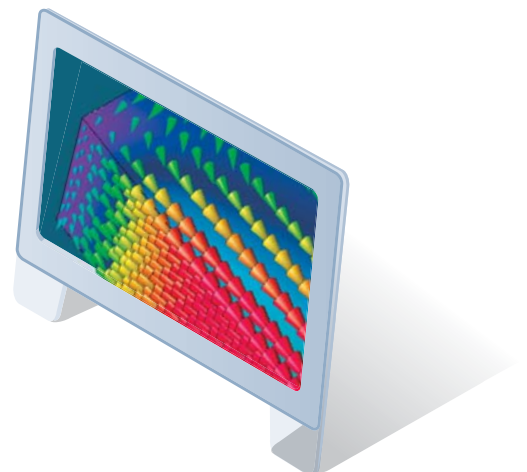


JMAG Newsletter

January, 2013

It is now simple to be precise

JMAG is a comprehensive software suite for
electromechanical equipment design and development.
Powerful simulation and analysis technologies provide a new standard in
performance and quality for product design.
Capture complex phenomena and gain valuable insights.



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JMAG Newsletter: Highlights of the January Issue

We look forward to your continued support of JMAG in the coming year.

This month's Newsletter is focused mainly on JMAG-Designer Ver.12.

JMAG-Designer Ver.12 was released in January, so be sure to download it. The Newsletter includes messages from the people in charge of developing some of the new features. Please have a look through these articles, and try any features you are interested in.

For this month's "Implementing JMAG," we asked Professor Min-Fu Hsieh, who is involved in renewable energy research at Taiwan National Cheng Kung University's Electric Motor Technology Research Center, for his expectations for JMAG and other topics.

In addition, the "A to Z" is about some commonly used functions in magnetic field analysis and the particular characteristics of each one, and the "Event Information" looks back on the JMAG Users Conference 2012 held in December of last year and opinions from people who attended.

The JMAG Newsletter is intended for everybody, from those who are currently using the product to those who have not started yet.

By all means, take this chance to introduce it to someone nearby.

This edition of the JMAG Newsletter is packed with more content than ever. We hope you enjoy it.

JSOL Corporation

Electromagnetic Engineering Department, Engineering Technology Division

Implementing JMAG

Electric Motor Technology Research Center, Taiwan National Cheng Kung University Use of JMAG in Renewable Energy Research

In May, 2012, JMAG's Taiwan distributor, Flotrend, held a JMAG Users Conference in Taiwan attended by around 60 JMAG users.

The JMAG Users Conference benefitted from the cooperation of Professor Min-Fu Hsieh, the current director of Taiwan National Cheng Kung University's Electric Motor Technology Research Center (EMTRC), and saw a lively exchange of ideas among engineers. This report gives an overview of Prof. Min-Fu Hsieh's activities.

— Please tell us about Taiwan National Cheng Kung University's Electric Motor Technology Research Center.

Prof. Hsieh: The EMTRC was initially founded by Prof. Mi-Ching Tsai in 1999 and further funded by China Steel Corporation in 2008. We aim to support motor-related industries in Taiwan.

We take part in a wide range of development and promotion activities, from materials to systems. We have worked with Delta Electronics Inc., SUNON Industry Company, Taiwan HITACHI Corporation, Tatung Technology Inc. and many other companies. Many of them are still our partners.

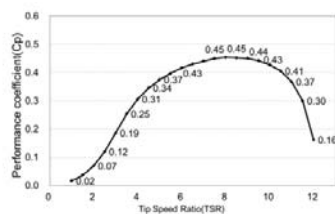


Fig. 1 A small wind turbine and its properties (Collaboration with Prof. Fei-Bin Hsiao, National Cheng Kung University)

— What kind of research are you doing?

Prof. Hsieh: I'm mainly focused on renewable energy (wind, tidal, etc.) and electric vehicles.

I work on rare earth and non-rare earth



permanent magnet motors and non-permanent magnet motors (for example, brushless double-fed and reluctance motors), magnetic circuits, and magnetization (especially post-assembly magnetization techniques).

— Could you tell us a little about the current state of your fields of expertise, electromagnetics and renewable energy?

Prof. Hsieh: Electromagnetics covers an extremely wide range of research and applications. Things from spintronics and magnetic memory to large-scale wind turbine generators of several megawatts are all closely related to electromagnetics.

A lot of papers are published in the academic societies. Hundreds of papers are presented in INTERMAG (sponsored by IEEE) every year, and COMPUMAG and CEFC also regularly get hundreds of submissions. These are all

magnetics-related conferences.

In recent years, awareness of energy and ecological issues has grown, and among technologies related to renewable energy and energy efficiency, generators and motors have received particular attention. The field of electromagnetics has greatly expanded because of this.

One example I can give you here is a large-scale wind turbine generator that uses high-temperature superconducting materials. The magnetic field generated by superconducting tapes or bulk materials can improve a generator's torque density, power density, and efficiency. This makes direct drive possible without a step-up gear, which in turn contributes to efficiency. Superconductor technologies are likely to be extremely important for future generators in renewable energy systems.

— I see. So it's connected to efficiency in generators. Could you tell us a little more about research into generators and motors?

Prof. Hsieh: Before, the problem of efficiency was not considered very important in development of motors and generators.

As motors have come to be used in a variety of fields, electronics, materials, and system control technologies have progressed, and high-performance motors can now be developed. Because of this, more and more high-performance motor development is happening in a lot of industries.

For example, the drive of air-conditioning compressors has evolved from fixed-speed drive to variable-frequency drive.

