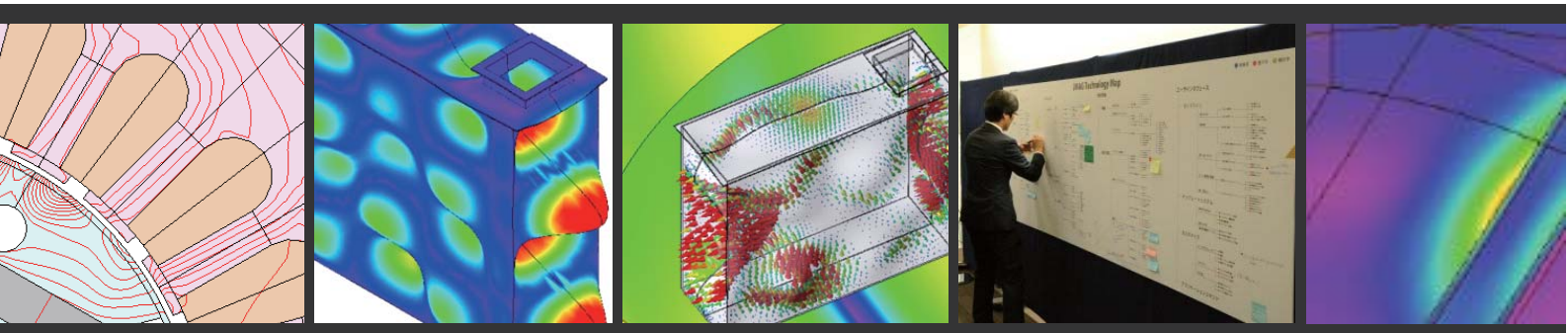
Simulation Technology for Electromechanical Design

JMAG®

JMAG Newsletter



January, 2016

Simulation Technology for Electromechanical Design

http://www.jmag-international.com

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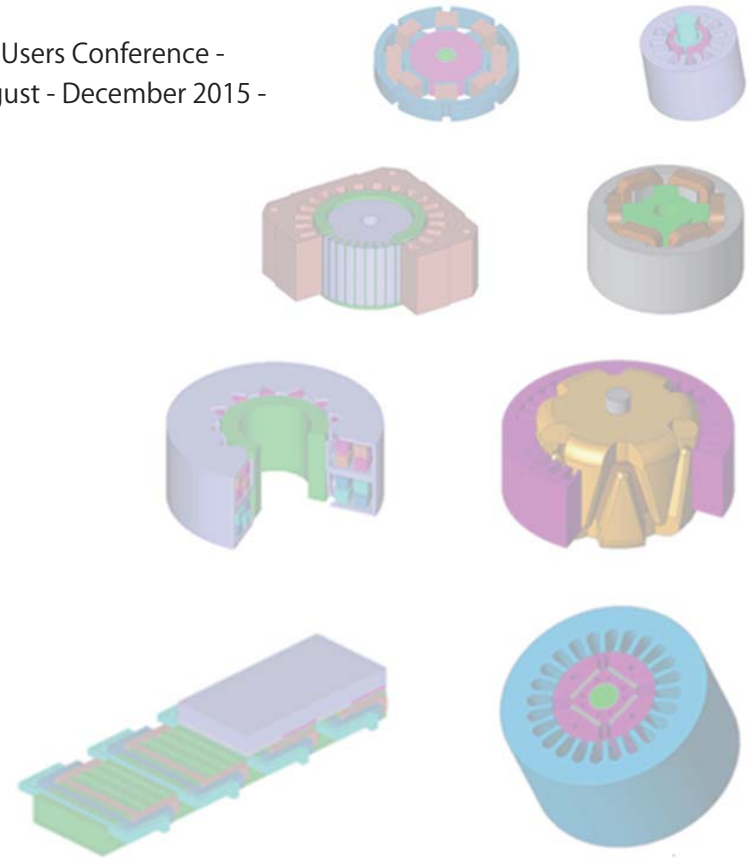

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JMAG Newsletter: Highlights of the January Issue

Happy holidays! We hope you are surviving through the cold winter season. This will be the January issue of the JMAG Newsletter, the first edition of 2016.

"Solution" focuses on case studies recommending countermeasures for electromagnetic vibrations using JMAG to meet regulations set by the new Japan standard on transformers.

"Product Report" will be introducing JMAG-Designer Ver.15.0 released in January, 2016. We will be presenting new features that have improved the overall usability of JMAG.

"Common Questions for JMAG" will cover 4 items related to operating environments. Please read a FAQ in a category that matches your interest.

"Event Information" looks back at the JMAG Users Conference held from Tuesday, December 8 to Wednesday, December 9, 2015.

The JMAG Newsletter is intended for everybody, from those who are currently using the product to those who have not started yet. So please feel free to pass this newsletter on to new users as well.

We hope you enjoy this information-packed issue and find something of value on each page.

JSOL Corporation

Solutions

Coupled Magnetic Field and Vibration Analysis for Power Transformer

JEC-2200, which is the national standards of transformers, has been revised, and load current noise and combined noise have been added to the noise regulation of transformers. For this reason, as a countermeasure for transformer noise, prior evaluation of design using simulation is gaining attention. This essay will look at the current state and themes of prior evaluation of vibration / noise with numerical simulation using JMAG, and introduce case studies.

Introduction

The vibration / noise caused by large power transformers were greatly reduced with the adoption of the step lap structure with regards to the iron core. However, with the revision of the JEC-2200 for transformers in November 2014 under the Japan Electrotechnical Committee (JEC) standards, standards for load current noise and its combined noise due to winding vibrations have been added. As a result, further noise reduction of transformers are becoming an important technological theme.

This essay will look at the current state and themes of prior evaluation regarding vibration / noise of large power transformers (transformers from here on) with numerical simulation using JMAG, and introduce case studies.

Vibration Phenomenon in Transformer Analysis

The vibration phenomenon that occurs from the transformer are roughly divided into two categories: excitation vibration or winding vibration. Excitation vibration is a vibration phenomenon that occurs with the vibratory force as the vibration source, caused by the magnetic flux that excites the iron core. It is said that magnetostrictive force inside the iron core and the magnetic attraction of the joint part contribute to vibratory force. As opposed to this, winding vibration is a vibration phenomenon that occurs when flux leakage from the winding works on the current inside the winding and produces Lorentz force, which becomes the vibration source.

Transformers run with commercial frequency and vibratory force caused by electromagnetic phenomena requires the component of the second harmonics. Commercial frequencies seem like low compared to general electric products; however some large power transformers have iron cores with a few meters in size, and the eigenfrequency becomes equivalent to commercial frequencies. For this reason, since basic wave components of large vibratory force have effect on vibration phenomena, it is important to take vibration prevention countermeasures.

Necessity of Magnetic Field - Structural Coupling Analysis

In a vibration phenomena analysis, vibration analysis setting the iron and winding as the vibration source works fine but since the vibration source has distribution, a preciseestimate of

distribution will be required for an accurate evaluation.

Excitation vibration occurs with magnetostriction vibration along with the magnetic flux flow inside the iron core and the electromagnetic attraction at the contact part of the yoke and leg as the vibration source. Anisotropic magnetic steel sheet is used for the iron core but anisotropy has large influence not only on the flow of magnetic flux but also on the distribution of magnetostrictive force and electromagnetic force. For this reason, an estimate of excitation force will require electromagnetic field analysis accountring for anisotropy. Lorentz force, which is the vibratory source of winding vibration is greatly influenced by the leakage flux from the winding; however, since leakage flux distribution is also largely influenced by the positioning of the clamp and shield, it is extermely difficult to predict distribution without using magnetic field analysis.

For this reason, it is inevitable to accurately evaluate the magnetostrictive force and Lorentz force as the vibratory source when estimating the distribution of the vibratory source of the transformer. A magnetic field / structure coupling analysis is necessary for a vibration / noise analysis.

Vibration Analysis of Large Transformers Using JMAG

Displayed below are results for analysis case studies such as excitation vibration, winding vibration, and vibration of the tank wall analyzed using the magnetic field-structural coupling analysis function. Themes that come up as we progress with the analysis will also be covered.

Excitation Vibration

This example ran an analysis presuming the contribution from the magnetostrictive force as the excitation force of excitation vibration.

Since the evaluation of excitation vibration is run with the same excitation condition as the non-load test, it is fine just releasing the secondary winding and adding rated voltage to the primary winding; however, the analysis was run with flowing current simulating the rated voltage. We set directional magnetic steel sheet for the magnetic properties and specified the point sequence of magnetic flux density - striction for magnetstriction properties in the rolling direction and transverse direction, respectively. As the boundary condition, the base of the iron core is assumed to be fixed on the stand.

The main stress distribution inside the iron core is shown in Fig.1. It can be seen that due to magnetostrictive vibration along the flow of the main magnetic flux, stress is caused. In response, as for the magnetostrictive force distribution, there is comppressed stress occuring in the direction of the main magnetic flux and the vertical direction (Fig.2). As a result of the iron core extending in the main magnetic flux direction due to magnetostrictive force, compression corresponding to Poisson's ratio occurs in the vertical direction of the main magnetic flux and becomes magnetostrictive force. There is also a tendency where magnetostrictive force concentrates along the seams of the joint part. Directional magnetic steel has anisotropy where striction in the main magnetic flux direction gets smaller but the continuity of magnetic flux in the joint part causes magnetic flux in the diagonal direction, increasing magnetostriction, and the magnetostrictive force concentrates along the seams. As for vibration, the main magnetic flux extends and contracts along the iron core, and depending on the current conditions of three-phase AC, it may occur along

the upper diagonal direction of both left and right of the iron core. Shows the result of radiated sound pressure distribution with magnetostrictive force as the vibratory force (Fig.2). It can be confirmed that sound pressure distribution relative to the vibration direction of the iron core is obtained.

In this analysis, the iron core is handled as a bulk-shaped model but to run an accurate analysis, the evaluation and the setting of equivalent Young's modulus and the Poisson ratio is necessary[1]. Modeling the seams, evaluating the constraint state of the iron core would also be necessary.

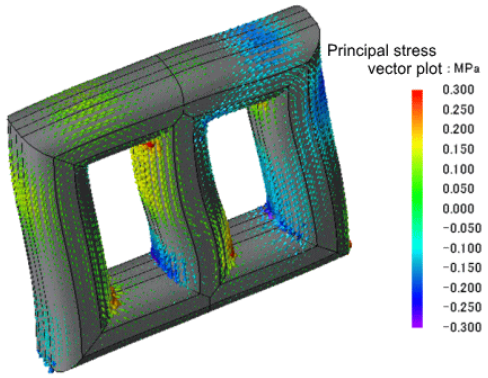


FIg. 1 Main stress distribution inside the iron core due to magnetostriction

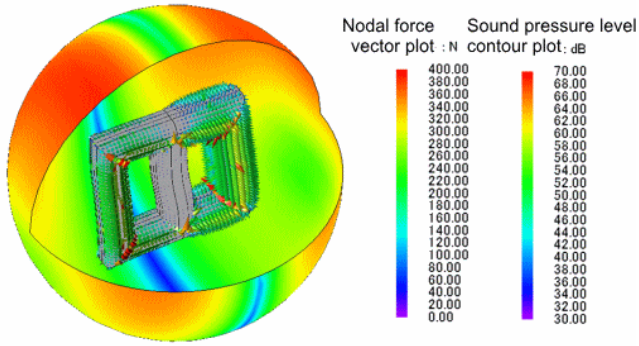


Fig. 2 Magnetostrictive force distribution and sound pressure level distribution inside the iron core

Winding Vibration

As for the load current of the transformer, the ratio that the excitation current accounts for is an extremely small proportion and it can be assumed that the primary current and the secondary current flows pretty much in the reverse direction. For this reason, repulsion occurs in the primary and secondary winding (Fig.3). With each winding, the current between wires are the same phase so attraction occurs in the coil axis direction.

The vibration state of winding is determined in the natural mode of the Lorentz force and winding. The natural mode of the winding differs depending on the type of winding. The main mode of cylindrical shaped coils is the elliptical mode where the winding vibrates in the cylindrical side direction but the main mode of disc-shaped winding is the extension and contraction mode that vibrates in the coil axis direction[2].

This examples assumes cylindrical shaped coils, so the elliptical mode with the basic components of vibration occurs and outputs the predicted results (Fig.4).

