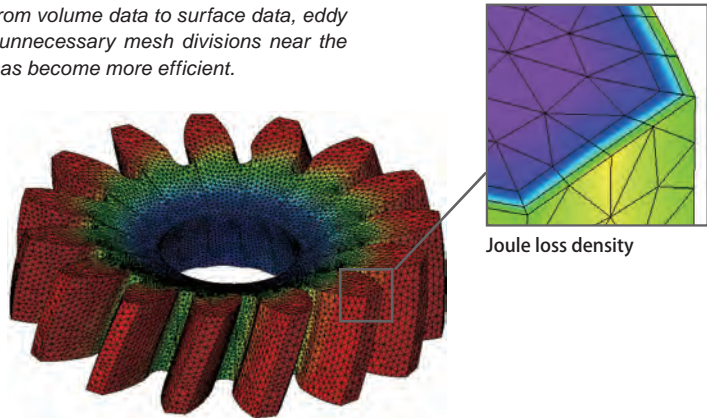
Deformation and temperature distribution
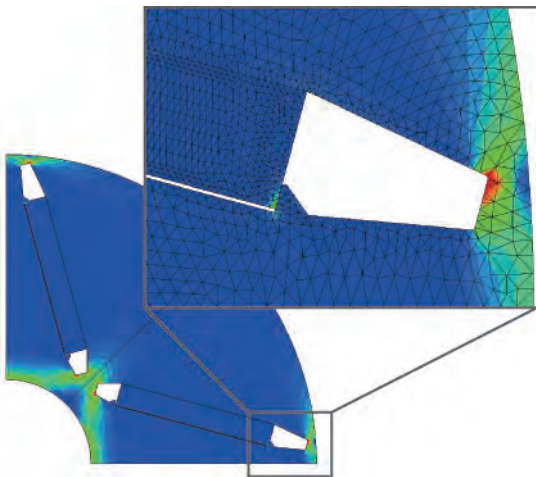
Nonlinear structural analysis

With the movement of IPM motor centrifugal force, the permanent magnet pushes on the stopper by dislocating from the tangent direction with the rotor core and friction as an intermediately, resulting in stress largely generating in the bridge part near the vicinity of the gap. Stress accounting for material nonlinearity is evaluated to achieve plastic regions locally.
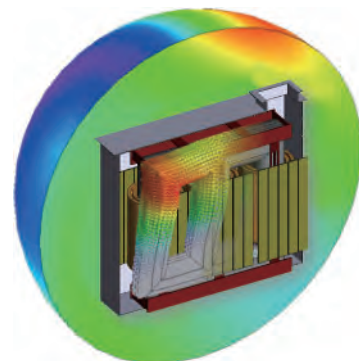
Magnetostriction vibration

Magnetostriction is one of the major sources of vibration and noise. This example visualizes vibration induced in a large transformer as well as sound pressure distribution in the surrounding area (on the sphere) based on magnetorestriction distribution results.

JMAG Solutions

JMAG provides solutions that are most suitable for each application and brings design and development to a higher level.

Induction Heating

JMAG accurately simulates and visualizes the intricate changes inherent in induction heating phenomena. Eddy currents flowing through surfaces can be obtained with high accuracy, allowing for the generation of high-quality skin mesh in work pieces. Detailed thermal management can be achieved by showing a visualization of the flow of eddy currents.

High-frequency induction hardening of a gear

This analysis verifies that temperature rises on the surface of the gears for both depth and timing as expected. The temperature distribution is predicted with accuracy through accurate eddy current distribution and magnetizing properties of temperature dependency.

An efficient analysis is achieved by mapping distributed losses in skin depth to the surface of a thermal model.
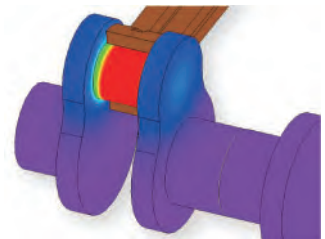

Power Transformers

JMAG reproduces the abnormal phenomena that occurs during the operation of power transformers. This allows for analyzing causes and the conceptualization of countermeasures. By using thin shell mesh technology to generate layered mesh while reducing the number of elements, it is possible to capture the stray loss that occurs within the housing at a high accuracy. Analyzing complex phenomena allows you to create designs that you can trust.

Stray loss in the Iron core

The following illustration shows the loss distribution of the iron core in a short circuit test. It can be observed that the leakage flux from the coil end enters perpendicularly to the plane of the steel sheet resulting in eddy currents generated on its surface. This leakage flux causes local heat generation during operation. By applying anisotropy to magnetic properties and electric conductivity, the behavior of magnetic flux and eddy currents in the laminated iron core can be correctly captured.
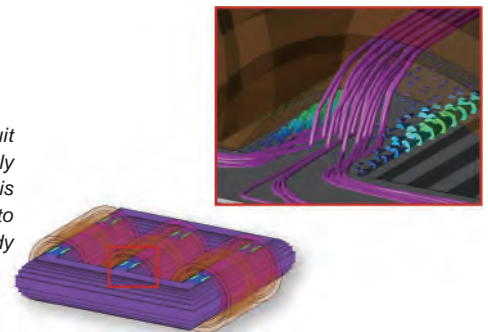
Solenoids

JMAG can optimize solenoid designs to maximize force while minimizing volume. This type of problem typically requires realistic drive excitation. To accomplish this, JMAG can create high-fidelity solenoid models that can then be exported to control/circuit simulation programs. By using a precise plant model (JMAG-RT model), you can now apply more realistic excitations to circuits.

Detailed analysis of solenoid valves

This case study shows the electromagnetic force vector applied to the plunger when the valve is closed and the flow speed contour of the path in the valve.

As the plunger is attracted by electromagnetic force and the distance with the yoke becomes closer, the phenomenon of flow speed up is accurately simulated. By coupling and solving fluid force with the motion equation, in addition to electromagnetic force and spring force, we have simulated nonlinear response characteristics in detail.
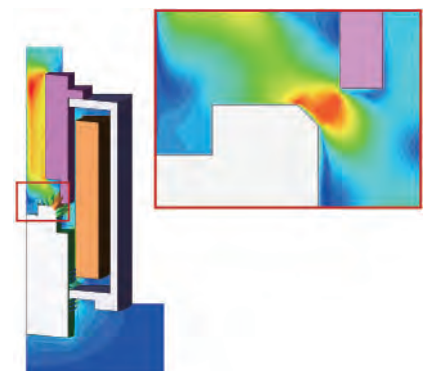
Linear Motors

JMAG is capable of analyzing not only of evaluating rotor thrust and cogging force, but can also perform analyses of the magnetic force distribution that works on the tips of the stator teeth. A proper grasp of thrust and ripple allows investigations into high precision positioning control to be carried out.