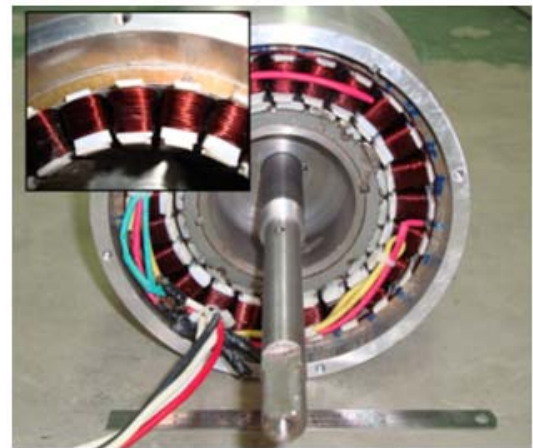


Fig. 2 A permanent-magnet generator (prototype)

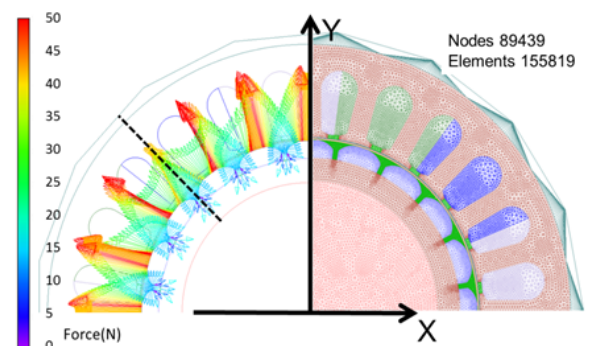


Fig. 3 JMAG analysis results:

electromagnetic force (left) and mesh (right)

— What is your outlook for the future regarding motors?

Prof. Hsieh: Each different motor has its strengths and weaknesses. You have to choose the right motor type based on what is most important for your application, the cost, size, efficiency, etc.

For example, permanent-magnet motors, induction motors, and reluctance motors each have their own problems. Still, each of them fulfill certain needs, and they are all being used as motors for electric vehicles.

In particular, induction motors, which had generally been considered a mature technology, are now expected to see higher performance through advances in materials and design. Even

the automobile industry, which had ignored induction motors, is now giving attention to high-performance induction motor development.

Further, integration of motors or generators into overall systems must be taken into consideration in order to achieve high performance. System integration will certainly be seen as even more important in the future.

— Please tell us about your expectations for CAE and development of human resources.

Prof. Hsieh: Motor design has become a lot more efficient thanks to improvements in computer performance and CAE software development.

Design accuracy is increasing through the use of JMAG. This is why engineers and researchers who can use CAE software play a key role in the industry.

Emphasis on both theory and practice is needed to develop these human resources.

For one thing, if engineers do not have the fundamental theory and knowledge, they will not be able to use CAE software correctly, and will not be able to verify analysis results or derive physical phenomena from those results.

Also, experience with experiments and physical prototypes allows them to take advantage of CAE's power in verifying design proposals.

There are many excellent electric motor manufacturers in Taiwan, but the research capability is not quite there, and there is a shortage of human resources for CAE. For these reasons, the development of CAE human resources is a serious issue for any further expansion of this industry.

— Finally, do you have anything to say to JMAG's Taiwan distributor, Flotrend Corporation?

Prof. Hsieh: I simulate heat dissipation using Acusolve, which is CFD software handled by Flotrend, and JMAG in combination. Flotrend is thoroughly versed in both programs, so setting this up was very quick. I'm sure I will make use of it linked to more and more simulation programs in the future. I hope I can count on your support.

Thank you very much, Professor Min-Fu Hsieh

Interviewer: Kevin Chen, Flotrend Corporation



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Product Report

Introducing JMAG-Designer Ver.12

We released JMAG-Designer Ver.12 in January, 2013.

In this report, the people in charge of various new functions introduce important points for your attention.

Overview

We have been working day after day on development to allow users to accurately grasp complex physical phenomena and obtain results via a few operations and without any confusion. The result is JMAG Designer Ver.12, which we released in January, 2013.

Details of how to use the software will be presented at Upgrade Seminars and other events. This report contains messages from the people in charge of developing the new functions.

- Simulation Engine

JMAG endeavors to provide fast and stable solvers and meshers. In Ver.12, we have released an expanded slide mesh that provides proper GPU support and mesh with a greater degree of freedom and precision.

- Physical Modeling

Detailed modeling is necessary to carry out accurate analyses, but there are limits to how much time can be spent on modeling. JMAG provides modeling functions that allow both high accuracy and high speed. Ver.12's release includes support for magnetostriction, as well as eddy current loss calculation functionality for laminated steel sheet. It also supports coil end modeling functions and harmonic current input for calculation of stray load loss.

- Results Analysis

Designs become more reliable as simulation can be done with more combinations of design parameters. We are always working toward better functionality for analyzing results in JMAG, and in Ver.11, we improved its efficiency map and parametric analysis functions. For

Ver.12, we have added optimization functions, evaluation of differences between results, and functions for harmonic analysis.

- Easier to Use

JMAG is a general-purpose simulation tool primarily for electromagnetic field analysis. It includes a large number of superior functions to enable better simulation. However, most designers who use JMAG need it for certain types of analysis.

Because of this, JMAG includes JMAG-Express, aimed particularly at motor designers. Ver.12 adds synchronous reluctance motor (SRM) support to the previously-supported permanent magnet synchronous motor (PMSM) and induction motor (IM).

We have also released JMAG-VTB Ver.2.0 with a new interface to be used as a dedicated system by users other than motor designers as well.

Now, we'll take a look at each of these functions.

Simulation Engine GPU Support

In recent years, graphics processing units (GPUs), which are hardware for high-speed graphics processing, have been receiving greater attention.

For this reason, JMAG began supporting GPUs at an early stage. In Ver.12, it is now possible to use multiple GPUs in parallel.

Fig. 1 shows one example of a comparison between CPU and GPU calculation times. In this example, using one GPU board leads to a near-doubling of calculation

speed over four CPU cores. As for multiple GPUs, calculation time is reduced with every GPU board that is added.