Modeling winding in an analysis is not in wire units and is rather modeled in bulk; however, in truth, they contain insulation and press board materials. For this reason, to conduct an accurate analysis, it is necessary to conduct an evaluation of equivalent material characteristics but for this case, the analysis assumes copper material characteristics for the winding of the bulk state.

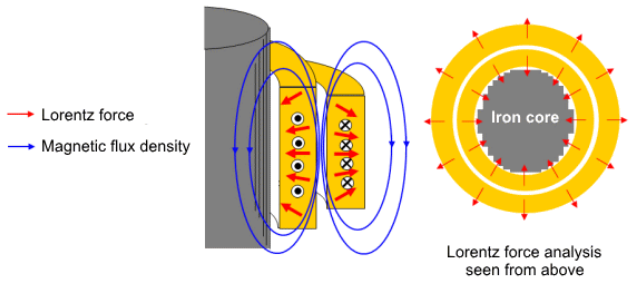


Fig. 3 Image of flux density distribution occurring in winding, and Lorentz force

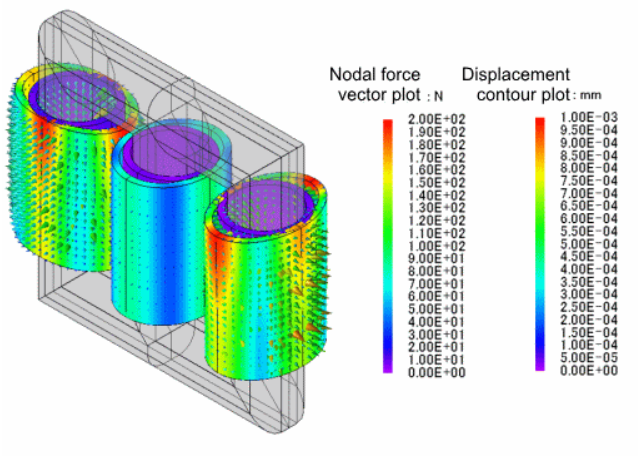


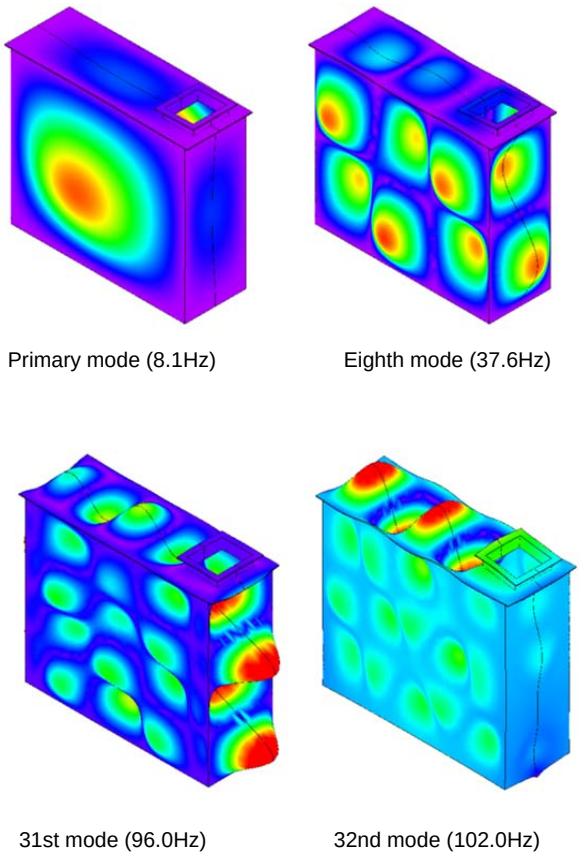
FIg. 4 Lorentz force distribution and displacement distribution occurring in the winding

Tank Wall Vibration

As for vibration from the tank wall, generally, excitation vibration or winding vibration occurs through surrounding structures or insulating oil and it is assumed that the tank itself will not be the source. However, analysis results of stray loss suggest that the eddy current and leakage flux occurring in the tank wall causes significant electromagnetic force. In an actual tank wall, it is assumed that the entire tank wall will not vibrate as there are vibration prevention measures with the placements of H steel acting as reinforcements. However, excitation vibration and winding vibration can spread as in the figure above and will shake the tank wall. For this reason, considering vibration along the tank wall is important and it would be interesting to compare their contribution[3][4].

This example was an analysis of the electromagnetic force distribution, which was considered vibratory force occurring along the tank wall in the state where load current is flowing. The area of the tank wall is large in the narutal mode so when there are no reinforcements placed, vibration of low frequencies starting from less than 10Hz can be seen, and it can be predicted that it will be easily integrated into the fundamental wave mode of vibratory force (Fig.5). When the noise from the tank wall does not have a sound insulating board, it will be directly radiated to the outside and it is thought to have large effects. From sound pressure distribution, it can be seen that the maximum is greater than 90dB and that vibration prevention measures for the tank wall is important (Fig.6).

The vibration analysis of the tank wall is relatively easy as there are no inclusions such as insulating oil, compared to excitation vibration and winding vibration, which are difficult to model. In the future, in addition to conventional excitation vibration and winding vibration as vibratory sources, it may be important to evaluate vibration from the tank wall.



Primary mode (8.1Hz) Eighth mode (37.6Hz)

31st mode (96.0Hz) 32nd mode (102.0Hz)

Fig.5 Natural mode of the tank

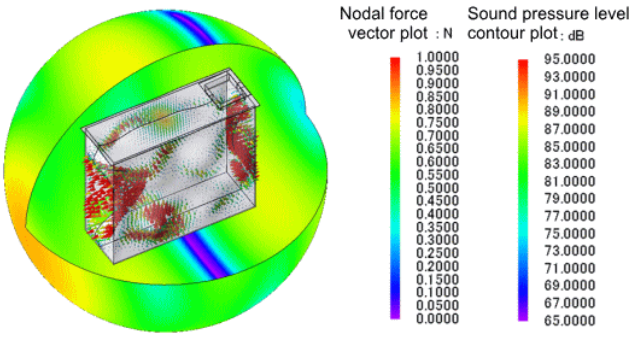


Fig.6 Excitation force distribution and sound pressure level distribution occurring in the tank

Lastly

With the progress in numerical calculation and hardware environments, quantitative evaluations in simulation in the field of large transformers have improved drastically, and have enhanced the design process. In terms of vibration phenomena, evaluation of excitation vibration, winding vibration using magnetic field - structural coupling in JMAG is possible. However, since the ratio of structural complexity to the scale of the structure is extremely large, model simplification cannot be avoided. With simplification, application of the homogenization method to each material inside the transformer and changing the original value is necessary. It can be said that the theme to increasing accuracy is to realize this calculation method.

（Takayuki Nishio）

[1]Naoyuki Kurita "Vibration analysis of transformer core with magnetostriction by using JMAG" JMAG Users Conference 2014

[2]Kiyoshi Wakimoto "Coil Vibration as a Noise Source Generated by Transformer Load Current" JMAG Users Conference 2013

[3]Kiyoshi Wakimoto "Electromagnetic force as a noise source generated by leakage flux in transformer tank" JMAG Users Conference 2014

[4]Kiyoshi Wakimoto "Noise and Vibration of Oil-Immersed Transformer Generated by Load Current" JMAG Users Conference 2015

Product Report

Introduction of JMAG-Designer Ver.15.0

JMAG-Designer Ver.15.0 (hereafter called Ver.15.0) was released in December 2015.

The multi-objective optimization engine can be used for the global design exploration of complex design space. In addition to the framework that reduces operation steps in the Geometry Editor and post-processing, operability of case control has also been improved for higher success with parametric analyses. Additional improvements include the check function of BH curves and magnetic field analysis accounting for hysteresis characteristics, as well as enhancements in customization features.

This report introduces you the new features in Ver.15.0.

Introduction

About 42 features have been added / improved in Ver.15.0.

A multi-objective optimization engine using genetic algorithms has also been embedded, and has allowed optimization in the practical use. We have continually improved operation for mesh generation and have maintained the distributed processing environment to allow hundreds and thousands of cases that are required for optimization. In addition, case controls are easier to use, and cases are displayed in a list for parametric analyses, which allow design spaces to be even more fully understood.

The user interface for the Geometry Editor and post processing has also been improved to allow for more efficient analyses to be performed. Analysis functions and material modeling functions are also now better than ever. Not only have magnetic performance evaluations been improved, but so have other analysis technologies, such as for electric field, thermal and structural analyses, allowing the entire machine to be evaluated from a multitude of perspectives.

This product report only covers a few of the 42 new features available in the new version; for a comprehensive overview, please visit the following Ver.15.0 introduction page.

http://www.jmag-international.com/products/jmag-designer/index_v150.html

Performing More Efficient Analyses

Reducing overall time for simulation workflow is sought by optimizing essential operations such as creating models, setting conditions, and visualizing results.

Picking up from where Ver. 14.1 left off, the user interface has been further refined, and frequently performed operations have been made into functions to support a more efficient workflow. Manual explanations for script functions have also been improved. So it is easier than ever for users to automate operations.

Geometry Library

Typical 2D and 3D geometry (polygons, circles, ovals, rectangles, spheres, cones, prisms, tori, and spirals) can be created by simply specifying their dimensions and coordinates (Fig. 1). Steps of sketch creation and feature settings can now be

omitted.

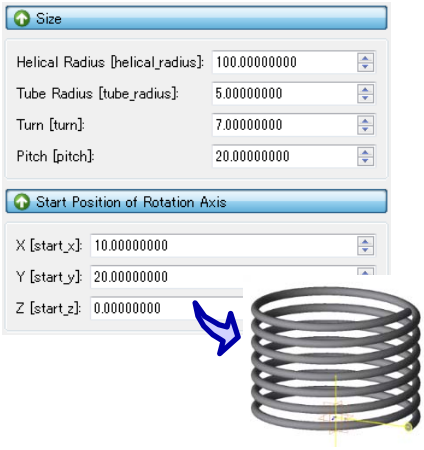


Fig.1 Example of creating a spiral part.

Create spiral geometry by simply entering its dimensions and coordinate values.

Region Boolean and Pattern Features

Region boolean function (Fig. 2) is added. Cutting shapes and holes can be easily created combined with line patterns or rotation patterns. Also, specifying features such as revolve, chamfer, and fillet with the pattern processing function allows these processes to be run simultaneously with pattern copy.

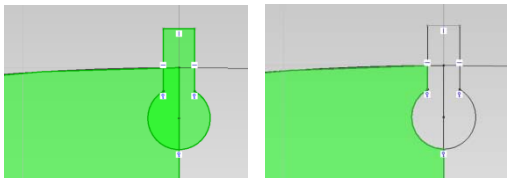


Fig.2 Region boolean function

The boolean function runs automatically when duplicate regions are created. The overlapping region is removed (left) and a notch is created in the geometry (right).

Fig.3 Creating damper bar geometry

Easily turn multiple notch geometry into a pattern by copying a region boolean feature

Outputting Circuits and Response Values to a csv File

Quickly access required information after completing a calculation with a csv file. In addition to outputting history graph items to a csv file in Ver. 14.1, circuits and response values can now be output as well (Fig. 4). Export only the needed results to the available physical computer when performing distributed processing.

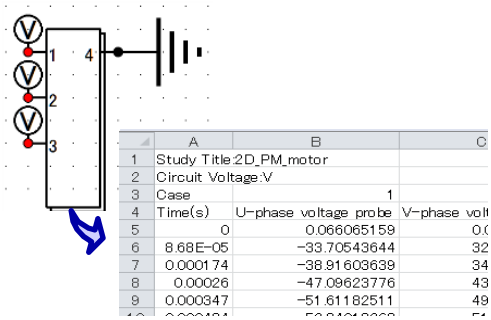


Fig.4 Example of outputting circuit terminal voltage

Output voltage values of the electric potential probe set in advance to a csv file all at once

Improved Mesher Capabilities

The flexibility for mesh generation is always being improved to allow generating the least amount of mesh required to capture phenomena precisely. The extrusion direction of thin solid mesh and extruded mesh can now be user-specified. Functions to specify the number of divisions and division ratio for manual mesh have also been added, allowing control over the mesh density.