Electromagnetic-force analysis

A harmonic analysis of the torque waveforms will help identify the optimal magnet skew. An appropriate skew angle will reduce cogging torque by 50% or more while maintaining the same thrust force. Reducing cogging torque will drastically reduce the amount of noise that the machine generates.
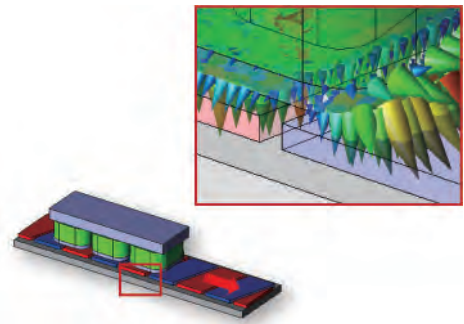
Power Converters

There are a variety of investigations that are possible in a power converter design. JMAG can simulate both winding and iron losses including the harmonic effects of the drive circuit. This can also be extended to losses generated under surge or fault conditions. With the loss distribution, it is then possible to calculate the temperature rise and include these effects in the thermal analysis.

The twist effect of a litz wire

In this transformer example, a ferrite core was modeled with gap in order to keep flux density below 0.3T. Leakage flux will form around this gap and penetrate the coils in close proximity. This leakage flux induces losses that can be reduced by changing the winding to Litz wire. Using Litz wire reduces the copper losses by 20% by reducing the effects of the leakage flux.
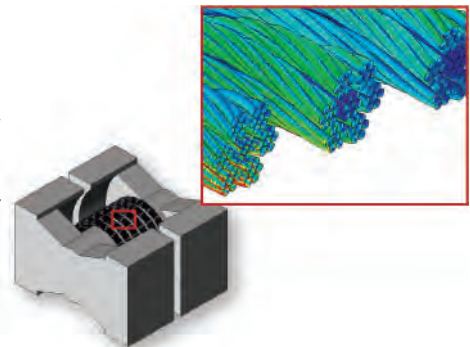
Wireless Power Transfer

JMAG makes it possible to carry out investigations ranging from basic RLC analyses to efficiency predictions. To determine the efficiency of a wireless power transfer design, you must analyze the power transfer as a function of position and angle. This can be done quickly in JMAG using the parametric analysis tool. This tool will not only predict optimal positioning, but it will also help develop a robust and reliable design.

Power transmission efficiency

In the electromagnetic induction-type wireless power supply, magnetic flux linking to the upper power-receiving side reduces due to positional misalignment.
A decrease in flux linkage causes a reduction in the mutual inductance between coils. From this the resonant frequency determined by the inductance and the capacitor is shifted, and transmission efficiency decreases. Also, when the voltage of the power-receiving side coil is constant, the input voltage on the power supply side changes, and the supply power itself reduces.

Model-Based Development
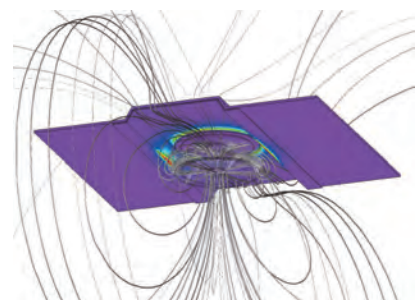
MBD Proposed by JMAG

We propose a workflow based on simulation for model-based development.
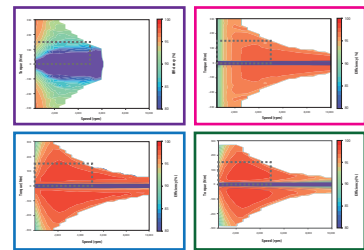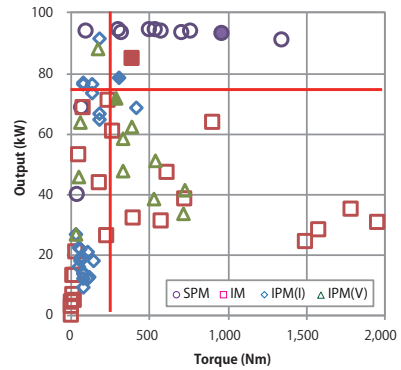**In order to achieve not only high performance for a component but also high integration within a system, the process from system and component design, to prototyping and performance evaluation, to system verification is continually repeated.**

A large design space based on system requirements is searched quickly and completely.

System Design

事例協力：Gamma Technologies

Battery   Inverter_Motor   Vehicle

Motor Basic Design

Parametric analysis is performed while changing the motor type, the number of poles, the number of slots, the number of turns, and the rotor diameter to evaluate the maximum output and maximum torque and narrow down the design candidates.

Evaluating Electric Efficiency During Run Time

Electric efficiency and battery run distance are evaluated by performing run simulations that include EV modes on motors that are narrowed down to their basic designs.

Component Design

From a wide range of characteristics being observed with parametric analysis, an optimum specific motor geometry and configuration are determined.

Ld   Lq

Torque   Flux linkage

Control Design Motor Characteristics

Magnetic saturation is fed to a control simulator and motor characteristics such as inductance, flux linkage, and torque, all three accounting for spatial harmonics, are output.

Rotor Geometry Optimization

Magnet size and positions are determined to maximize torque and minimize iron loss within an assumed operating region.

Point A
24
77 203 218
2,293

Point B
24
21
65
91
13

Point C
109 90
813
601
711

Point D
180
97
276 1,022
855

Efficiency (%)
98
97
96
95
94
93
92
91
90

Torque (Nm)
300
200
100
0
-100
-200
-300

Speed (rpm)
1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

■ Iron loss
■ AC copper loss
■ DC copper loss
■ Eddy current loss in magnet
■ Mechanical loss

Press ring

Magnet

Rotor core

Stator core

Coil end

Magnetic flux frequency
component and
loss density distribution

Evaluation with Efficiency Maps

Motors are created virtually and efficiency maps are produced that include detailed geometry, detailed iron loss, magnet loss, and AC loss, which were not considered in the basic design. Evaluate both motor and generator modes and analyze the loss breakdown at each operating point.