We intend to continue making even greater improvements in processing speed, particularly with multiple GPUs, in the future.

(Masahiko Miwa)

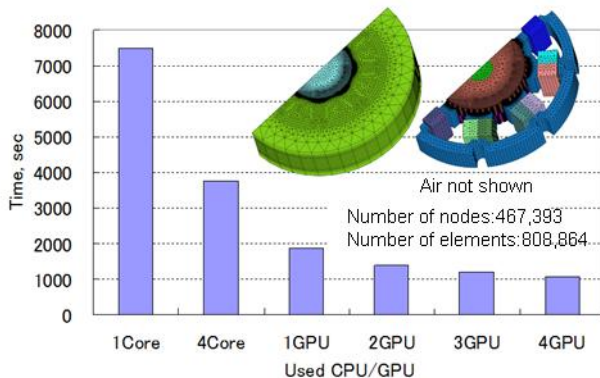


Fig. 1 GPU used for a hybrid stepper motor

Computer Used: CPU: Intel(R) Xeon(R) X5672@3.2GHz

GPU: Tesla C2070

* Evaluation of calculation time for solution-finding only.

Time for building equations and file I/O not included.

Extended Slide Mesh

To create the mesh for 3D analysis of a rotating machine, JMAG provides both a slide mesh function and a function to create mesh at each step (patch mesh). The slide mesh function allows greater analysis accuracy than the patch mesh function, but in the past there have been limits to the geometries on which it can be used. For this reason, it was necessary to use the patch mesh function when running analyses on a rotating machine with a case or on an axial gap machine.

In Ver.12, we have developed an extended slide mesh function that allows accurate analysis of these types of machine. This function combines the slide mesh and patch mesh functions. Therefore, by applying a slide mesh to the air gap areas that are vital for precise

analysis, and creating mesh at each analysis step for the other air regions, more accurate analysis can be achieved (Fig. 2).

This is one result of the high-precision technology development for rotating machines that we are working on for JMAG. Please try using this for any rotating machine models that you used to analyze with the patch mesh function.

(Kensuke Matsunaga)

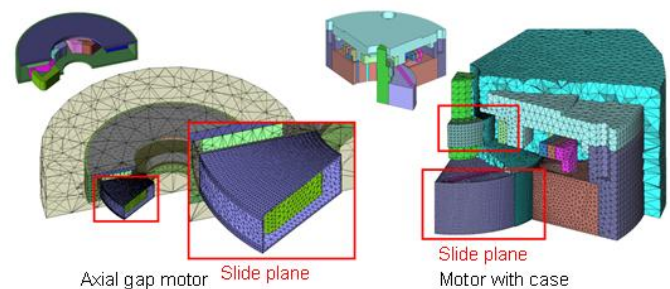


Fig. 2 Using the expanded slide mesh

Physical Modeling

Support for Magnetostriction

Magnetostriction is generated when magnetic flux flows in magnetic steel sheet. Although the changes to a geometry due to magnetostriction are subtle, the effects they can have on electrical devices are not necessarily so minor. For example, magnetostriction is a major cause of vibration and noise in a power transformer. Therefore, it is important to estimate noise and vibration caused by magnetostriction at the design stage.

In Ver.12, it is now possible to run a structural/vibration analysis taking magnetostriction into account. Based on the magnetic flux density obtained from magnetic field analysis, and taking magnetostriction properties into account, the virtual force that produces magnetostrictive strain is calculated as the magnetostrictive force (the left side of Fig. 3). The force calculated in this manner is treated as an input load in JMAG's structural/vibration analysis, the same as the usual electromagnetic force.

Magnetostrictive force can also be used in other structural analysis software via electromagnetic force settings tools.

The right side of Fig. 3 shows the displacement due to magnetostriction in a transformer core, with the right and left legs clearly expanding from the magnetostriction. Even when it is not possible to prototype power transformers, the effects of magnetostriction can be estimated using this function.

By paying attention to the various problems that arise from electromagnetic phenomena, such as vibration and noise due to magnetostriction, JMAG robustly supports the design of electric devices.

(Kensuke Matsunaga)

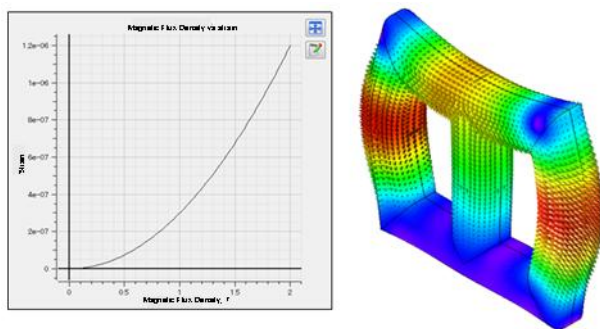


Fig. 3 Magnetostrictive vibration in a transformer core

Eddy Current Loss Calculation for Laminated Steel Sheet

Because of the use of power supplies with higher frequencies in rotating machines, transformers, etc., the eddy currents generated inside laminated steel sheet have become a problem in recent years. Up to now, it has been necessary to create an extremely fine mesh during simulation for each layer of laminated steel sheet and run a 3D analysis in order to accurately estimate the loss in steel sheet. To solve this problem, we have made it possible to use simple settings to consider eddy currents inside steel sheet in electromagnetic field analysis.

In order to allow evaluation of loss in the laminated

core of a motor or transformer, a rough mesh is generated for the core, which is treated as one solid mass in 3D analysis, and the analysis can then be run taking the eddy currents in each steel sheet lamination into account (Fig. 4). Analysis considering eddy currents in steel sheet can also be done with 2D analysis.