Specifying the Extrusion Direction of Thin Solid Mesh

By freely specifying the extrusion direction of thin solid mesh, mesh necessary for capturing the desired phenomena can be efficiently created. For example, for an eddy current distribution analysis of core geometry as shown below, thin solid mesh is created only for the surface of the material where eddy currents are generated (Fig. 5). By roughly

cutting out tetrahedral mesh, the phenomena in the core section can be grasped in detail while also efficiently reducing the mesh elements.

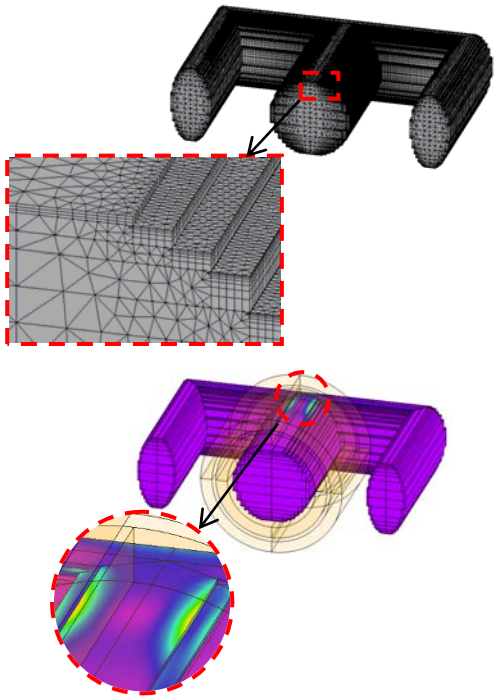


Fig.5 Eddy current loss analysis of a large transformer
Create thin solid mesh as a separate part for the core surface where eddy currents are being generated (upper), and then accurately analyze the loss distribution (lower).

Improved Analysis Functions

The all-new zooming analysis function, a technique for reducing calculation time while allowing phenomena to be captured in high detail, separates out a single, detailed section of the model and analyzes the section. When it comes to electromechanical design, comprehensive solutions are sought not only for magnetic performance, but everything from the intricate details of a machine to the machine as a whole, such as noise phenomena and dielectric breakdown. To achieve this with JMAG, we are focused on improving electric field, thermal and structural analysis functions. Electric field analyses using higher-order elements can now be performed.

Zooming Analysis

Performing an analysis by separating out just a single section of a large, detailed model is now possible. This allows copper loss analyses for wires and stray loss analyses for cases to be easily performed. When typically performing a copper loss analysis, an analysis model which simulates the wire geometry the size of several millimeters is required, and this increases the number of mesh elements, and in turn, creates longer calculation times. The newly implemented zooming analysis is an efficient analysis method which limits the model size to just one section separated out from the rest of the analysis model.

In a copper loss analysis for an IPM motor, the model size is minimized by calculating copper loss from two analyses: analysis of a master model simulating the wire in bulk, and analysis of a sub-model of only the slot wire section (Fig. 6). By using vector potential distribution obtained in the master model analysis as a boundary condition in the sub-model analysis, magnet positions not included in the sub-model and slot geometry effects can be accounted for, and copper loss distribution can be obtained (Fig. 7). A typical analysis for a case that requires one hour can be performed in under 10 minutes using a zooming analysis.

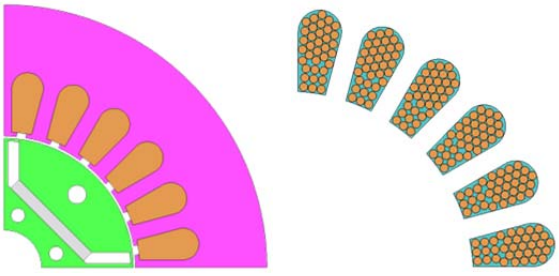


Fig.6 Copper loss analysis model using the zooming analysis method [1]
A model expressing the wire as bulk (left) and a model with only the slot and wire section (right) are created and analyzed.

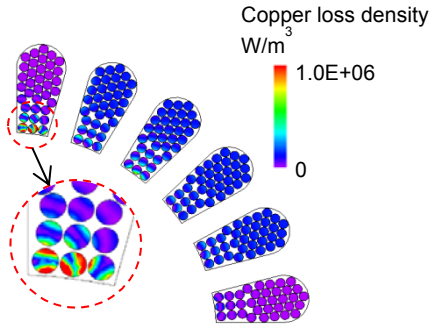
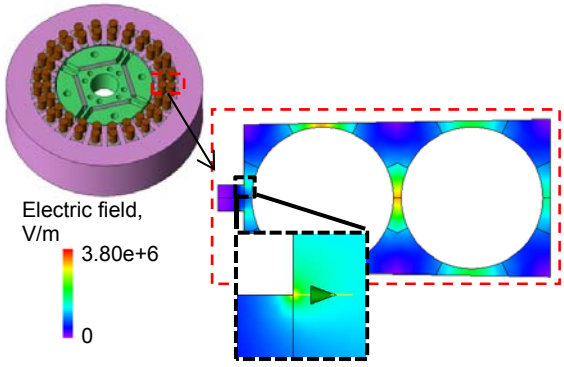


Fig.7 Obtained copper loss distribution

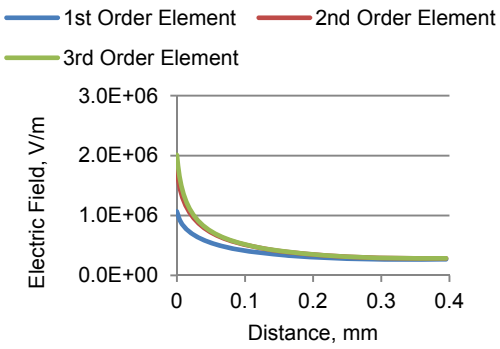
Increased copper losses due to slot higher harmonics components can be seen in the wire near the slot opening.

Higher-Order Element in Electric Field Analysis

To perform a detailed evaluation of dielectric breakdown in the air, which requires a quantitative evaluation of electric field intensity, locally occurring electric field concentrations must be analyzed with high accuracy. Analysis methods using higher-order elements were incorporated so suddenly changing electric fields can be captured. Evaluating with an increased resolution in areas where electric fields concentrate is possible (Fig. 8).



(a) Electric field distribution



(b) Electric field distribution over the line

Fig.8 Electric field distribution analysis of a slot

Analyze the electric field distribution of a wire in a motor. Express electric field concentrations using higher-order elements

Improved Coupling Functions with Abaqus

By directly linking a JMAG magnetic field analysis and an Abaqus thermal analysis or structural analysis, elasto-plastic deformations due to induction heating and formation issues using electromagnetic force can be solved with high accuracy. Electromagnetic force affecting magnetic material and Lorentz force affecting non-magnetic material can now be accounted for simultaneously to solve for deformations (Fig. 9). Appropriate time intervals can be set depending on the coupling issue. An option has been added to allow the time intervals for a JMAG transient response analysis to be synchronized with Abaqus Implicit time intervals.

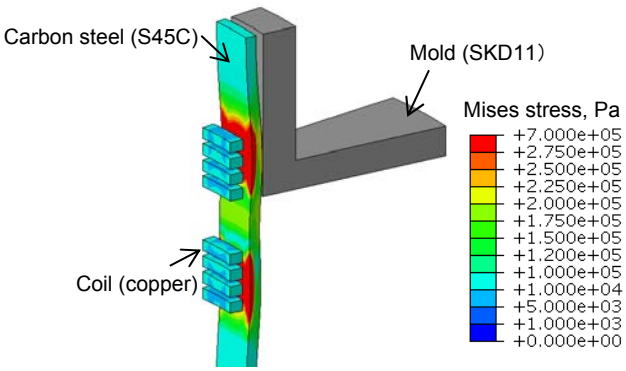


Fig.9 Analysis example of electromagnetic forming

Analyze plate deformations accounting for electromagnetic force affecting carbon steel, which was obtained in JMAG, and Lorentz force affecting the coil

Material Modeling

Modeling technologies that can accurately acquire losses due to various factors are essential for evaluating the reduction of losses occurring in a machine. In addition to incorporating the various characteristics of electromagnetic steel sheets and magnets, modeling technologies have been developed which can account for the production effects such as deterioration from processing. There are over 700 products in the material database to make analyses even more reliable, and now hysteresis characteristics can be used directly in a magnetic field analysis.

Magnetic Field Analysis Accounting For Hysteresis Characteristics

By directly accounting for minor loops in magnetic properties for a magnetic field analysis, (Fig. 10), loss evaluations can be performed accounting for the energy balance. Vector play models are used to express minor loops.

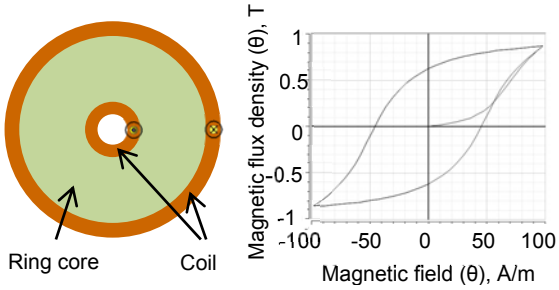


Fig.10 Example of a 2D transient analysis of a ring core

A 0.05A sinusoidal wave current is applied to the coil, and alternating magnetic field generated in the ring core draws the symmetry loop

Check Function of BH Curves

Actual measurement environments can limit the preparation of sufficient reference points, and may become data where differential permeability (*μdiff*) is not simple reduction. Convergence of calculation can be improved by running smoothing for the BH curve if necessary (Fig.11).

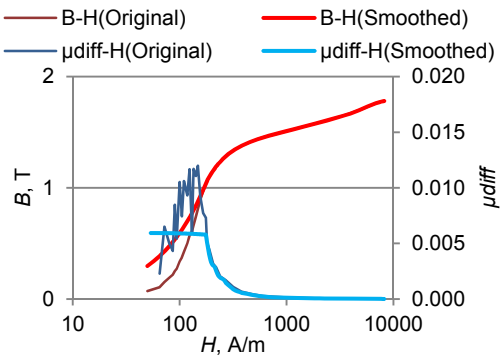


Fig.11 Example of smoothing BH curve

Confirm state of the input data from differential permeability and magnetic field graph then convert to a smoother curve with smoothing

Addition of Material Data

Neodymium bonded magnet from Molycorp Magnequench, electromagnetic steel sheet from ThyssenKrupp, and soft magnetic composite from Höganäs has been added (Table 1). Approximately 240 types of core materials and 460 types of PM materials can be used.

Table 1 Added material list

Molycorp Magnequench Corp. Neodymium bonded magnet (*1)	10-8.5HD-20180 11-8-20222 12-8HD-20175 13-9-20063 13-9HD-20179 14-12-20000	15-7-20065 15-9HD-20178 B+-10118 B+-20056 B-20172 B-20173
ThyssenKrupp Corp. Magnetic steel sheet	TKSE M 235-35 A TKSE M 400-50 A TKSE M 530-50 A	TKSE M 330-35 A TKSE M 470-65 A TKSE M 800-100 A
Höganäs Soft magnetic composite (*2)	Somaloy_110i_1P Somaloy_130i_1P Somaloy_130i_5P Somaloy_500_1P Somaloy_700_1P Somaloy_700_3P	Somaloy_700HR_1P Somaloy_700HR_3P Somaloy_700HR_5P Somaloy_1000_3P Somaloy_1000_5P

*1 Intensity of magnetization field varies in 6 patterns for each material: 7.5kOe,10kOe,12.5kOe, 15kOe,20kOe,40kOe

*2 Soft magnetic composites from Höganäs in Ver.14.1 has been replaced with 11 new materials

Customization

Analysis functions and material modeling have been enhanced so users can be further involved in electromechanical design. On the other hand, the

customization function has been improved for flexible support in evaluation items specializing in machinery, control methods, and original complicated analyses. To be specific, the user subroutine has been enhanced, and setting items customizable by the user have also been increased. Subroutines supported in the settings of iron loss calculation, current source, and voltage source have also been added.

Customizing Iron Loss Algorithm

A new setting that can now be customized is the iron loss algorithm. There are several methods on how to categorize and cut apart losses depending on the approach. Subroutine of iron loss calculation has been added in response to demands for breaking up iron loss components using an original algorithm (Fig.12).