Using the latest simulation technology at present using HPC (high performance computing), virtual prototyping on computers is performed accurately modeling actual machines.
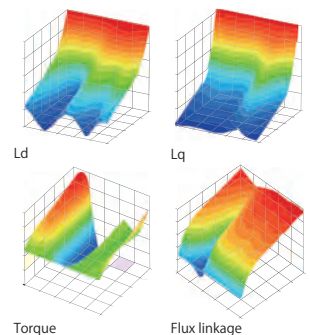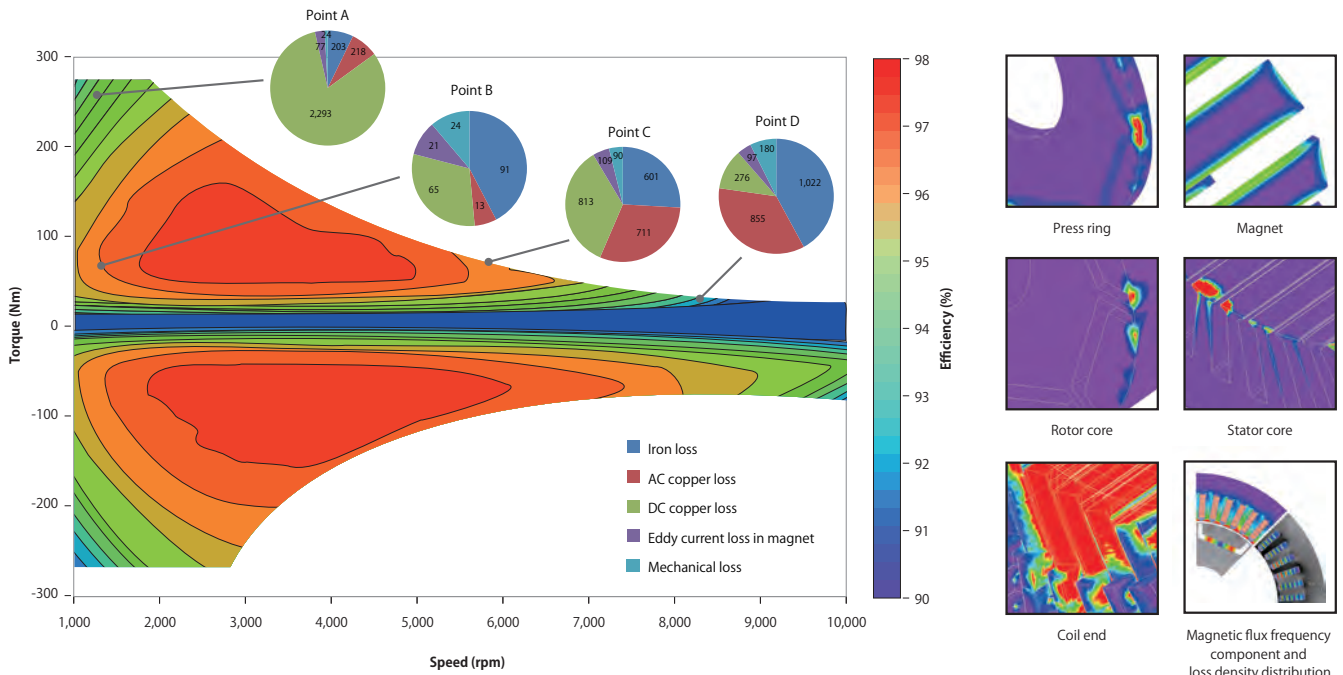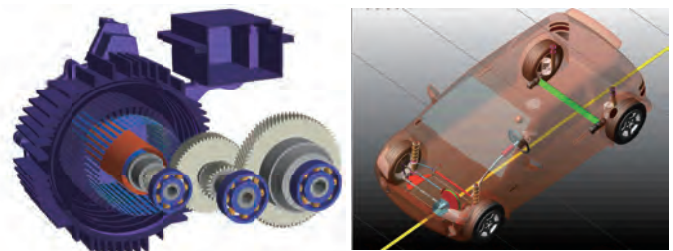
Virtual Prototyping

Vibration Evaluation

Vibration that did not cause any issues with the motor alone also has its behaviour changed by the construction of the system. Electromagnetic force distribution is linked to an NVH simulator to perform verification at a high accuracy.

Example provided in cooperation with:
Romax Technology, MSC Software Corporation
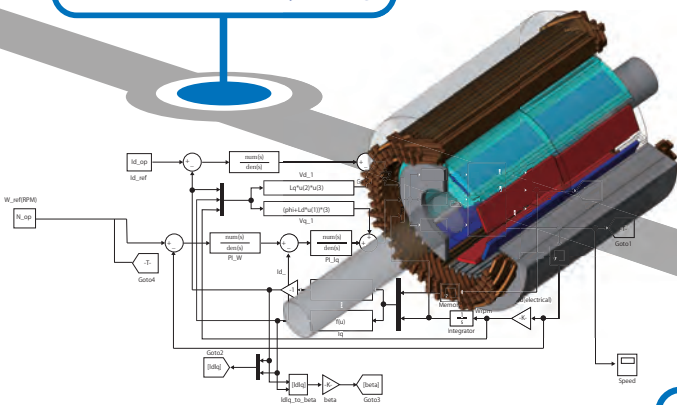
Using a highly accurate model, whether system requirements have been met are checked in detail.

System Verification

Performance Evaluation

Together with the distributions of the magnetic field, loss, temperature, and forces internal to the motor that cannot be checked with a real motor being checked, the performance over a wide range of operating conditions is checked giving ideas for improvement.

Torque (Nm)
200
150
100
50
0

Interruption   Command torque

0   0.2   0.4   0.6   0.8   1
Time (sec)

— JMAG-RT   — Ld/Lq   • JMAG-FEA
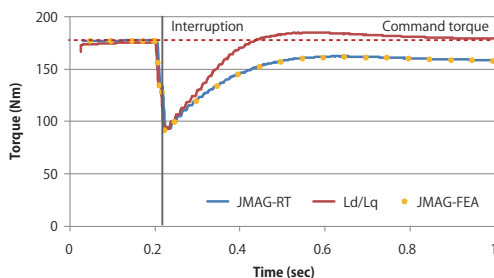
Failure Detection Verification of a Motor ECU using JMAG-RT

By using a high accuracy JMAG-RT motor model, failure detection verification of a motor ECU can be performed, and torque behavior at the time of circuit failure can be reproduced with the same accuracy as with using 3D FEA.