Here is an example of the use of this function in a 2D rotating machine analysis. A reduction in output torque corresponding to generated loss can be observed by using this function to consider lamination loss. In this example, the result is an average 8% reduction in torque (Fig. 5). We have also applied the harmonic current input function mentioned above to the current power in order to take harmonics into account.

Because an already-existing 2D model can be used without alterations, settings are extremely simple. We hope this feature will be useful for anyone who has wanted to know the loss in lamination, but found it too much trouble to create a 3D mesh.

(Kazuki Semba)

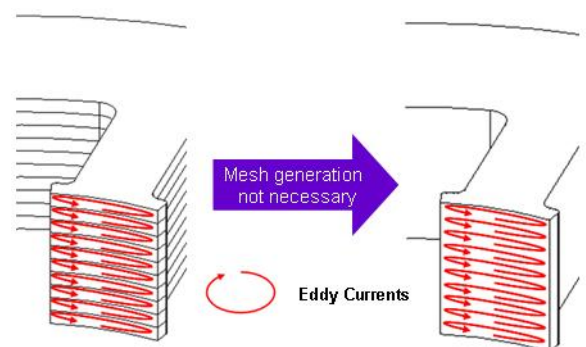


Fig. 4 Eddy current distribution in laminated steel sheet

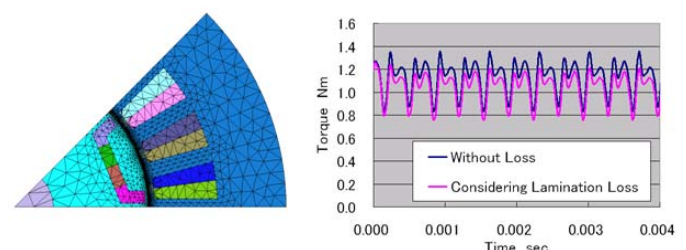


Fig. 5 Reduction in torque due to loss in a 2D motor

Coil End Modeling Functions

How can winding geometries be modeled to include their coil ends? In order to accurately grasp physical phenomena such as stray load loss, the effects of coil ends cannot be ignored. However, there are surely many people who have had bad experiences due to the need for complicated sweep lines in creating CAD for coil end geometries.

With the new coil template functionality in JMAG-Designer Ver.12, it is no longer necessary to define these complicated sweep lines. You can now create complex winding geometries including coil ends simply by entering parameters such as number of slots and pitch. Furthermore, not only can you model entire winding geometries with the coil template function, but you can also smoothly connect just the ends to models of coils that you have already created (Fig. 6). We hope you will try using this function.

Coil templates in Ver.12 are our first foray into geometry templates. In the future, we plan to add many more different types of geometry template, not limited to winding geometries. Please watch out for more geometry templates coming soon.

(Yuya Yamashita)

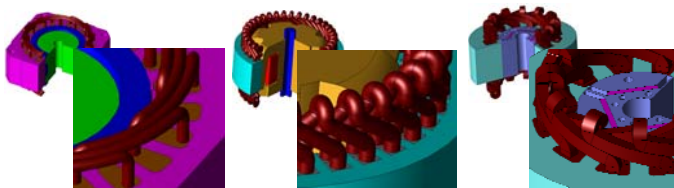


Fig. 6 Coil end modeling using coil templates

Harmonic Current Input

Settings for harmonic current have now become easier in electromagnetic field analysis. High-order current and phase can now be set in an instant, based on data that has been set for the fundamental wave current.

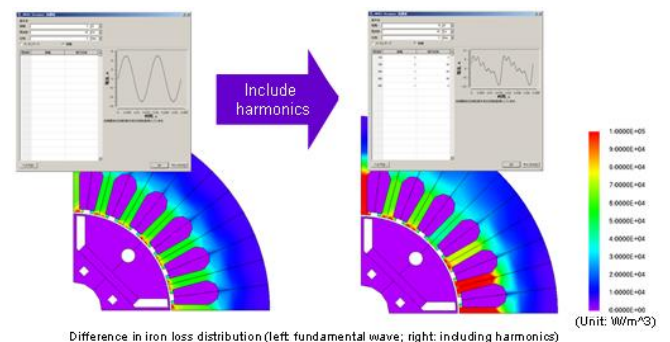
Recently, there have been more and more instances

of harmonics occurring in drive current due to pulse-width modulation (PWM), increased rotation speed of rotating machines, and other reasons. This has made it more important to estimate the effects of harmonic current in electromagnetic field analysis. For example, in current waveform control, adding harmonics to the fundamental wave can greatly change output. By using this function, it is easy to evaluate the effects of any harmonic order.

Also, in the past evaluating harmonic iron loss was made more difficult because noise created during actual measurement was often carried over into harmonic current. With this new function, it is easy to use FFT from a measured current waveform to generate a current waveform with high order of the main component.

We hope this feature will be useful for anyone who wants to easily estimate harmonic effects using electromagnetic field analysis.

(Kazuki Semba)



Difference in iron loss distribution (left: fundamental wave; right: including harmonics) (Unit: W/m³)

Fig. 7 Harmonic current input

Multi-Purpose File Export

Demands in product design are constantly being raised. For the design of electrical devices, fulfilling electromagnetic demands is necessary of course, but there are also thermal demands and demands in terms of vibration and noise. In order to meet all of these in a timely fashion, electromagnetic design must be carried out in parallel with thermal and mechanical design.

In order to support solutions to development issues, a "Multi-Purpose File Export Tool" has now been developed for J MAG (Fig. 8). With this function, high-precision electromagnetic force distributions, heat generation distributions, and others obtained in J MAG can easily be used in other software.

Highly accurate analysis results (physical quantity distributions) from J MAG are exported in the Nastran file format. This is a highly general-purpose file format, and it can be imported by most software.