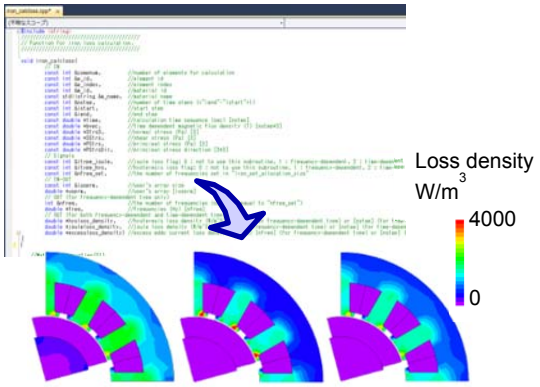


Fig.12 Example of customizing iron loss calculation

Directly calculate each loss (from the left: hysteresis loss, classical eddy current loss, excess eddy current loss) from magnetic flux density of the rotor core and stator core using subroutine

Exploration of Design Space

Design exploration may eventually become the key to electromechanical design. Multi-objective optimization engine using genetic algorithm expands the design space and allows exploration of optimization design proposals. The advantage of multi-objective optimization in JMAG is that it can be easily run, as with parametric analysis. Reviewing the procedure to specify the design variable and adding a design proposal to the design table has allowed Ver.15.0 for improvements in accuracy of operations. Functionality has also been improved such as support for point sequence data, as well as enhancements in analysis functions such as Pareto curve and correlation matrix.

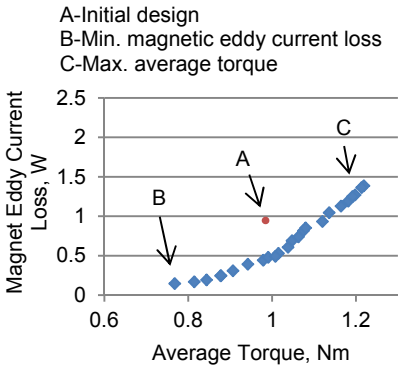
In addition, the MATLAB engine is now available for use in multi-objective optimization, and an interface to register the user engine to the optimization panel has been embedded so complicated/various optimization processing can be run from JMAG.

Multi-Objective Optimization

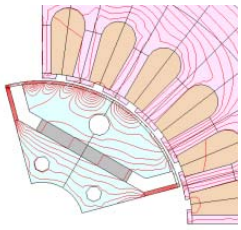
Genetic algorithm embedded from Ver.14.1 now supports multi-objective optimization, and this has allowed optimization design for contrary design issues such as performance and cost.

For example, rotor design of IPM motors needs to maximize torque while controlling loss that occurs in the magnet. Multi-objective optimization can be run with magnet width, magnet thickness, position, and slit width as design variables for these application issues (Fig.13). Magnet torque can be increased by enlarging magnet width and magnet thickness, and there are hopes for improvements in average torque from the initial design proposal. On the other hand, reduction in magnet eddy current loss can be expected by effectively passing magnetic flux of the slot harmonic components that is the principal harmonic component inside the magnet through the slit part, but average torque drops simultaneously and control of the slot geometry becomes the key for optimization design. Using magnetic flux distribution and the correlation matrix allows examination of the obtained

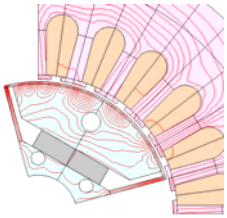
optimization design (Fig.14).



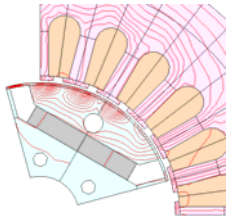
(a) Acquired Pareto solution



A-Initial design



B-Min. magnet eddy current loss



C-Max. average torque

(b) Optimized geometry and slot harmonic components of magnetic flux line

Fig.13 Pareto solution and optimized geometry [2]

Magnet eddy current loss is reduced, average torque is increased. Pareto curve is structured in the bottom-right direction (a), design proposal is examined from flux line distribution (b)

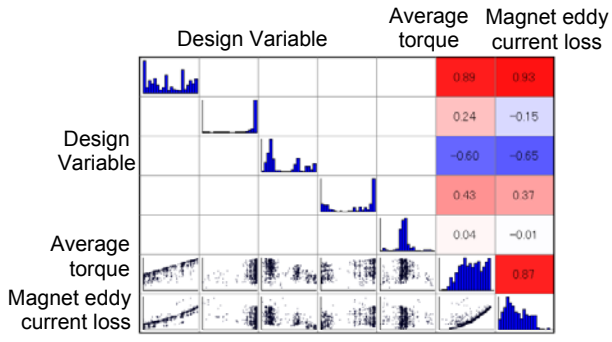


Fig.14 Correlation matrix

Confirm correlation coefficient with each design variable

Improvements in Case Control

Parametric analysis can be run in three steps.

Step1: Select a design variable in the [Select Parameters].

Step2: Register a design proposal in the [Design Table].

Step3: Run calculation.

Improvents in the user interface of case control allow movement from the selection of design variables directly to the input window of the case according to the execution step (Fig.15).

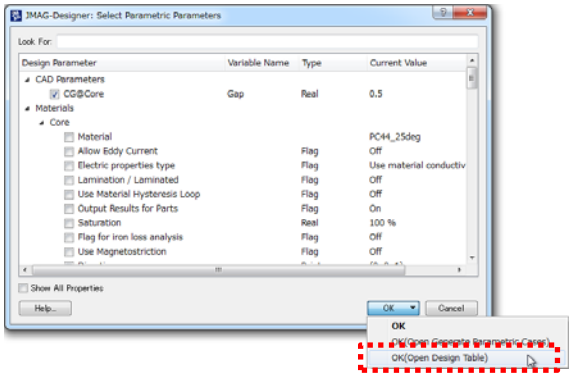


Fig.15 Operation method of parametric analysis

Open design table directly from the [Select Parametric Prameters] panel

Improved Geometry Parametric Operation

With improvements in the user interface, the operation procedures have also been made easier to understand in parametric analysis that uses dimensions as variables. When using only geometry dimensions as design variables, select a variable in [Select CAD Parameters], open the design table directly, then register a case. Furthermore, each variable can be previewed in the model, and design variables are now easier to select (Fig.16).

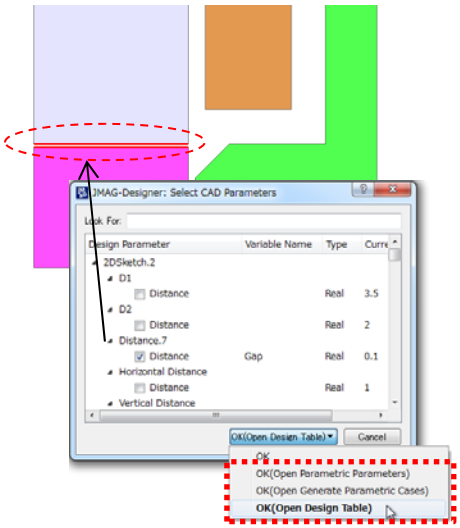
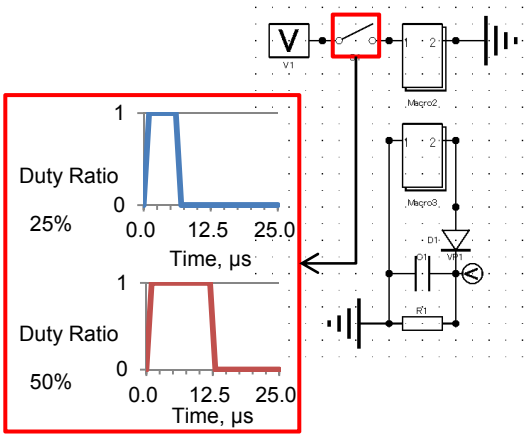


Fig.16 Geometry parametric operation method

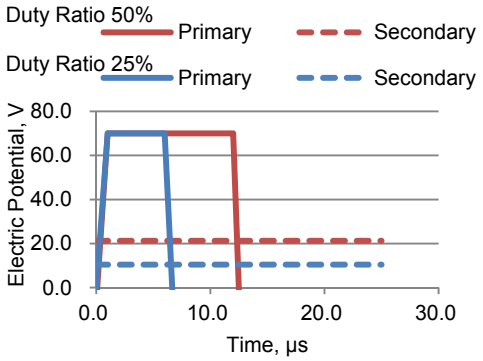
Confirm settings of the model, and open design table directly

Parametric Support for Point Sequence Data

The target range has been expanded so all settings can be used as design variables. Parametric analysis with time-dependent point sequence data of circuit components and material characteristics as design variables can be run (Fig.17). Point sequence data is specified for each case in case control.



(a) Switch settings



(b) Voltage characteristics

Fig.17 Current voltage characteristics analysis of flyback converter

Analyze current voltage characteristics when the duty ratio is changed (b) changing point sequence data of the switch (a)

Distributed Processing and Job Management

Affinity with general-purpose job management systems (such as LSF) is improved so existing systems can be used effectively by predicting users' involvement with hundereds and thousands of analyses with parametric analysis or optimization calculation.

In addition to function improvements in JMAG-Scheduler, the function to monitor job state when using the general-purpose job management system has also been improved.

Running a Project Batch from JMAG-Scheduler

Distributed processing of coupling analysis can be directly run from the JMAG-Scheduler. The specified analysis group can be selected when running batch processing (Fig.18).

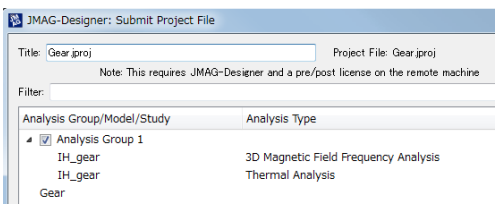


Fig.18 Batch processing of magnetic two-way coupled magnetic field and thermal analysis

Specify analysis group included in the specified jproj file

Conclusion

We hope you will enjoy the latest version of JMAG. This product report introduced part of the new features in Ver.15.0. Introduction videos of each function can be viewed at our company website (*3). In addition, tutorials and sample files of each function can be accessed from the download page of Ver.15.0 (*4). Please make use of these services.

We hope JMAG's newest features will prove useful for your business.

*3 JMAG Function Videos URL:
http://www.jmag-international.com/products/jmag-designer/index.html

*4 Sample data URL:
http://www.jmag-international.com/products/jmag-designer/index_v150.html
Accesible from the sample data of the Introducing JMAG-Designer Ver.15.0 page. A user account will be necessary.

(Mari Nakamura)

[1] Katagiri, Sano, Semba, Mimura, Matsunaga, Tani, Yamada: “Loss Calculation of Rotating Machine using Zooming Analysis”, The Papers of Joint Technical Meeting on Static Apparatus and Rotating Machinery, IEE Japan, SA-16-029, RM-16-029, pp.55-60(2016) (in Japanese)

[2] Kida, Katagiri, Matsunaga, Semba, Sano, Suzuki, Tani, Yamada: “An Evaluation of Genetic Algorithm for Multi-Objective Design Optimization of Electromagnetic Device”, The Papers of Joint Technical Meeting on Static Apparatus and Rotating Machinery, IEE Japan, SA-15-100, RM-15-138, pp.65-70(2015) (in Japanese)

Fully Mastering JMAG

Common Questions for JMAG

We are receiving many inquiries related to operating environments from January to March as it is a great opportunity to update JMAG and replace calculators. We will be introducing 4 questions related to operating environments of JMAG from the FAQ posted on the JMAG website.

TROUBLESHOOTING FAQ-1009

Q1. JMAG-Designer Ver.15.0 cannot be installed on Windows XP. Which OS runs JMAG?

Installation of JMAG-Designer Ver.15.0 was not successful in Windows XP, as an error occurred in both the license server (FLEXlm) and JMAG. Can Windows XP not be used for JMAG-Designer Ver.15.0?

A1. JMAG support for a particular OS will end once Microsoft has ended extended support.

For more information about the latest operating environment for JMAG, see the JMAG website.

https://www.jmag-international.com/jp/products/specification.html

Operating environments supported as of January 2016are introduced below.

Part of the library has been updated in JMAG-Designer Ver.15.0 to support Windows 10 and Windows Server 2012 R2. For this reason, the license server (FLEXlm) needs to be updated when using JMAG-Designer Ver.15.0; however, it is reported that it does not run on old Windows OS. Please consider updating Windows OS if Windows XP or Windows Server 2003 is used.

The supported OS are the following.

Windows Vista (32bit/64bit)

Windows 7 (32bit/64bit)

Windows 8.1 (32bit/64bit)

Windows 10 (32bit/64bit)　(support starts with the service pack released on February, 2016.)