JMAG's Motor Solutions

Electric machines must satisfy a wide range of requirements. JMAG has what it takes to achieve these goals, enabling virtual design, production and evaluation of electric machines quickly, easily and in detail.

JMAG delivers the high accuracy evaluation of iron loss down to 1% efficiency needed for hybrid electric vehicles (HV) and full electric vehicles (EV). Actual motor design, production and evaluation can be easily conducted virtually with instant and accurate results.

Torque waveform

Cogging torque

Eigenmode

Electromagnetic force distribution

Stray loss

Copper loss map

Efficiency map

Iron loss map

Iron loss harmonic analysis
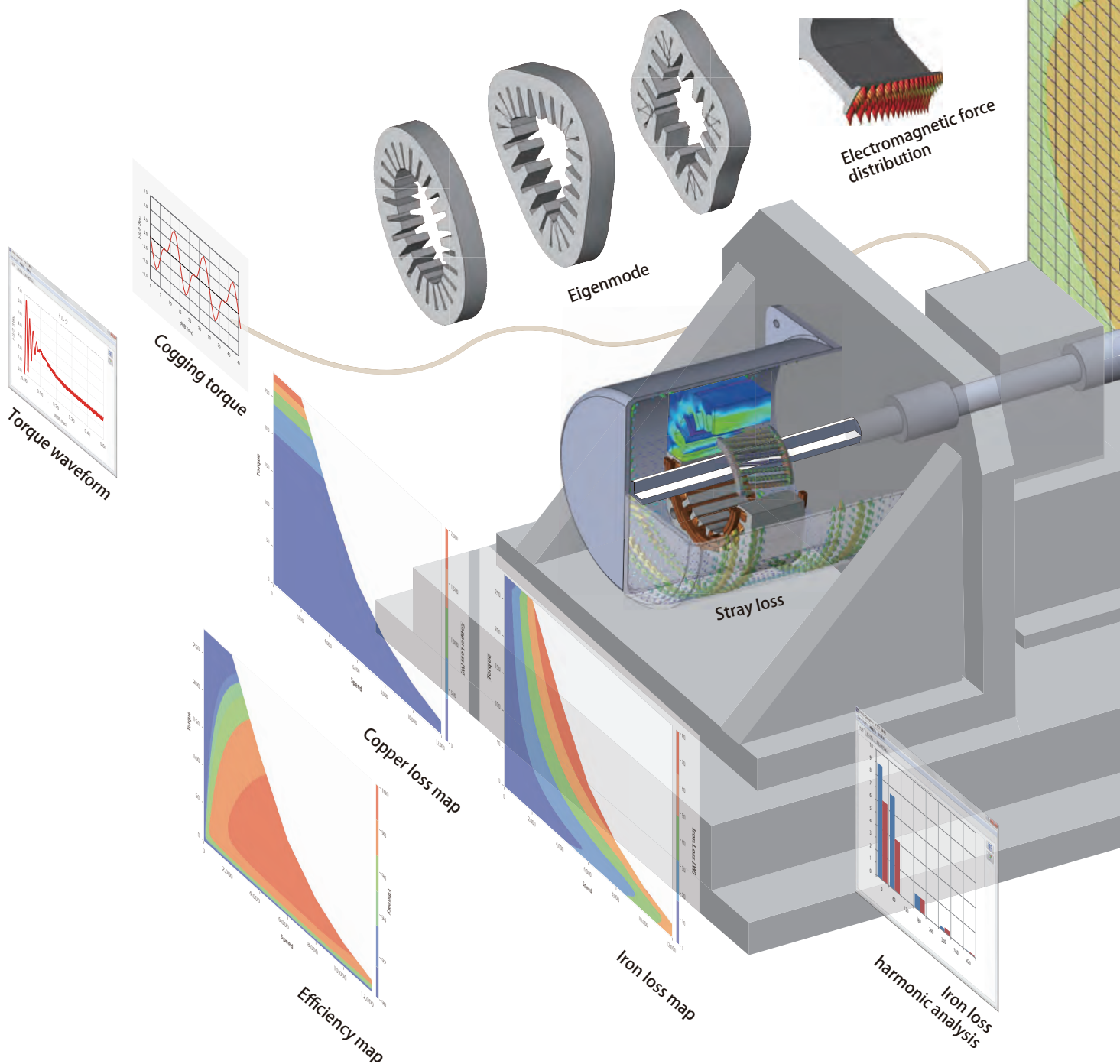
- Initial design evaluation
  Motor templates and CAD link, as well as motor design evaluation with the help
  of the property extraction function, can be done with simple steps.
- Modeling
  Geometry: Accurately simulates complicated design such as laminated steel sheets with the editor function
  Materials: Models material properties in detail such as magnets that have gone through thermal demagnetization
  Mesh: Generates high quality mesh recognizing the symmetry of the geometry
- Analysis
  Rich in analysis functions vital for motor designers, such as a function to render efficiency maps instantly
  by specifying a control method.

Three dimensional flux lines

Sound pressure level

Ld

Lq

Eddy current distribution in lamination

Magnetic flux density distribution

Temperature distribution

Control circuit Inverter circuit

Press-ring eddy current distribution

Permeance coefficient distribution

Segmented magnet

Temperature distribution in a magnet

Temperature variation

Stress distribution

Iron loss distribution

Flux lines

Magnetic flux distribution

Distribution of magnetic flux in gap

Centrifugal force of rotor

Loss distribution in the coil

Electric field between the core and the coil

Current waveform

Induced voltage waveform

13

Optimization

In order to express the design automization of electrical appliances, from concept to detailed designs, a seamlessly usable framework is required.

JMAG is capable of making practical use of not just parametric optimization, but topology optimization also, in addition to multi-purpose optimization functions as well as single-purpose optimization functions.