- Analysis results obtained in J MAG are mapped onto mesh models created in other companies' software. There is no need to employ separate mapping tools. Various formats such as Nastran and Abaqus file formats are supported.
- Physical quantities obtained in J MAG analysis can be exported. Export can be done with processing by average over time, average over segment, FFT, etc.

Based on J MAG's open-interface concept, we have made efforts to improve its linking with other software. Added to the previous linking with Abaqus and LMS-Virtual.Lab, this new function helps to make analysis results even more useful.

(Yoshiyuki Sakashita)

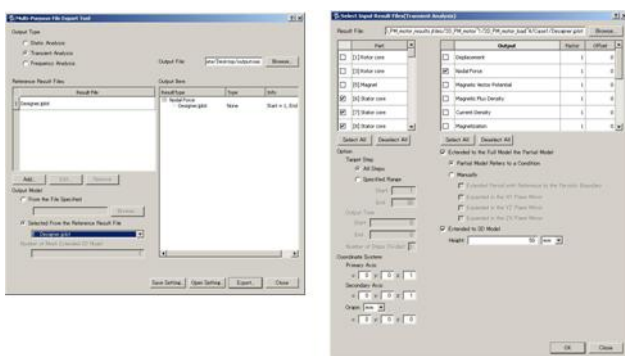


Fig. 8 The Multi-Purpose File Export dialog box

Results Analysis Optimization

Ver.12 adds automatic optimization capabilities to the parametric system in J MAG-Designer. The existing parametric function allowed a design to be explored by creating many different cases, however, it was necessary to create all the cases manually. The new function starts from a single case and automatically creates new cases to optimize the design according to user specified criteria. J MAG-Designer uses the response surface method for the optimization and does not require the user to write any scripts.

To enable the optimization function we have also updated the parametric analysis functions, adding new capabilities.

- A new table to display response data and parameters in a single dialog so results can easily be compared
- New integral functions to calculate response data from element data, for example maximum flux density in a region.
- New response data calculations for finding ripple and range.

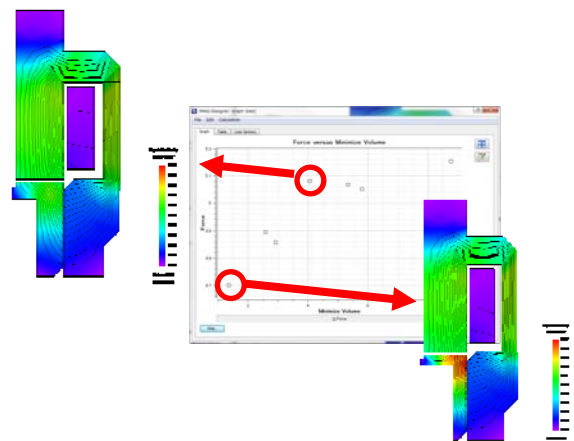


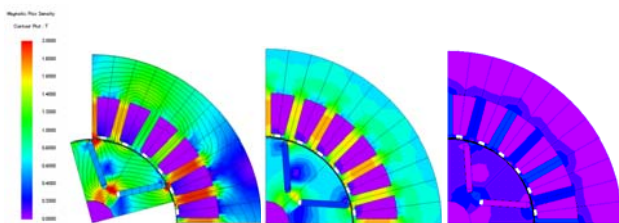
Fig. 9 Optimization of an actuator

Calculation Tools

New tools for analyzing the results have been added in Ver.12. Two calculation tools are available from a new folder in the treeview.

FFT - Fourier Transform for Contour Results

The FFT tool allows you to perform a Fourier transform on time domain results and then display contours of the harmonic components. For example, the results from a time domain simulation of a motor can be transformed into the frequency domain and the flux contours at the harmonic frequencies displayed.



Difference Calculator

When comparing the results from different designs or materials JMAG-Designer could display the results side-by-side but it is still difficult to see small changes. To make the comparison easier, we have added a difference tool which calculates the difference between two results and can display a contour plot of the difference. JMAG's mapping technology is used to allow the difference between results on different meshes to be displayed.

(David Dibben)

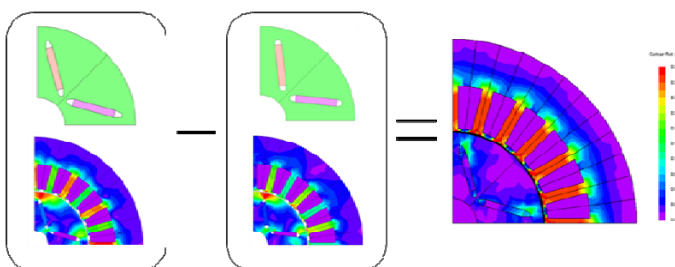


Fig. 10 Effects of differences in magnet arrangement and flux

barriers on magnetic flux density distribution in stator

Easier to Use

JMAG-Express

JMAG-Express is a design tool that allows you to perform motor design and evaluation by simply entering parameters such as geometry, winding, and rotation speed, following a template. High-precision results are obtained thanks to its use of the Finite Element Method (FEM).

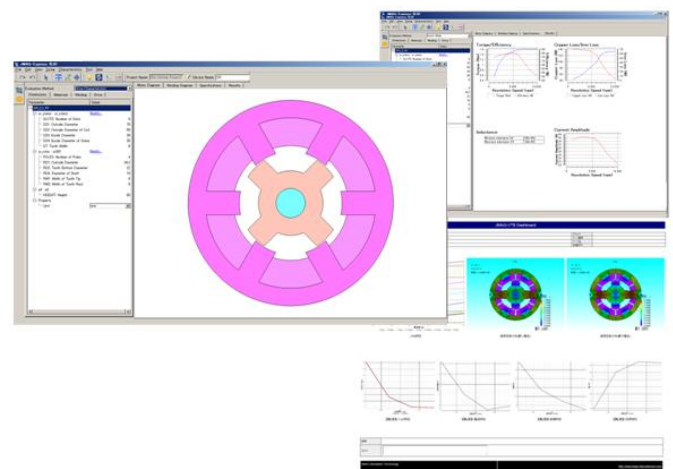


Fig. 11 Analysis of a switched reluctance motor in JMAG-Express
(left: settings dialog, right: analysis results)

In Ver.11.1, precision analysis using FEM was limited to permanent magnet synchronous motors, but here I would like to introduce the analysis contents of our newly-added support for induction motors and switched reluctance motors, which have been proposed as substitute candidates for permanent magnet motors.