Windows Server 2008 (32bit/64bit)

Windows Server 2008 R2 (64bit)

Windows Server 2012 (64bit)　(support starts with the service pack released on February, 2016.)

Windows Server 2012 R2 (64bit)　(support starts with the service pack released on February, 2016.)

Red Hat Linux Enterprise 5 (64bit)

Red Hat Linux Enterprise 6 (64bit)

SUSE Linux Enterprise 11 SP2 or later (64bit)

OPERATION METHODS FAQ-946

Q2. Can license use be limited depending on the user?

Please tell me how to specify limitations on the number of analyses that can be run simultaneously to a specific user account.

A2. Limitations can be set for each user or host by using the option file.

An option file function provided by FLEXlm can be used. The following limitations can be defined for option files.

・Allow the use of a product to a specific user/host

・Reject the use of a product to a specific user/host

・Set maximum number of license use to a specific user/host

A license due to using/fixing an option file does not need to be issued again.

It is important to take caution such as not mistaking the description as it may lead to troubles such as not being able to use the license etc.

Specification method and specific examples of an option file are as follows.

Restart the license server once it has been set.

(1) Location and file name of the option file

In the default settings, the file "jri.opt" can be read from the directory where FLEXlm is installed.

The license file needs to be fixed when using a different directory or file name.

Example: Change the third line of the license file (jripro.lic) to the following when an option file is created as C:¥JRI¥lic¥optionfile.opt.

VENDER jri options= C:¥JRI¥lic¥optionfile.opt

(2) Allow use of a product

Use the INCLUDE keyword when allowing the use of the product to a specified user/host.

Format:

INCLUDE module name USER/HOST user name/host name

Example: When allowing the use of JMAG-Designer to user01

INCLUDE JMAG-Designer USER user01

Example: When allowing the use of JMAG-Designer to host01

INCLUDE JMAG-Designer HOST host01

Users/hosts that are not defined in INCLUDE cannot use this product.

The use of all products included in the license file can be allowed if the INCLUDEALL keyword is used.

Example: When allowing the use of all products to user01

INCLUDEALL USER user01

(3) Reject use of a product

Use the EXCLUDE keyword to reject the use of the product to specific users/hosts.

Format:

EXCLUDE module name USER/HOST user name/host name

Example: When rejecting the use of JMAG-Designer to user01

EXCLUDE JMAG-Designer USER user01

Users/hosts that are not defined in EXCLUDE can use this product.

Use the EXCLUDEALL keyword to reject the use of all products included in the license file.

The way it is used is the same as INCLUDEALL.

(4) Setting maximum number of licenses used

Use the MAX keyword when specifying the maximum number of licenses that can be used by each user/host.

Format:

MAX maximum number of licenses used simultaneoulsy module name USER/HOST user name/host name

Example: When the maximum number of licenses used simultaneously in JMAG-Designer is set to "1" for user01

MAX 1 JMAG-Designer USER user01

The total maximum number of used licenses in the MAX line can exceed the number of licenses defined in the license file.

However, analysis cannot be run when the maximum number of licenses exceeds the number defined in the license file.

If there are multiple MAX lines for the same product, the least number will be set.

(5) Grouping users/hosts

Only one user/host can be specified as a target for INCLUDE, INCLUDEALL, EXCLUDE, EXCLUDEALL, and MAX.

Define the user group/host group beforehand and specify the group name in each keyword line to specify multiple users/hosts.

An arbitrary name can be specified to the group name.

Format:

GROUP group name　user name/host name

Example: When registering user01 and user02 to UG01 and allowing the use of all licenses to the group UG01

GROUP UG01 user01 user02

INCLUDEALL GROUP UG01

Example: When host01 and host02 are registered to HG01 and the maximum number of licenses used simultaneously in JMAG-Designer is set to "1" for the group HG01

HOST_GROUP HG01 host01 host02

MAX 1 JMAG-Designer HOST_GROUP HG01

If the same group name is described in multiple lines, all specified users will be added to the appropriate group.

Example:　Registering user01, user02, user03, and user04 to UG01

GROUP UG01 user01 user02

GROUP UG01 user03 user04

(6) Notes

Mistaking the description may lead to troubles such as not being able to use the license etc.

Please note the following.

・The length of one line in the option file is up to 2048 letters. The letter "¥" can be used as a continuation character of line. In addition, lines that start with "#" are assumed to be comment lines.

・Changes in the option file will not be reflected unless the license server is restarted. Changes in the option file cannot be reflected in utilities such as lmreread as the option file is only referenced when the server is started.

・Unexpected movements may result if the same user/host is registered in multiple groups.

・The EXCLUDE list is checked before the INCLUDE list so users/hosts that exist in both lists cannot use the product.

Q3. Is there a recommended operating environment when using parallel processing (shared memory multiprocessing (SMP)) for large models?

I am looking into using the Parallel Accelerator 2(PA2) license for calculating large models.

What operating environment do you recommend?

A3. When selecting a CPU for performing parallel computing, take not only the CPU speed into consideration, but also ensure that the CPU is able to quickly access the memory as well.

When performing parallel processing, multiple processes access the memory at the same time. If the access bandwidth is small, or if the access speeds are slow, fast parallel processing speeds cannot be expected. When the system architecture can only support one CPU, memory access bandwidth decreases, so it is recommended to use a system with at least two CPUs when performing parallel processing.

Other specifications to consider are as follows.

- Number of cores:

  It is recommended that the number of cores exceeds the number of expected parallel processes.

- Intel Smart Cache:

  A larger cache will yield faster calculations.

・Memory (RAM) type: DDR3-800/1066/1333/1600

  Check your computer documentation to verify which types of RAM are compatible. The number represents the RAM speed. Choose the fastest RAM type supported by your computer.

- Number of memory channels:

  The number of CPU memory bus connections.

  If there are four memory channels, then the amount of memory accessed by each CPU is multiplied by four,, resulting in higher speeds.

- Maximum memory bandwidth:

  Theoretical peak performance for memory bus is achieved when all memory channels are fully utilized and the fasted type of RAM is being used.

  Slower speeds will limit parallel performance.

Please click the link below for the system requirements that we recommend.

System requirements: SMP solver

<http://www.jmag-international.com/jp/products/specification.html>

Q4. What kinds of features do remote systems have? How are they arranged?

A4. A remote system is divided into computers for creating analysis models and computers for performing calculations, a setup which manages and performs jobs.

For example, when 100 parametric analysis cases are performed using 5 computers for calculations, each computer handles 20 cases. The local machines can be shut down in the middle of calculation, allowing the analysis to safely continue over the weekend.

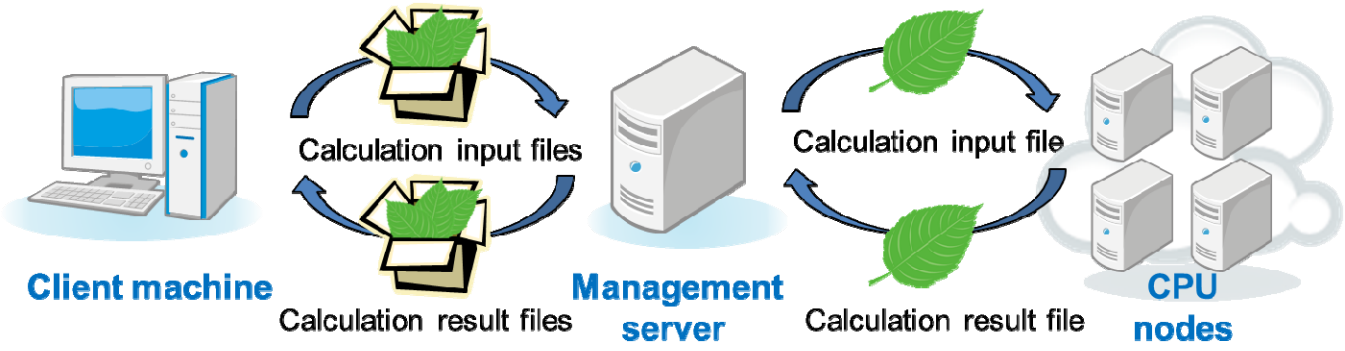
A remote system is composed of three layers: The client computer, the management server, and the CPU nodes. Each layer must have the following applications installed.

Client computer: JMAG-Designer

Management server: JMAG-RemoteSystem

CPU node: JMAG-Designer, JMAG-RemoteSystem

Between the layers, the input file and result file for the calculation are exchanged using "job" and "leaf" units. A set of the calculation input file (jcf file) and the calculation result file (jplot file) for one case is referred to as a "leaf", and all the "leaf" analysis units combined are called a "job". When using a remote system with a tool such as JMAG-RT, one "job" contains more than one "leaf"(Fig.1).



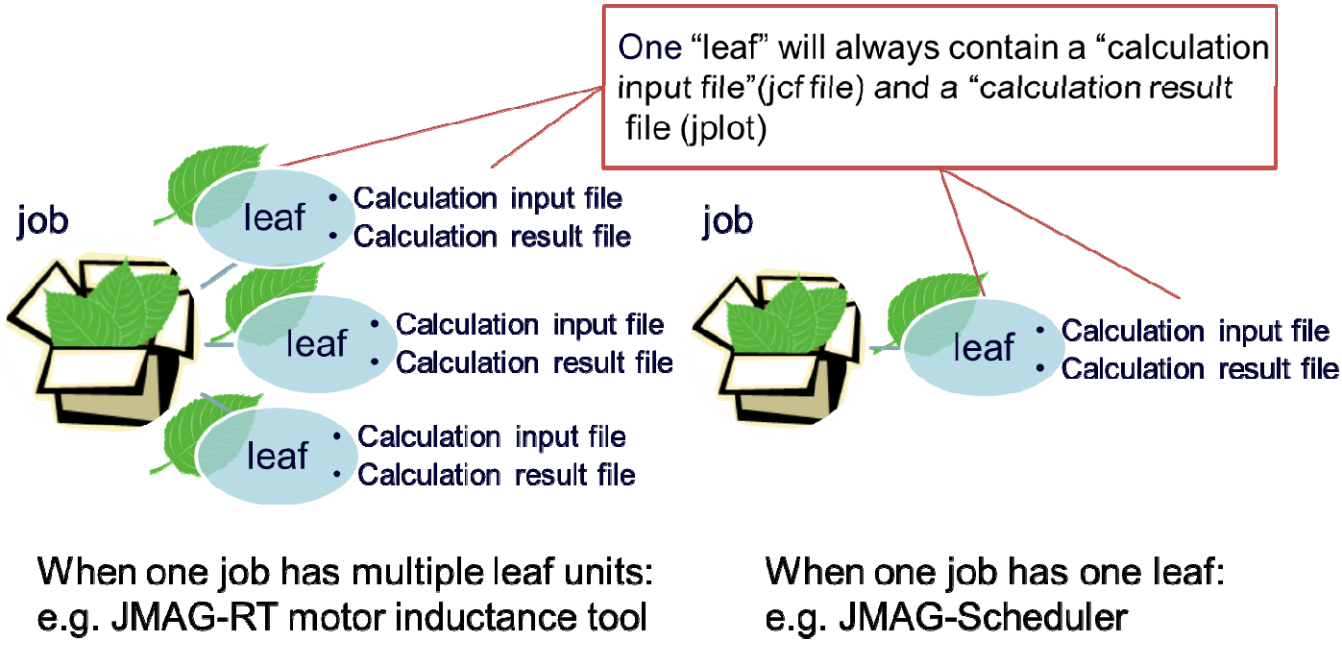


Fig.1 Outline of "job" and "leaf"

The following shows the process flow, starting with performing a calculation using a remote system, and ending with acquiring the results(Fig 2,3).

(1) The analysis model is created on the client computer, a remote system is used to perform the analysis, and then the input file for calculation is sent to the management server as a "job".

(2) The job is divided into "leaf" units on the management server, and the "leaf" units are sent to the CPU node. The CPU node to be used is then selected automatically from the specified CPU group.

(3) Once calculation of the received "leaf" is completed on the CPU node, the result file is sent to the management server. After the data is sent, all the analysis data on the CPU node is deleted.

(4) After all the "leaf" calculations contained in the "job" are completed, and the management server receives all the result files, the result files are sent to the client machine. By default, all the analysis data are removed from the management server, but the settings can be configured so the data is kept.