IPM motor topology optimization

Obtain IPM motor magnetic circuits to maximize average torque and minimize torque ripple using stress during centrifugal force analyses as control conditions. In the bridge part, the magnetic circuit which leaves a width capable of enduring stress is obtained, maximizing magnetic energy.
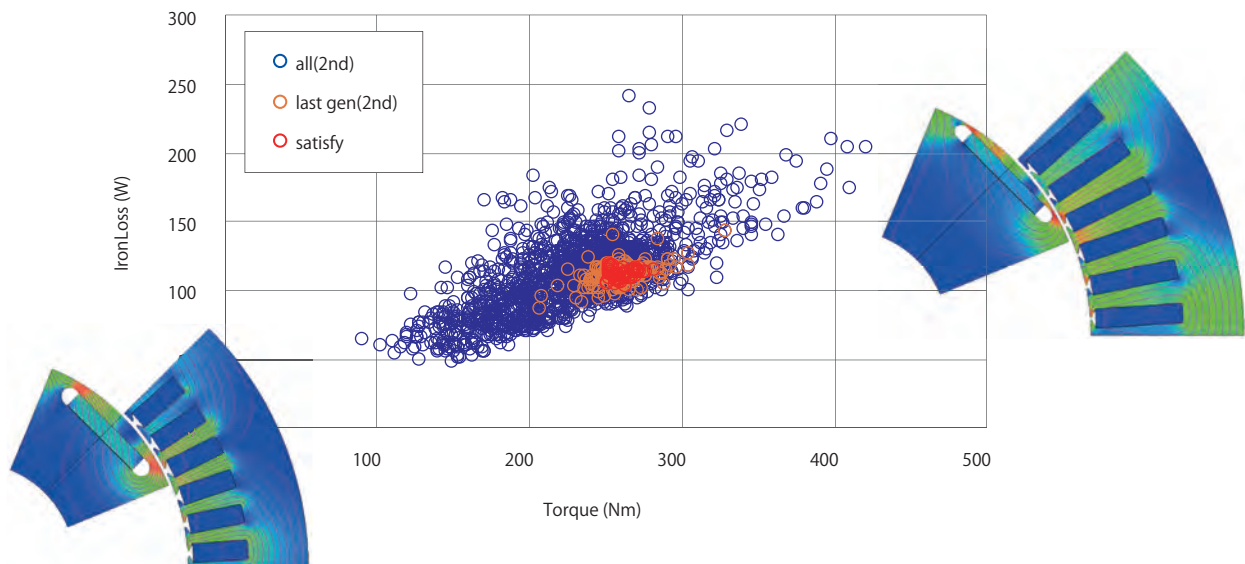
Multi-objective optimization

IPM motor multi-objective optimization is performed with low speeds to high speeds, low loads to high loads, average torque maximization and torque ripple minimization in addition to stress during centrifugal force analysis accounted for as iron loss and constraints at each rotation speed. In order to increase average torque, the magnet is positioned on the gap side, and by modifying the geometry of the slot opening, a magnetic circuit designed to reduce torque ripple and iron loss is obtained.

JMAG's Proposed Model Based Development

JMAG-RT enables model based development with high concurrency, allowing plant design and control design to be performed concurrently. JMAG-RT is a system which generates high-fidelity plant models (JMAG-RT models) in a system level simulation from FEA models. From system design, to ECU verification using HILS, JMAG-RT has a wide range of uses.

Features

- Using a virtual device model in HILS means that it is possible to test the ECU while the device is still under construction. This can reduce the amount of test time necessary on the actual test bench.
- Conceal information about geometries or materials so it can be shared between business companies.
- The JMAG-RT model captures device performance that includes non-linear effects, saturation, and space harmonics. This high fidelity model's response is nearly identical to the actual device's response.
- FEM-Parameterized PMSM Block Support: Use JMAG-RT models with Simulink and Simscape.
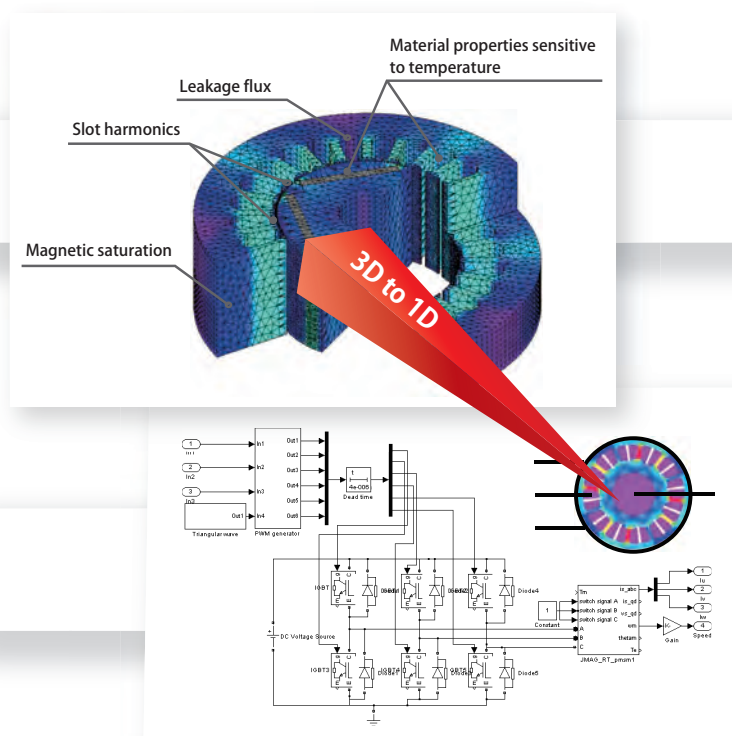
Supported System

JMAG-RT is applicable to major SILS, MILS and HILS systems which are used for system-level and real-time simulations.

- SILS/MILS
  - MATLAB/Simulink   - GT-SUITE   - Amesim   - MapleSim
  - PSIM   - SaberRD   - SimulationX   - RecurDyn   - SIMBA
- HILS
  - OPAL-RT   - dSPACE   - DENSO TEN   - A&D
  - DSP Technology   - Speedgoat   - Typhoon HIL
  - Concurrent RT

Supported Devices

- Permanent magnet synchronous motors (3-phase, 6-phase)
- Induction motors (3-phase, 6-phase)
- Stepping motor (2-phase)
- Switched reluctance motors (3-5 phase)
- Linear solenoid
- Permanent magnet linear motors (3-phase)
- Wound-Field Synchronous Motor
- Synchronous reluctance motor (3-phase, 6-phase)
- Generic model