Switched reluctance motors have a high degree of nonlinearity, making it difficult to predict properties such as inductance and linkage flux. Also, it is essential to ascertain torque ripple in order to find ways of reducing their tendency to produce vibration and noise. In JMAG-Express, the following evaluations are possible (Fig. 11):

- Psi-I characteristics
- Static characteristics
- Drive characteristics
- Torque ripple

Due to efficiency standards, it may become necessary to reevaluate earlier designs for induction motors. In JMAG-Express, the following evaluations are possible:

- Circuit parameter
- Drive characteristics
- Torque characteristics
- Line start

We hope you will try JMAG-Express for these situations.

JMAG-SuperExpress's name has been changed to JMAG-Express.

JMAG-VTB

As electrical devices become more complex, more detailed analysis of physical phenomena is needed at the same time that less time is being spent on analysis due to shorter development times and cost reductions. JMAG-VTB was created as a next-generation analysis tool for making "complicated analysis simple" in order to help engineers struggling with these issues. Here, I will briefly explain how complicated analysis can be done more easily.

In order to accomplish complex analysis such as multiphysics, it is necessary to create analysis models for each physical phenomenon, and then carry out calculations linked in the correct order. JMAG-VTB has analysis steps stored as existing procedures, so a user needs only to click a button to get results. In order to obtain the target results, there is no need for confusion about which coupled analyses should be run, what order calculations should go in, and so on. (Fig. 12).

Further, in any kind of analysis, it is necessary to set parameters such as geometry, materials, conditions, mesh, and results processing when creating analysis

models. Since some of these parameters are dependent on geometry, they must be converted to values appropriate to the analysis target. JMAG-VTB already contains analysis know-how for different analysis objectives, so appropriate parameters are automatically set for the geometry provided by the user. Even beginners to analysis will not be brought up short by what kind of mesh to generate, how to consider values for step conditions, etc.

Please give JMAG-VTB a try for these situations.

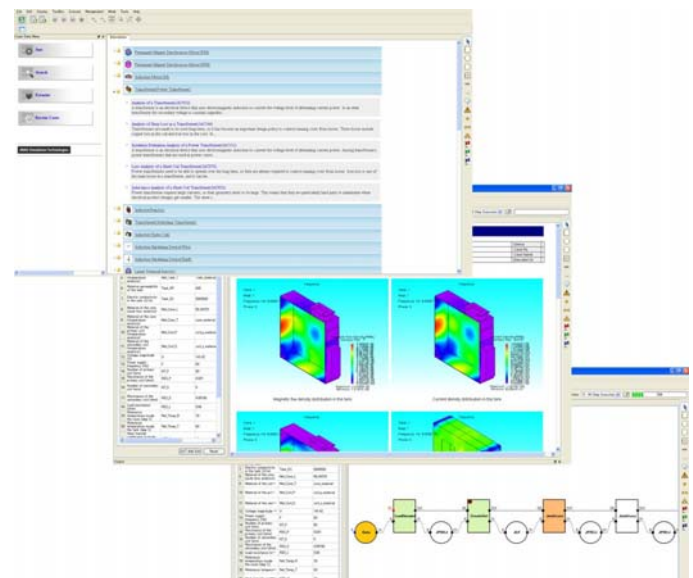



Fig. 12 JMAG-VTB's start-up screen, dashboard, and workflow

(Mayumi Warita)

In Closing

So, what do you think? There are still many more features that unfortunately could not be covered in this report. We are now conducting JMAG Upgrade Seminars and special seminars to introduce various functions. We hope JMAG's newest features will prove useful for your business. 

Editor: Toshie Furubayashi

Explaining FEA: Effectiveness of FEA in the Development Process

Is FEA effective in motor design?

Issue 1 Let's utilize it in initial design

This issue is aimed at those designing or using motors, we let you know the effects of utilizing simulations. We would be happy if this is used as a reference for designing better motors.

Overview

Along with the progress in computers and software, finite element magnetic field analysis (FEA below) is being utilized in motor design and is actually producing results in development. On the other hand those not using FEA might be thinking, "I know FEA is good but evaluating will take effort and time so in the end a traditional design sheet will be quicker." In this series, we will explain "Why FEA is effective in motor design?". We would be happy if this is used as a reference for utilizing FEA and designing better motors.

FEA's Benefits

In the motor design field, the benefits of using FEA are gathered below and compared with using the magnetic circuit method which has often traditionally been used.

- Motor geometry can be expressed in detail
- Magnetic saturation can be handled precisely
- Complex phenomena can be visualized

(1) Motor geometry can be expressed in detail

In FEA, motor geometry is expressed as it actually is with finite element mesh so it is possible to obtain an answer regardless of what the motor geometry is like. In contrast, in the magnetic circuit method it is necessary in advance to assume places magnetic flux will pass through as flux paths.

Flux paths that were not assumed can be regarded as not existing. On this point FEA is extremely effective in evaluating motors with complex flux paths and new types of motors in which we do not know how to assume flux paths.