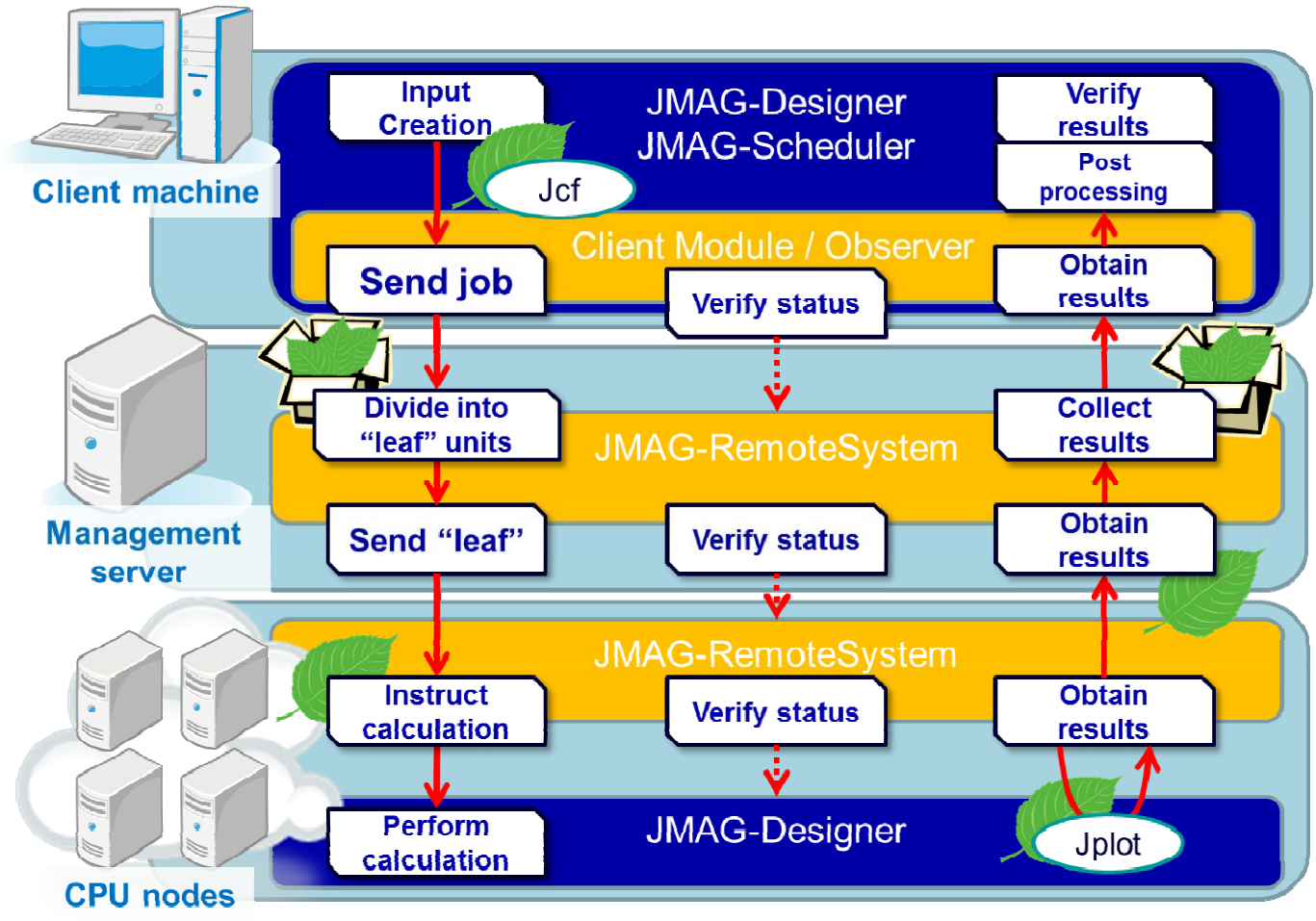


Fig.2 Remote system configuration and calculation flow

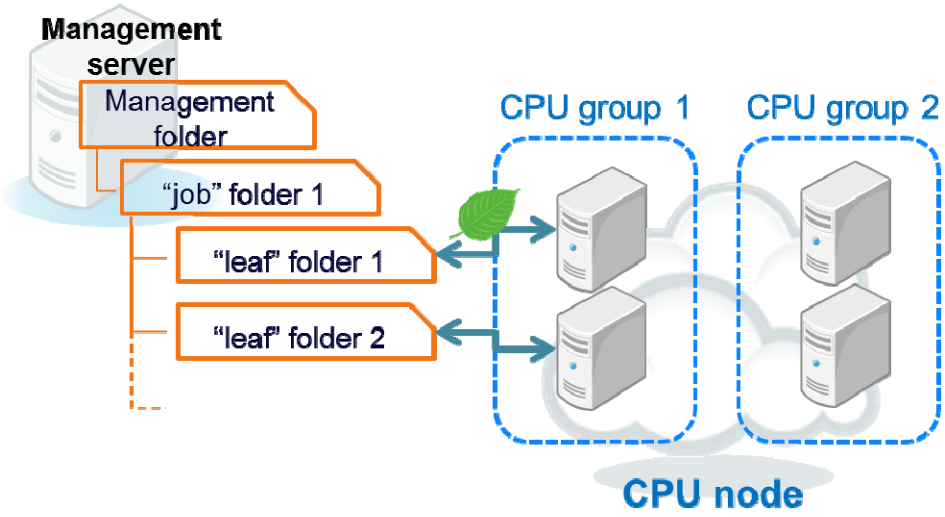


Fig.3 Function of the management server

Progress monitoring for each job, file management, and CPU node management is performed on the management server.

Technical FAQ on the Web

We have technical FAQ on our homepage, so come take a look if you have any questions:

URL: http://www.jmag-international.com/support/ja/faq/index.html (User verification required)

The technical FAQ is a collection of actual questions from our clients, so you might discover some new ways to use JMAG if you go through them. We regularly update our website FAQ. Use this together with the JMAG Newsletter to make your analysis work more effective. Please don't hesitate to use JMAG technical support if you have any questions when using JMAG. We hope you will fully master JMAG!

（Takashi Kondo）

Event Information

Report on the JMAG Users Conference

The JMAG Users Conference has been held not only in Japan but also Korea, India, Europe, Taiwan, North America, and China.

JSOL has continued to reflect the opinions of global users in our software through requests and feedback collected from the development plan board introduced in the Japan Users Conference and discussions between JMAG members and users, as well as amongst users. We would like to look back at the Users Conferences held in Japan, Taiwan, North America, and China.

JMAG Users Conference in Japan

Conference Outline

Host ： JSOL Corporation

Date ： Tuesday, December 8 – Wednesday, December 9 , 2015

Venue：Tokyo Conference Center - Shinagawa（Tokyo, Japan）

URL ： http://www.jmag-international.com/event/conference2015/

The JMAG Users Conference is not only known for unique user case studies and partner exhibitions, but it is also an opportunity for users to evaluate JMAG development policies. We have received frank opinions from many users regarding the current functions, support, and future development policies. Developments in JMAG are pursued with reference to these valuable opinions.

For those who were not able to participate last year, join us this year to make the best of JMAG. We would like to start off with the introduction of the JMAG Users Conference held in Japan.

Presentations

We invited Hokkaido University professor, Hajime Igarashi, and University of Glasgow Emeritus Professor, T.J.E. Miller for the keynote speech, and had 13 sessions by JMAG users, totalling 33 presentations. Their presentations covered the latest topics, case studies using JMAG, as well as points they had the most difficulty such as with development results and the process. We received input from participants saying it helped in "understanding the recent market situation" and "knowing the fact that they had difficulties with similar issues."

Development planning (December 8 10:10～11:10)

Development planning of JMAG

Dr.Takashi Yamada
JSOL Corp.

We shared a year's worth of accomplishments, such as a parallel solver to increase calculation speeds and an improved user interface to increase efficiency, and we also shared our most current development plan. This year we introduced another important topic that we have been putting our best efforts towards: design space exploration.

Keynote Speech
(December 8 11:10～12:10)

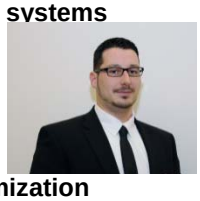
Optimal Design Using Computational Electromagnetism
Dr.Hajime Igarashi
Hokkaido University

The presentation covered an explanation of the optimization method using genetic algorithms and case studies applying these optimization methods to optimization issues in electromagnetic field analysis.

The presentation showed that the implementing the topology optimization in the domain of motor design especially using electromagnetic field analysis has begun.

Optimization Session
(December 8 13:10～14:40)

Optimization of Traction Motors for Automotive Applications using High-Performance Computing
Mr.Bernd Cebulski
IAV GmbH

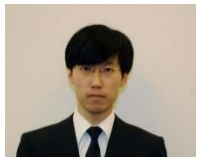


Electromagnetic-thermal coupled multi-objective optimization on HPC systems for rotating electrical machines used in phev applications
Mr.David Philipp Morisco
Robert Bosch GmbH

Multi-Physics Machine Design Optimization Based on Finite Element Analysis Using High-Throughput Computing
Dr.Wenying Jian
Nanjing University of Aeronautics

All three sessions were similar in the sense that multi-objective optimization accounting for multiphysics (magnetic field-thermal, magnetic field-structural) were analyzed in short amounts of time using a large-scale cluster. These were sessions that proved practical use for optimization calculations that originally took a lot of time.

Electric power Session
(December 8 13:10～14:40)



Analysis of a Claw Pole Rotating Machine Regeneration
Mr.Taiga Komatsu
Mitsubishi Electric Corporation

Noise and Vibration of Oil-Immersed Transformer Generated by Load Current
Mr.Kiyoshi Wakimoto
MEIDENSHA CORPORATION

Starting performance analysis of solid salient poles synchronous motor by Finite Element Method
Mr.Ryosuke Tan
TOSHIBA MITSUBISHI-ELECTRIC

We had one transformer presentation and two generator presentations.

Transformers were discussed as a theme of vibration/noise coupling analysis for three consecutive years, indicating a systematic approach to the issue of vibration/noise in transformers.

Presentations on generators were both related to the effects of coil ends, and possibly reflected on the trend of generator analyses.

Motor 1 Session
(December 8 16:10～17:40)

The effort of fast numerical simulation of large scale electromagnetic field analysis
Mr.Toshihisa Abe
SUZUKI MOTOR CORPORATION

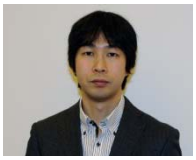
Coupled Thermal/Structural/Magnetic Field Analysis Using JMAG
Mr.Shinya Tanaka
JFE Techno-Research Corporation

JMAG Case Study Presentation for Developing Electric Components of a Motorcycle Engine
Mr.Kouta Yamahaku
YAMAHA MOTOR ELECTRONICS CO.,LTD.

All three presentations were related to motors such as large-scale calculations with MPP, thermal-structural-magnetic field coupling analysis, and designers' involvement in JMAG.

Wireless power transfer Session (December 8 16:10～17:40)

Introduction to the Difference between Electromagnetic Induction and Magnetic Resonance Coupling
Dr.Takehiro Imura
The University of Tokyo



Development of a wireless power transfer technology and electromagnetic field analysis
Mr.Tomio Yasuda
TECHNOVA INC.

Electromagnetic design method of wireless charging coil mounted under a vehicle
Mr.Hiroaki Yuasa, Mr.Nobuhiro Kibudera
TOYOTA MOTOR CORPORATION
/ Mr.Norihiro Kimura Nippon SOKEN INC.

There were three presentations from both the perspective of industry and academic.

History of wireless power supply and theories related to transfer efficiency were covered in the "academic" perspective, and application technologies targeting automobiles were covered in the "industry" perspective.

Analysis technologies that are expected of JMAG became clear through the sessions.

Morning Session (December 9 09:30～10:00)

Useful Tips for JMAG-Designer
Mr.Masayuki Kawai
JSOL Corp.

We introduced “Useful Tips forJMAG-Designer”.

The presentation introduced handy functions with demonstrations that were not covered in the New Features document.

Keynote Speech (December 9 10:00～11:00)

The Electric Machine Designer in the 21st Century
Emeritus Professor T.J.E. Miller
University of Glasgow

The presentation introduced the value of JMAG-Designer in its capability for detailed analysis while providing guidelines for JMAG to be a practical motor design tool.