Machine Design Tool for Design Engineers
JMAG-Express

JMAG-Express quickly performs multifaceted evaluation to obtain machine design that meets performance requirements. Operations are easy with templates for motor geometry and evaluation items. The templates can be reused and you can run multipurpose optimization with the built-in engine. Design exploration covers magnetic, thermal, structural, and control design and tests a wide range at high speed from concept design to detailed design.
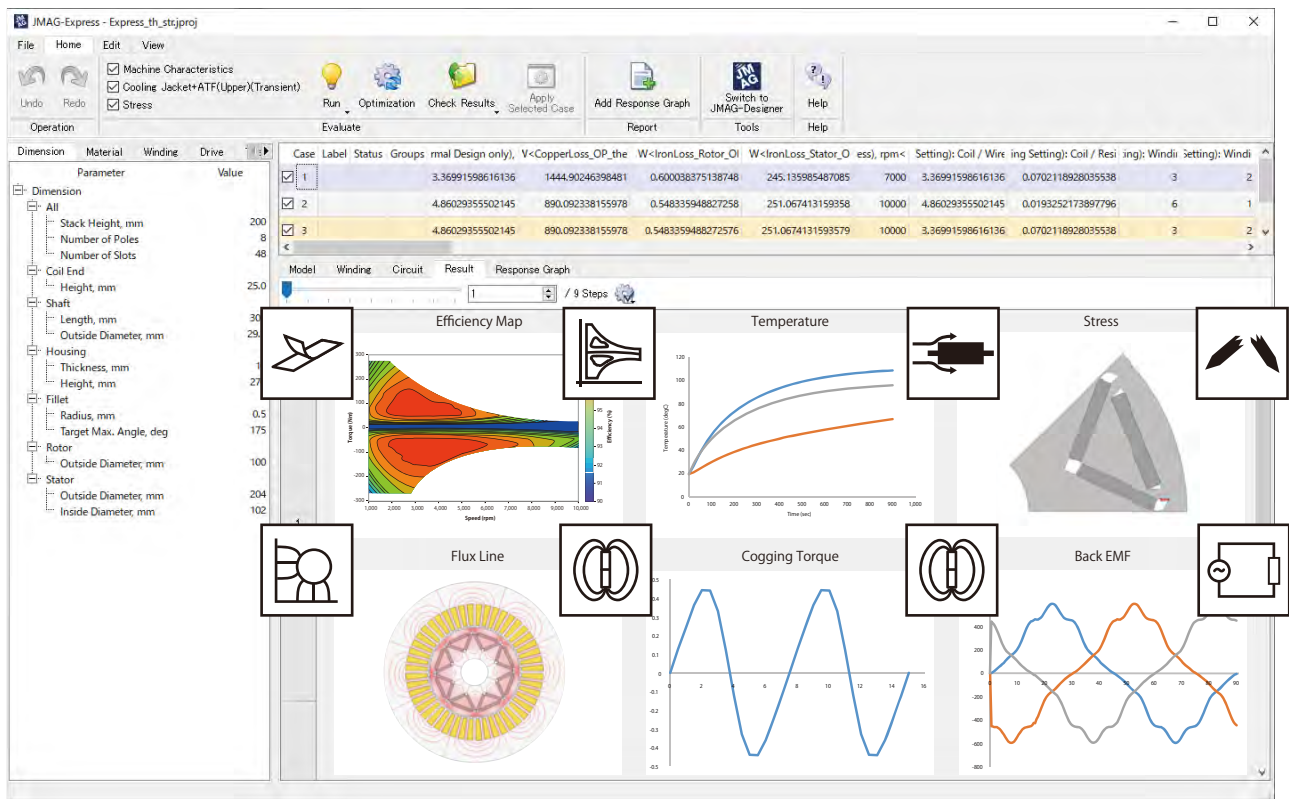
Capabilities

- One-click simultaneous evaluation of magnetic, thermal, and structural characteristics of motors
- High-speed calculation makes way for evaluation of multiple motor designs
- Run a detailed evaluation in JMAG-Designer by just switching display mode
- Flexible support for analysis accuracy requirements and various applications

Evaluation items

You can create and reuse templates of what you want to evaluate
- Preinstalled
  - Magnetic design: machine constant, efficiency map, cogging torque, torque ripple, induced voltage, demagnetization
  - Thermal design: natural/forced cooling, cooling jacket, temperature evaluation in a drive cycle
  - Structural design: stress evaluation

Motor types

You can add and use 2D or 3D custom shapes
- Preinstalled
  - IPM
  - SPM
  - IM
- Custom
  - WSFM
  - Axial Gap Motor
  - Claw-Pole Motor
  - SRM
  - SynRM
  - Brush Motor
  - Universal Motor etc.

External Interface

JMAG is also striving to provide more linking capability with various systems and is putting efforts into interface development.
Using a direct interface, linking with other software can be performed seamlessly. A generic interface can be used to exchange data using a generic format such as CSV, and to link with an in-house system.

Direct Interface

JMAG's direct interfaces allow seamless data exchange with other software.
By exchanging detailed results data between software applications at high speed without loss of precision, a high accuracy analysis is possible without impact on ease of use.

- **Structural : Abaqus**

  The electromagnetic force distribution obtained by electromagnetic field analysis in JMAG is transferred to Abaqus for vibration analysis and non-linear structural analysis.
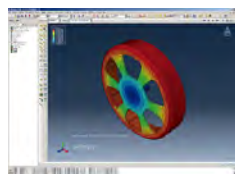
  *[1]

- **Fluids : STAR-CCM+**

  Thermal fluid analysis is performed by providing a loss distribution obtained by electromagnetic field analysis in JMAG as a heat source for STAR-CCM+.
 A temperature distribution is returned to JMAG, and the temperature is reflected in the magnetic characteristics allowing two-way coupled analysis to be performed.

  *[3]

- **Coupled analysis interface : MpCCI**
- **Control : MATLAB/Simulink, PSIM**
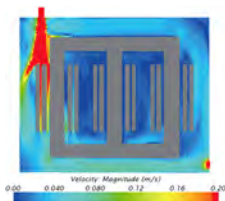
- **Sound : Simcenter 3D (LMS Virtual.Lab)**

  Performs electromagnetic vibration and noise analysis.
  Excitation force is obtained from electromagnetic field analysis in JMAG, and the excitation force data which tends to be large is compressed and transferred.
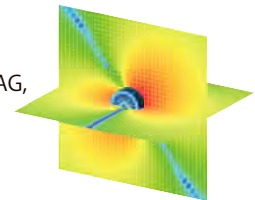
  * [2]

- **Vibration : Romax nexus**

  Vibration analysis is performed combining the motor and gear or speed reducer.
  The electromagnetic force per stator tooth and rotor torque solved for using JMAG are passed to Romax nexus.