(2) Magnetic saturation can be handled precisely

The magnetic circuit method can also to a certain degree account for the effects of magnetic saturation if nonlinear permeability is applied to the flux paths. However as magnetic saturation grows stronger, even inside the flux paths permeability distribution arises and handling it becomes difficult. In addition, when magnetic saturation grows stronger, magnetic flux is leaks from the flux paths assumed and in order to handle this phenomenon, it is necessary to identify the flux paths where flux is leaking and which route was taken. In contrast, FEA can account for permeability distribution and leakage into the air and deal precisely with magnetic saturation. From this point, FEA can be said to be particularly essential in the design of recent permanent magnet synchronous motors using rare earth sintered magnets which have extremely strong magnetic force.

(3) Complex phenomena can be visualized

This could be said to be FEA's biggest benefit. The motor design's good and bad points can be understood from the motor design results and from

looking at the acquired macro amount for torque and inductance but what is really important is understanding, "Why is it this way?". If this is not understood, we cannot make better designs. With FEA it is possible to visualize magnetic flux distribution inside the motor which would be extremely difficult to actually measure. Doing this allows us to understand local magnetic saturation and to put this to work understanding causes and measures. Also by visualizing not just magnetic flux but also eddy currents and demagnetization of the magnet, it is possible to have a motor design with higher efficiency and reliability.

Utilizing FEA at Each Phase of the Design

Here for convenience we will divide motor design phases into three, "concept design, initial design", "detailed design", "perfecting the design" and we will explain how FEA's benefits can be put to work in each phase through a series in three parts, starting from this issue.

(1) Concept design, initial design stage

At this stage we calculate motor properties and decide a rough layout, size, number of poles and number of slots. In this first issue, we will introduce ways to utilize FEA in concept design, initial design stages.

(2) Detailed design stage

At this stage, we take the rough design decided in the concept design, initial design stage and perform a parameter study assigning parameters such as dimensions and current value for each part of the design and we optimize the design. In the second issue, we plan to introduce optimization using FEA and also ways to analyze FEA results and use them as knowledge in the design.

(3) Perfecting the design

FEA is effective when taking the design refined in the detailed design stage and perfecting it more, when performance from actual machine experiments is below that forecasted and for analyzing cause when troubles arise. For example, eddy currents generated in permanent magnet motors, demagnetization, effects of stress in magnetic steel sheets, effects of inter-bar current in induction motors are areas in which FEA's high analysis abilities are demonstrated and we plan to introduce actual examples in the third issue.

Permanent Magnet Synchronous Motor Initial Design

Permanent magnet synchronous motors are used in fields such as power trains of hybrid, electric vehicles and in air conditioners or washing machines so there are expected to have high performance and high efficiency. Because they use rare earth sintered magnets with high magnetic force and are expected to have high output density, one of their characteristics is that the magnetic flux distribution in the iron core tends to be high.

Here we will see how FEA can be utilized in the initial design stage of permanent magnet synchronous motor designs.

Characteristics of interior permanent magnet synchronous motors

Recently, among permanent magnet synchronous motors, there are an increasing number of examples of adopting interior permanent magnets types (IPM below), which make possible reluctance torque combined usage. IPM enable reluctance torque and magnet torque in the current phase to be controlled so they realize enhanced efficiency in wide drive ranges. However, IPM also has a higher level of rotor design freedom than

traditional surface magnet types and because flux paths in the motor also change depending on current controls, it is difficult to apply the traditional magnetic circuit method to them. By applying some restraints, it is possible to use the traditional magnetic circuit method but there end up being restraints applied to the level of freedom. In contrast, FEA has no restraints so it is possible to freely test rotor designs that have not been tested before. FEA utilization can also be said to be essential in the initial design stage when the rough motor layout is decided for motors which have a high level of freedom such as IPM.

Evaluating the magnet layout

Using JMAG-Express, which is a tool enabling the effects of FEA to be experienced easily, we will test an IPM with three magnets in each pole and placed in a triangular arrangement, as shown in Fig. 1. When using a magnet arrangement like this that we have no experience designing, how much are the dq axis inductance which is important to decide the character of the IPM? The results of the characteristics calculated are shown in Fig. 2. JMAG-Express is using FEA but these results could be derived in under one second.

In this way, d axis inductance L_d is 12.7mH, q axis inductance L_q is 32.2mH, with regard to how much reluctance torque can be obtained, we discover instantaneously how far we might be able to raise the revolution speed in the voltage supplied to the inverter. By also easily testing layouts other than this, we get an indication of what kind of layout we should use to achieve the design objectives.

After this we will use JMAG-Designer to, decide the magnet angle and implant depth, run a parameter study of flux barrier geometry, and carry out design optimization.