Requirements for motor design tools, as well as explanations on issues such as lack in accuracy if it is to be too simple, while being less useful and too slow if it is to be complicated, were covered in this presentation.

Motor 2 Session (December 9 12:00～14:00)

Study on the Application of the JMAG Optimization Function in Motor Design
Mr.Yoshiyuki Sakashita
PUES Corporation

Some JMAG Designing Technique on IPMSM under a Magnet-Saving Scheme
Dr.Tadashi Sonobe
MAYEKAWA MFG. CO., LTD.

Thermal Demagnetization Analysis of Neodymium-Iron-Boron Sintered Magnets With Non-Uniform Coercivity Distribution by Diffusing Heavy Rare Earth Element Using JMAG
Mr.Nobuyuki Shimbo
TDK Corporation

Eddy Current Loss Evaluation and Temperature Rise Verification of Stator Core Clamping Stud Bolts in Alternating Current Rotational Machines
Mr.Seigo Taku
TOSHIBA MITSUBISHI-ELECTRIC INDUSTRIAL SYSTEMS CORPORATION

Four presentations were on the theme of motors.

The first was case studies using the GA function of JMAG in motor design, the second was magnetic circuit design and structure design using centrifugal force analysis, the third was demagnetization characteristics analysis of diffused magnets, and the fourth was the evaluation method of eddy current that occurs in the supporting structure member of large-scale machines.

The variety in case studies shows that JMAG is

used in wide-ranging applications and fields.－－－－

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Induction Heating Session (December 9 12:00～14:00)

Development and Experimental Verification of Simulation Code on Induction Heat Treatment Process
Dr.Ju, Dong-Ying
Saitama Institute of Technology

Feedback control assisted IH analysis
Mr.Hiroshi Yuki
NTN Corporation

Metal Induction Heating Analysis with Two-Way Coupling of JMAG and STAR-CCM+
Mr.Masaki Takeuchi
Fuji Electric Co.,Ltd.

Analytical Predictions for Residual Stress in Crankshaft Subjected to Induction Hardening
Mr.Hideaki Ueda
YANMAR CO., LTD.

Three presentations were on case studies of coupling between JMAG and other software, and one presentation was on customization topics.

Applied ranges and evaluation items are increaing annually, so it may have been a good opportunity in understanding the the applied range of JMAG is continually expanding.

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Loss Session (December 9 16:05～18:05)

Evaluation of Iron Loss Analysis and Material Modeling Accounting for Residual Strain
Mr.Hiroyuki Sano
JSOL Corp.

Evaluation of performances of a PMSM taking into account the impact of the lamination cutting
Dr.Xavier JANNOT
Leroy Somer

Propulsion System Linear Motor: Optimization using HEEDS + JMAG
Dr.James R Dorris
Hyperloop Technologies

Measurement and evaluation for the iron loss of electrical steel sheets considering the compressive stress.
Dr.Shinya Urata
Toyota Central R&D LABS.,INC

Three presentations were on evaluation studies of effects due to cutting and stress of steel sheets, indicating a high interest in loss. There was also an optimization case study of coupling with HEEDS. It may have assisted some in solving issues related to loss.

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JMAG-RT / Measurement Session (December 9 16:05～18:05)

Applied Cases of Control Development and Verification for Motor HILS using JMAG-RT
Mr.Tomohiro Morita
Fuji Heavy Industries Ltd.

Applying HILS in the Development of Sensorless Motor Control
Mr.Akira Ide
Toyota Industries corporation

The design of magnetic circuit for magnetostrictive sensor
Mr.Hiroshi Matsumoto
YAMAHA MOTOR CO., LTD.

In-orbit magnetic attitude disturbance in LEO small satellites
Dr.Takaya Inamori
The University of Tokyo

The first two presentations were on case studies of JMAG-RT in control evaluation and ECU verification, and the last two presentations were introductions of new JMAG case studies. Both presentations became useful references for plotting the expansion of JMAG.

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Partner Seminar (December 9 14:45～15:15)

Innovative process of design exploratio using JMAG and HEEDS
CD-adapco Co., Ltd.
Dr.Taiki Matsumura

(December 8 14:45～15:15)

From circuit to virtual integrated system, Model-Based reliability verification and analysis

Mentor Graphics Japan Co., Ltd.
Mr.Masanari Ueda

(December 8 14:05～14:35)

On the modeling, prediction and solutions for acoustic emission of Reluctance Machines (RM)

SIEMENS PLM Software
Dr.Koen De Langhe

(December 9 14:05～14:35)

2-Step Multi Objective Optimization of EV System by 1D and 3D Integration

Cybernet Systems Co., Ltd.
Dr.Koichi Shigematsu

(December 9 15:20～15:50)

JMAG Parallel Execution Environment using a PC Cluster

SCSK Corporation
Mr.Atsuo Nakata

(December 9 15:20～15:50)

JMAG-RT Running in a 260mmRT Running in a

DSP Technology Co.,Ltd.
Mr.Yoshihiko Ozaki

(December 9 14:05～14:35)

Future of Tools for Real-Time Test

National Instruments
Mr.Ben Black
／ OPAL-RT Technologies
Mr.Jean Belanger

Open forum
(December 9 18:05～18:25)

JMAG's responses to user proposals

JSOL Corp.
Takashi Yamada

The forum introduced topics that were discussed most addressing the demands written on the development plan board and the feedback we received.

JSOL will strive for further developments of features and improvements so we can report our efforts in the JMAG Users Conference of 2016.

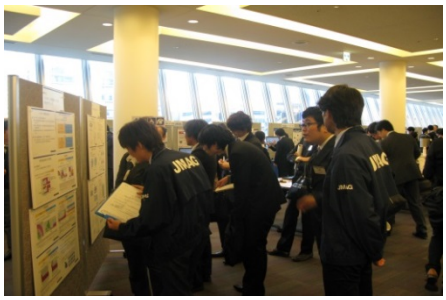
Poster Exhibition

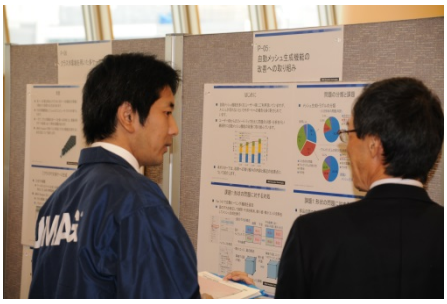
From introducing the analysis techniques to troubleshooting, 15 posters were on display for the duration of the conference.

The posters showed everything from the basics of electromagnetic analyses, which allow physical phenomena to be understood, to steps detailing how to use JMAG. We emphasized not just conveying information, but communication as well. We hoped that by having JMAG developers available to answer questions and offer analysis hints, the posters could be more easily understood.

Development for JMAG-Designer Ver 15.0 was focused on adding functions for supporting optimization designs and improving usability. On top of introducing the new features, we were also able to listen to what everybody would like us to develop in future versions. Regarding the introduction of the improved post-function, needed for performing a multi-faceted results analysis, we received the following positive feedback: "Having all the documents for the post-function served a great reference". We also introduced various case studies for multiphysics analyses that are thought of by many as something they would like to do, but because of their difficulty they don't know how to get started. We received comments such as "I can't believe that could be analyzed", and "I want to learn more about methods for performing even more detailed analyses".

We received comments from those who visited our poster exhibition such as "Because they were on display the entire time, I was able to look at them in detail", and "All the information I needed to really get started using JMAG was available to me". We hope we can continue to give valuable information to our users.





Seminars and Development Boards

Together with the presentations from JMAG's technical partners, demonstrations were given so JMAG can be even better used. Because JMAG's functions were introduced through the developer's presentations, we felt this was a great opportunity to get to know JMAG on a deeper level.

This year we used simple models to introduce the always popular iron loss analyses so beginners could also understand as well, while also demonstrating result differences when using various analysis methods. It seemed everybody especially took note of our introduction to direct current magnetic properties. Some participants told us that participating in seminars enabled them to resolve current job issues they were having.

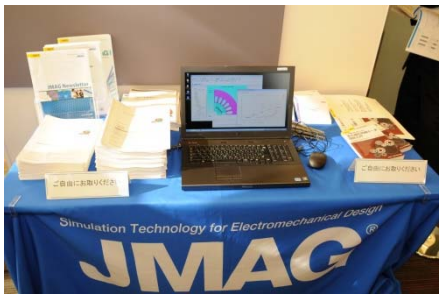
We plan to give more seminars that aid in resolving issues.

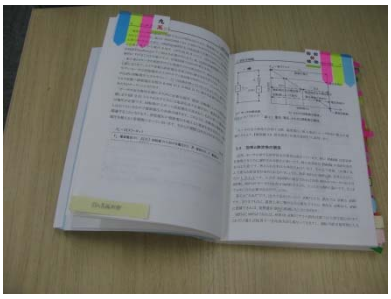
Titled "Development plans made by everyone", we exhibited a development board in which everybody could freely write their opinions. We received all kinds of feedback from our attendees. The opinions we received will serve as a basis for our future development plans.


Exhibition

In anticipation of the all new JMAG-Designer Ver.15.0 being released, we held a demonstration at our booth. Users were able to preview the new features and improved functions, and we hoped everybody could experience for themselves how much easier it is to use JMAG.

We were very surprised by large amount of written input we received from the monitors for our motor design handbook. The handbook will go on sale this year. We will release more information in the days ahead, so stay tuned.



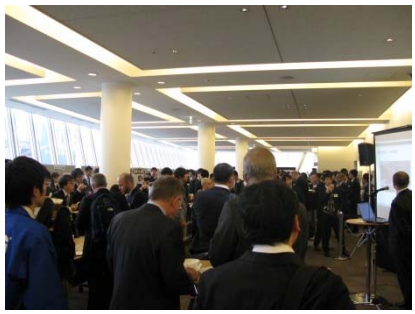


Partner Exhibitions

Material manufactures, who provide data for the material database, and many of our technical partners gave presentations.

Our premium sponsor SCSK brought cluster machines, giving a demonstration on large-scale calculations. We received opinions from those considering clustering such as "Seeing an actual cluster machine shocked me".

Various kinds of useful information on developing electronic machines was provided at the JMAG Users Conference by our partners.



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NATIONAL INSTRUMENTS
OPAL-RT TECHNOLOGIES

Announcing the 2016 JMAG Users Conference

The 2016 JMAG Users Conference will be held from Wednesday, December 7th to Thursday, December 8th at the Tokyo Conference Center - Shinagawa (Tokyo, Japan). Be sure to mark those dates in your calendars!

JMAG Users Conference in Taiwan

Conference Outline

Host ： FLOTREND CORPORATION

Date ： Tuesday, August 25, 2015

Venue： ： GIS NTU Convention Center (Taipei, Taiwan)

URL ： http://www.jmag-international.com/event/2015/2015_TaiwanUC.html

The JMAG Users Conference was held in the GIS NTU Convention Center in Taipei on August 25th. From universities to electronic manufactures, over 70 organizations attended the conference.

50% of the participants came from universities (professors and students), 25% were existing customers, and the last 25% accounted for potential customers. The large number of university participants can be attributed to "Future JMAGer (JMAG User) Cultivation", one of the strategies employed by the event organizer and Taiwan distributor Flotrend. Their aim is to allow university students to get a feel for JMAG's technical capabilities and ease of use in hope of them to continuing to use JMAG even after they start their professional career.

We also had many presenters, such as Nidec Corporation Research and Development Center, Taiwan, and also various research institutions and prestigious universities.

Universities and national research centers in Taiwan aim to serve as a hub for technical information; both the participants and presenters offer a community which is slightly different than Japan's. Targeting universities for potential customers isn't a viable strategy in Japan; we learned a lot from the activities of the Taiwan distributors.

JMAG Users Conference in USA

Conference Outline

Host ： POWERSYS Inc.

Date ： Wednesday, October 21 - Thursday, October 22, 2015

Venue： THE WESTIN SOUTHFIELD DETROIT（Southfield, America)

URL ： http://www.jmag-international.com/event/2015/2015_USAUC.html

Use of JMAG has been growing in America as well, and this marks the third year we have held a users conference here. This year a two-day users conference was held in Detroit, America's automotive capital.

The first day was Technical Day, covering technologies with considerable interest related to electromagnetic field analysis. Solutions and related technologies were covered. A wide range of topics were covered, from theoretical topics such as increasing analysis accuracy, to other advanced topics covering multiphysics and design optimization calculations, but this was far from a one-way conversation; participants shared many of their honest opinions and requests.