  * [4]

- **Optimization : modeFRONTIER, Optimus, HEEDS, optiSLang**
- **Vibration : MASTA**

Multi-Purpose File Input/Output

Various software applications can be linked to using a file.
CSV, Nastran, and Universal formats are supported, and various types of meshes can be mapped to. Physical quantities that can be input or output: loss, heat transfer coefficients, electromagnetic force, stress, strain, displacement, speed, temperature, acceleration, magnetic flux density, magnetization quantities, current density, permeance, electric field

Actran by
Acoustic Radiation Case

- **Structural : MSC Nastran, NX Nastran**
- **Thermal fluids : Acusolve, SCRYU/Tetra, Particalworks**
- **Sound : Actran**
- **Control, 1D : MATLAB/Simulink, Amesim**

COM Interface Support

It is possible to use JMAG with other software by running VB Script and other scripting languages.

*Reference :
[1] JMAG Application Catalog #114 Vibration Analysis of an Outer Rotor Motor
[2] CWIEME Berlin 2015
[3] JMAG Application Catalog #206 Temperature Analysis of an Oil-Immersed Transformer Using a Coupled Magnetic Field and Thermal Fluid Analysis
[4] JMAG Leaflet #91 NVH analysis of EV drivelines with JMAG and Romax nexus

Products Structure

JMAG provides a wide array of tools covering conceptual designs to advanced designs. Many interfaces are also supported for the combined use of various software and systems.

General purpose FEA software for electromechanical design
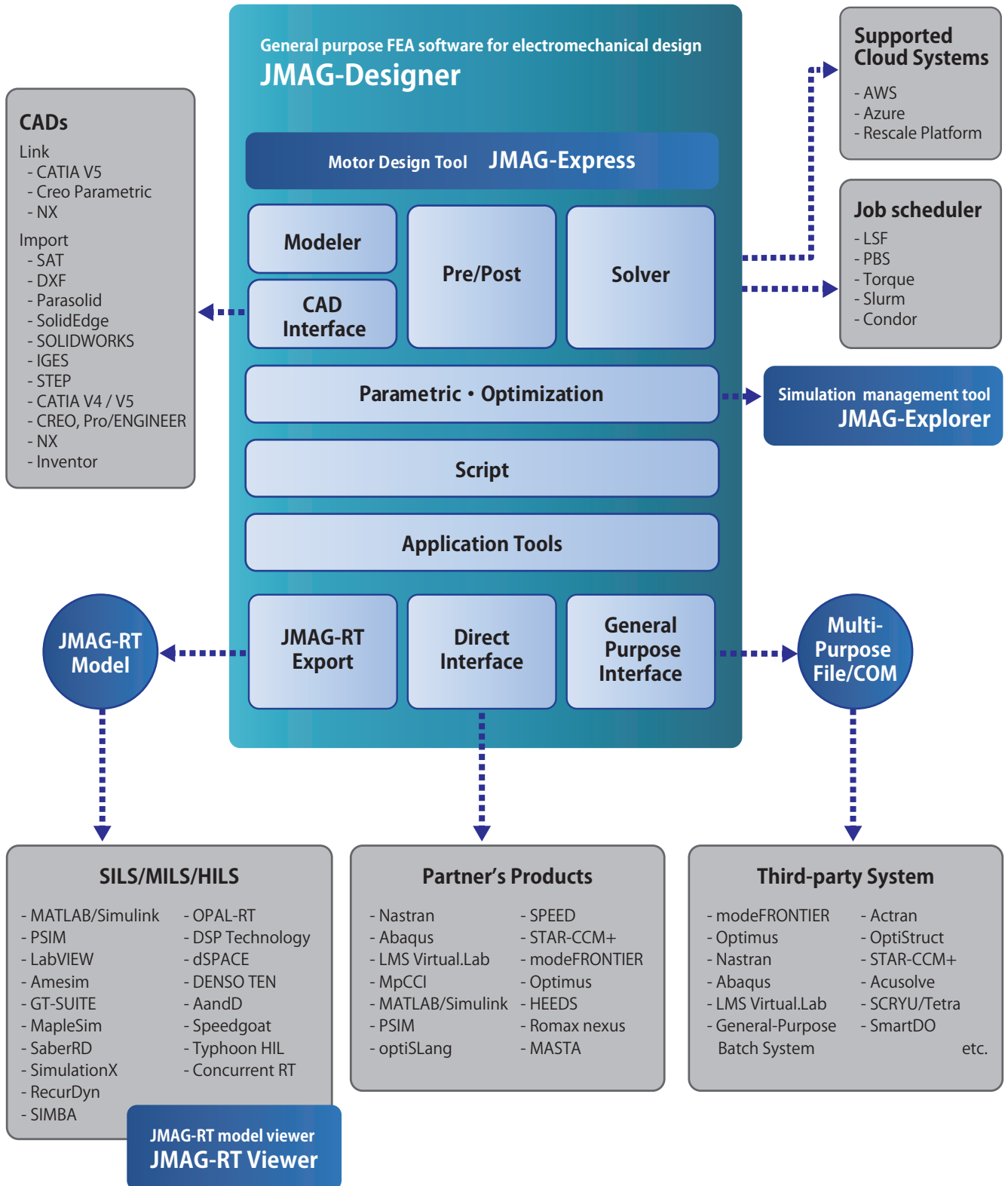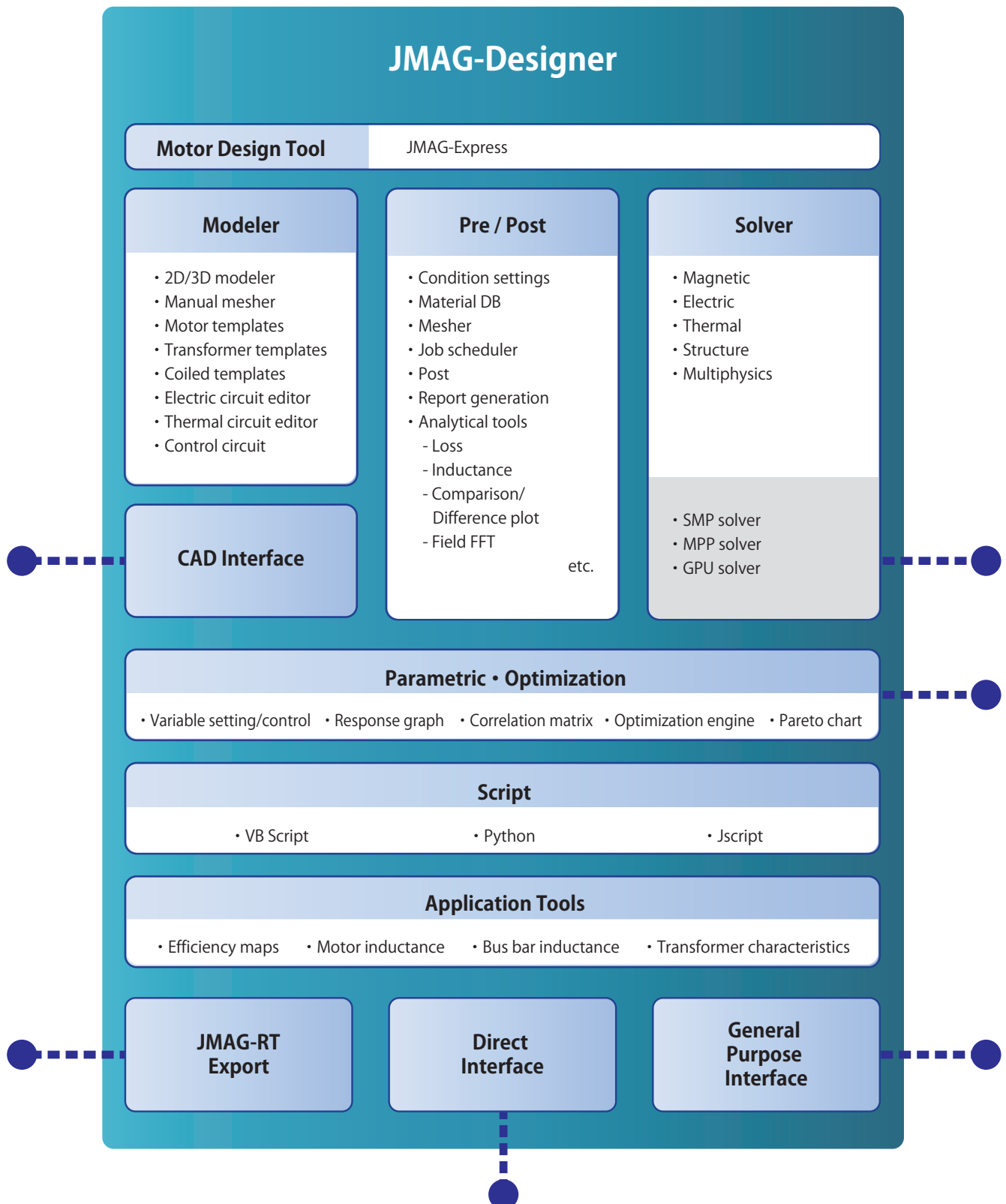## JMAG-Designer

Motor Design Tool   JMAG-Express

- Modeler
- CAD Interface
- Pre/Post
- Solver
- Parametric · Optimization
- Script
- Application Tools
- JMAG-RT Export
- Direct Interface
- General Purpose Interface

CADs

Link
  - CATIA V5
  - Creo Parametric
  - NX

Import
  - SAT
  - DXF
  - Parasolid
  - SolidEdge
  - SOLIDWORKS
  - IGES
  - STEP
  - CATIA V4 / V5
  - CREO, Pro/ENGINEER
  - NX
  - Inventor

Supported Cloud Systems

- AWS
- Azure
- Rescale Platform

Job scheduler

- LSF
- PBS
- Torque
- Slurm
- Condor

Simulation management tool
JMAG-Explorer

JMAG-RT Model

Multi-Purpose File/COM

SILS/MILS/HILS

- MATLAB/Simulink
- PSIM
- LabVIEW
- Amesim
- GT-SUITE
- MapleSim
- SaberRD
- SimulationX
- RecurDyn
- SIMBA
- OPAL-RT
- DSP Technology
- dSPACE
- DENSO TEN
- AandD
- Speedgoat
- Typhoon HIL
- Concurrent RT

JMAG-RT model viewer
JMAG-RT Viewer

Partner's Products

- Nastran
- Abaqus
- LMS Virtual.Lab
- MpCCI
- MATLAB/Simulink
- PSIM
- optiSLang
- SPEED
- STAR-CCM+
- modeFRONTIER
- Optimus
- HEEDS
- Romax nexus
- MASTA

Third-party System

- modeFRONTIER
- Optimus
- Nastran
- Abaqus
- LMS Virtual.Lab
- General-Purpose Batch System
- Actran
- OptiStruct
- STAR-CCM+
- Acusolve
- SCRYU/Tetra
- SmartDO
- etc.

JMAG-Designer has an intuitive GUI, advanced modeling functions, and various result display functions.
To efficiently use these functions, an automation function is also provided.

JMAG-Designer

Motor Design Tool	JMAG-Express

Modeler

- 2D/3D modeler
- Manual mesher
- Motor templates
- Transformer templates
- Coiled templates
- Electric circuit editor
- Thermal circuit editor
- Control circuit

CAD Interface

Pre / Post

- Condition settings
- Material DB
- Mesher
- Job scheduler
- Post
- Report generation
- Analytical tools
  - Loss
  - Inductance
  - Comparison/
    Difference plot
  - Field FFT

etc.

Solver

- Magnetic
- Electric
- Thermal
- Structure
- Multiphysics

- SMP solver
- MPP solver
- GPU solver

Parametric・Optimization

・Variable setting/control　・Response graph　・Correlation matrix　・Optimization engine　・Pareto chart

Script

・VB Script　　　　　・Python　　　　　・Jscript

Application Tools

・Efficiency maps　　・Motor inductance　　・Bus bar inductance　　・Transformer characteristics

JMAG-RT Export

Direct Interface

General Purpose Interface

JMAG

Simulation Technology for Electromechanical Design

JMAG Libraries

For those who are considering using electromagnetic field analysis, those who are familiar with JMAG, and those who are using JMAG-RT motor models for control verification, sample models and documentation and data for each situation are available.
Please use.

	Case studies	Function descriptions	Performance verification	Modeling	Operating instructions	Sample data
Leaflet		●				
White Papers			●	●		
🔒 Self Learning System (JMAG -SLS)				●	●	●
Application Catalog	●					
🔒 Application Note	●			●		●
🔒 Function Tutorial		●			●	●
JMAG Function Videos		●			●	
JMAG Users Conference Proceedings	●		●	●		
Implementing JMAG	●					
🔒 Technical FAQs				●	●	
JMAG-RT Model Library						●

🔒 ：JMAG software users

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For more information about JMAG, visit：https://www.jmag-international.com

2023-09