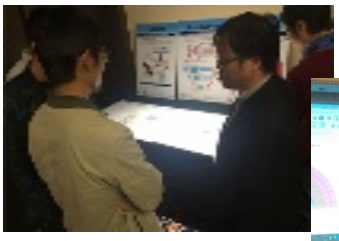
On the second day, six organizations and research groups held presentations and shared their case studies. Organizations representing America such as General Motors and Michigan State University gave presentations, giving us a peak into actual JMAG projects and how JMAG has made its way into the realm of university education. Extremely advanced machinery and phenomena were exhibited during the presentations; innovation from a technical aspect and the expected role of JMAG to analyze these innovations was incorporated into these enriching presentations.

A total of approximately 70 people attended the meeting, but regular participants and staff held technical talks not only in the main hall, but in the side rooms as well, making for a very exciting two days. It was very reassuring for the staff to see

such a lively event being created by JMAG users overseas, and it lifted our spirits by continuing to provide value in order to meet their expectations.

JMAG Users Conference in China

Conference Outline



Host ： IDAJ-China Co.,LTD.

Date ： Tuesday, November 24, 2015

Venue： Grand Soluxe Zhongyou Hotel（Shanghai, China）

URL ： http://www.jmag-international.com/ event/2015/2015_ChinaUC.html

The annual users conference hosted again this year by JMAG's China distributor IDAJ in Shanghai. Over 60 users attended, coming from industries such as local automobile and electronics manufacturers. Two engineers from JSOL also joined the conference to exchange information and engage in lively discussions about JMAG.

This year's conference had the largest user turnout so far, and we felt how much effort our distributor had put into working with local businesses. The number of participating users continues to grow every year, and JMAG's core user base also continues to take shape.

Free discussions were held the first day of the conference. IDAJ and JSOL put their brains to the test and tried to resolve an array of difficult questions fielded by the users. When we couldn't come up with an answer, other users chimed in with their ideas, giving way to a lively discussion. It was anything but orderly, but it truly was a "user's" conference.

The focus of second day was JMAG user case studies, and IDAJ presented the new version of JMAG and a FAQ. From JSOL, Hiroyuki Sano presented a JMAG development roadmap, and Tetsuya Hattori presented analysis technology trends. During the user case studies, China's top automobile manufacturer FAW presented a memorable case study on the development of motor systems for hybrid cars. Having an excellent command of JMAG, difficult analyses were tackled, which collected a lot of attention from other participants. Other user case studies showed great mastery of JMAG; it was apparent how IDAJ always goes above and beyond with their support. It is a challenge for JSOL to even better support the activities of our distributor.

Of course, we received many feature requests. We hope that we can develop these requests in the future.

The JMAG Users conference is held in many different cities. We hope that those of you who couldn't attend, and of course also those of that those of you did attend this year will attend a future conference held in one of the cities.

We hope that your time spent at the conference was a fulfilling experience.

Writer: Tomomi Igarashi

Event Information

Event Report for August - December 2015

Attendees report on events held fromAugust to December, 2015. We hope you will attend our next event.

Exhibition NI Week 2015

Conference Outline

Host : National Instruments Corporation

Date : Monday, August 3 - Thursday, August 6, 2015

Venue: Austin Convention Center (Texas, USA)

URL : http://www.ni.com/niweek/

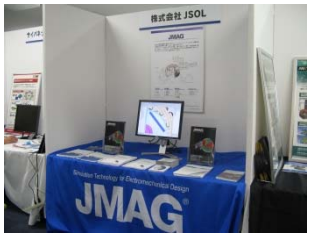
National Instruments Corporation is a measuring instruments and controller manufacturer, and their headquarters are located in Austin, Texas. NIWeek, largest technology event, was held, and participants from a wide array of technology fields from America and other countries around the globe gathered at this conference.

During the conference, product exhibitions and workshops including a variety of demonstrations were held, covering the introduction of latest technology trends using application examples and development history, and lively discussions with the participants filled the conference hall.

JMAG's booth presented a coupled analysis cases between JMAG-RT and National Instruments' Motor HILS. The demonstrations and motor drive case studies including inverters and ECUs allowed us to see how much high accuracy HILS environments have expanded.

Exhibition 2015 IEE-Japan Industry Applications Society Conference

Conference Outline



Host : The Institute of Electrical Engineers of Japan

Date : Wednesday, September 2 - Friday, September 4, 2015

Venue: Oita University (Oita, Japan)

URL : http://www.gakkai-web.net/gakkai/jiasc/hp15/index.html (Japanese only)

JMAG booth was exhibited at the Japan Industry Applications Society Conference hosted by IEE. Because this was an event held by academic society, many university students and professors joined the conference, as well as those performing research in corporations.

This year, we had many opportunities to be asked about the merits of implementing JMAG from those working with universities heard that JMAG are chosen by other universities. We introduced some examples where JMAG has been utilized in wide applications for designing electric devices.

Surprisingly, there were JMAG users among the presenters and JMAG was a topic of discussion in the academic conference. Through attending this event, I felt the need to constantly improve our software to meet the demands of our dedicated users.

（Mari Nakamura）

Presentation The Magnetics Society of Japan - Annual Conference

Conference Outline

Host ： The Magnetics Society of Japan

Date ： Tuesday, September 8 - Friday, September 11, 2015

Venue： Nagoya University School of Engineering (Aichi, Japan)

URL ： http://www.magnetics.jp/kouenkai/2015/ (Japanese only)

The Magnetics Society of Japan hosted an Annual Conference, and we presented on the subject of "Finite Element Analysis for Electromechanical Design". We talked about the role of electromagnetic field analyses in the world and the necessity and requirements of new material models with a focus on losses.

Many participants came from universities and research institutes, and we feared they had little involvement with analyses, but the researches stated that the time has come to be more open to these technologies, and we received many questions from them.

There were times in which we were unsure of how to convey the benefits of analysis technologies to those working in different fields than what we are normally accustomed to, and it was a beneficial experience that helped us broaden our views.

Presentation Electromagnetic field analysis application technologies for motor design

Conference Outline

Host ： Kodo Polytech Center

Date ： Thursday, September 17 - Friday, September 18, 2015

Venue： Kodo Polytech Center (Chiba, Japan)

URL ： http://www.apc.jeed.or.jp/seminar/course/15semiP024.html/ (Japanese only)

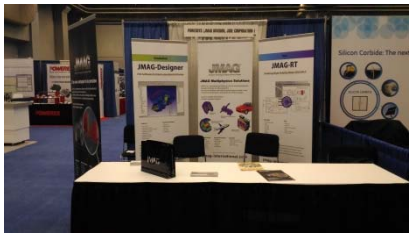
As part of the skill development seminar hosted by the Kodo Polytech Center, we gave a seminar titled "Electromagnetic Field Application Technologies for Motor Design" which introduced methods to learn countermeasures for loss, heat, and vibration from electric and magnetic motor characteristics evaluation through demonstration using electromagnetic field analysis software. We demonstrated methods to create a plant model extremely similar to a physical machine, which is useful for designing controls, in order to bring out the best performance in a motor.

We received feedback from the participants telling us their understanding of analyses was deepened. Because many participants voiced their desire to join next time as well, we hope we can convey the advantages of JMAG in the future seminars including topics on how JMAG can solve issues that arise from design.

（Takayuki Nishio）

Presentation Exhibition ECCE 2015

Conference Outline



Host ： IEEE

Date ： Sunday, September 20, - Thursday, September 24, 2015

Venue： Palais des congrès de Montreal (Montreal, Canada)

URL ： http://2015.ecceconferences.org/exhibitors/

We participated again in this year's annual conference hosted by IEEE. This year a total of 142 lecture sessions were

held, and each held lively discussions regarding technological issues, far exceeding the success of last year.

During the Losses in Electric Machines session, we presented on a method to increase the accuracy of a loss analysis for a SR motor. Receiving many questions after the presentation, and we felt everybody left with a heightened interest in loss analyses. WEMPEC also gave a very memorable presentation regarding their new motor.

Since there were no lectures during the exhibition session, users were able to focus on the exhibition and posters. At the JMAG booth we demonstrated the features of JMAG and showed loss analysis case studies. We were pleasantly surprised to see how much more known JMAG had become compared to the first time we participate in ECEE. We hope to hold more lively presentations and exhibitions at future events.

（Hiroyuki Sano）

Exhibition Coil Winding, Insulation & Electrical Manufacturing Exhibition (CWIEME CHICAGO)

Conference Outline

Host ： i2i Events Group

Date ： Tuesday October 6, 2015 - Wednesday October 7, 2015

Venue： DE Stephens Convention Center (America: Chicago)

Booth No: K4

URL: http://www.coilwindingexpo.com/chicago/

We participated in CWIEME held in America. CWIEME is the world's largest exhibition for various components of electric machines including electric motors and transformers, such as windings, laminated steel sheets, magnets, and insulation.

At the JMAG booth, we performed a demonstration of the new features in JMAG-Designer Ver.14.1, showed solutions for motor design and applied case studies for transformers and JMAG-VTB.

Exhibition MATLAB EXPO 2015 Japan

Conference Outline

Host ： MathWorks Japan

Date ： Friday, October 16, 2015

Venue： GRAND PACIFIC LE DAIBA (Daiba, Tokyo ,Japan)

URL ： http://matlabexpo.com/jp/ (Japanese only)

Continuing from last year, we participated again in the MATLAB EXPO hosted by Mathworks Japan. Because the session break times varied, many attendees visited our booth even while presentations were being held.

Many companies partnered with JMAG also participated, and coupling solutions with JMAG-RT were shown at other booths. Attendees working with control design were interested in high-accuracy plant models at other booths, and many of them also visited our booth as well. We received a variety of questions, from RT model basics to advanced application technologies, allowing us to feel that JMAG-RT joint solutions have become more popular since last year. We will continue to develop functions helpful for business so our software can be further utilized for model based development.

（Tetsuya Hattori）

Exhibition Siemens PLM – Simulation & Test Performance Engineering Conference

Conference Outline

Host ： Siemens Japan K.K.

Date ： Thursday, November 26, 2015

Venue： Tokyo Conference Center (Tokyo ,Japan)

URL ： http://www.plm.automation.siemens.com/ja_jp/about_us/events_webinars/seminars/simulation-and-test-conference2015.shtml (Japanese only)

We participated in Siemens PLM - Simulation & Test Performance Engineering Conference hosted by Siemens Japan K.K. Presentations on model-based development were given with over 200 attendees present, and the atmosphere was electric with excitement as we were shown the direction upcoming vehicle technology development is heading.

At our booth, we showed how useful JMAG-RT coupling solutions can be to model based development. We also received many questions from attendees regarding the coupling functions with LMS Virtual Lab. We were able to hear what many of our JMAG users want from our software, and we were motivated to continue to make the coupling functions even better.

（Takayuki Nishio）

Presentation Exhibition IESF 2015 Japan

Conference Outline

Host ： Mentor Graphics Japan Co., Ltd.

Date、Venue： Wednesday, December 2nd, 2015 Midland Hall (Japan: Aichi)

Friday, December 4th, 2015 Tokyo Conference Center Shinagawa Japan: Tokyo)

URL ： http://www.mentorg.co.jp/events/iesf/iesf2015 (Japanese only)

IESF is a conference targeted towards system simulations for automobiles, hosted by Mentor Graphics Japan. This year's conference also had guest speakers from the automobile industry, and they proposed a total solution covering a wide range of fields from evaluation of automobile ECUs and electric architecture to on-board application development, as well as thermal/electromagnetic analyses.

We gave a presentation titled "Introduction to JMAG-RT: Performing Highly Reliable Motor Drive Simulations using High Accuracy Motor Models", and discussed the high accuracy plant model, JMAG-RT for SystemVision (Mentor Graphics) which is now being developed.

At our booth we introduced high accuracy MILS/SILS/HILS simulations using high accuracy motor models with JMAG-RT. With regard to our high accuracy control simulation proposal, it was beneficial to see how JMAG-RT is needed from the perspective of vehicle development and the development of on-board systems.

（Yusaku Suzuki）

This issue has focused largely on reporting exhibitions and seminars held in Japan, the United States and Europe. JMAG will continue to strive to not only provide technological support, but also to play a part in our customers' global strategy.

Writer: Tomomi Igarashi

JMAG®

Simulation Technology for Electromechanical Design