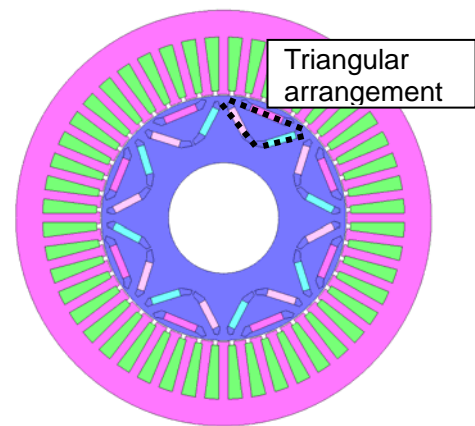


Fig. 1 Motor with magnets in triangular arrangement

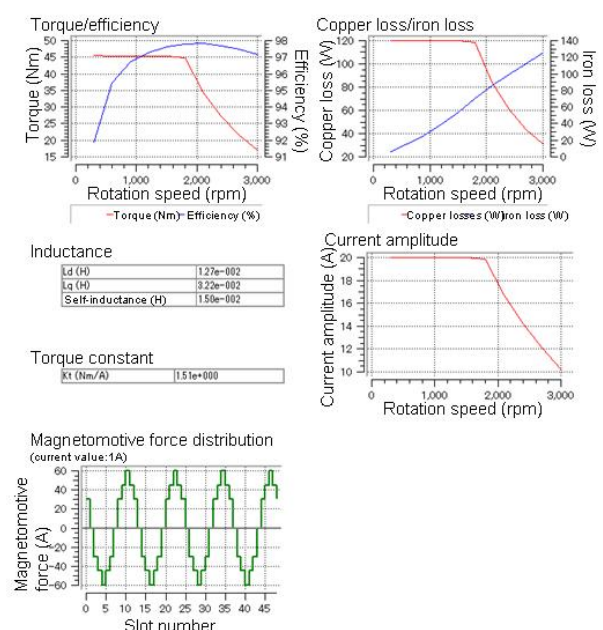


Fig. 2 Motor characteristics with magnets in triangular arrangement

Induction Motor Initial Design

Induction motors have been used in a wide range of fields since until now but they are receiving new attention as efficiency regulations are introduced and as an alternative to permanent magnet motors as rare earth prices rise. Here we will look at how FEA can be utilized in the initial design stage of induction motors.

T-shaped equivalent circuit in induction motors

In initial design of induction motors, calculations of torque and current characteristics in relation to slip are performed often using the T-shaped equivalent circuit shown in Fig. 3. The leakage reactance and secondary resistance used in the T-shaped equivalent circuit (equivalent circuit parameter below), are important parameters for deciding induction motor characteristics and in design when the rotor is locked or in no-load rotation, the equivalent circuit parameter is estimated from the magnetic circuit method and the cage geometry.

For induction motors with deep-slot cages such as the one in Fig. 4, an equivalent circuit parameter is obtained when the rotor is locked and in no-load rotation, torque-slip characteristics were obtained from the T-shaped equivalent circuit and the results are shown in Fig. 5. Fig. 5 shows the results of a detailed FEA analysis that was carried out after and in calculations by the T-shaped equivalent circuit, maximum torque is overestimated as much as 60% and we understand that slip that becomes maximum torque is also different. Why do the results end up like this?

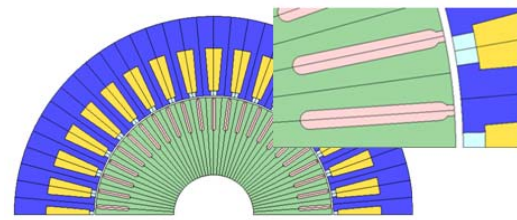


Fig. 4 Deep-slot type induction motor

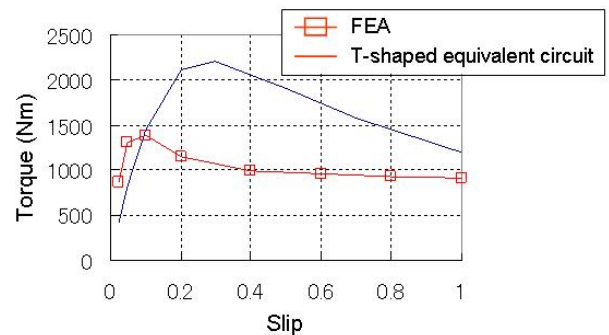


Fig. 5 Slip characteristics comparison 1

Equivalent circuit parameter calculations using FEA

In order to examine the causes, the current distribution for the bar of slip 1 (when locked), and slip 0.5 is shown in Fig. 6. Both have the same contour range. In contrast to slip 0.5 in which the current has permeated to the inside of the bar and the distribution is comparatively uniform, we understand from slip 1 that it has accumulated near the slot opening. This phenomenon is caused by slip changing the frequency of the magnetic flux linkage in the rotor. Secondary resistance differs greatly depending on whether the current has distribution or is uniform (the greater the current accumulation, the greater the secondary resistance), we can infer that the reason characteristics in Fig. 5 did not match is "because the secondary resistance obtained when bound was used for another slip". Also because current distribution changes, we can forecast from the contour diagram that leakage flux is affected.

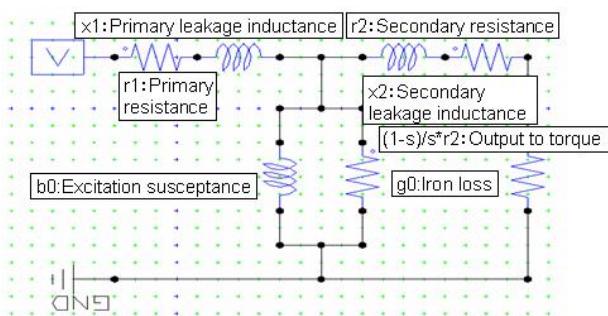


Fig. 3 Induction motor T-shaped equivalent circuit

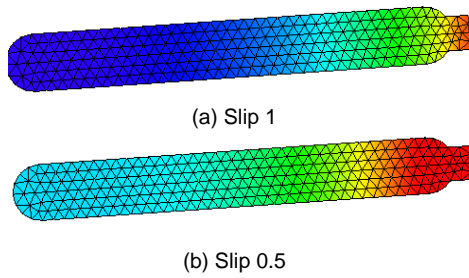


Fig. 6 Bar's current distribution

Using FEA in this way in detailed analysis enables the slip characteristics that account for current distribution in bars to be obtained but on the other hand, calculation takes time. That's why we think about utilizing FEA in equivalent circuit parameter calculations. As shown in the example before, for slip 0.5 and slip 1 we calculate the equivalent circuit parameter and use it in T-shaped equivalent circuit calculations (for other slip, obtain equivalent circuit parameter with linear interpolation and extrapolation). Slip-torque characteristics that will obtain results are shown in Fig. 7. By comparing it with Fig. 5, we can understand there is a major improvement in accuracy. Detailed analysis with FEA certainly does takes calculation time but calculation time using FEA to calculate the equivalent circuit parameter introduced this time is over in a few minutes.

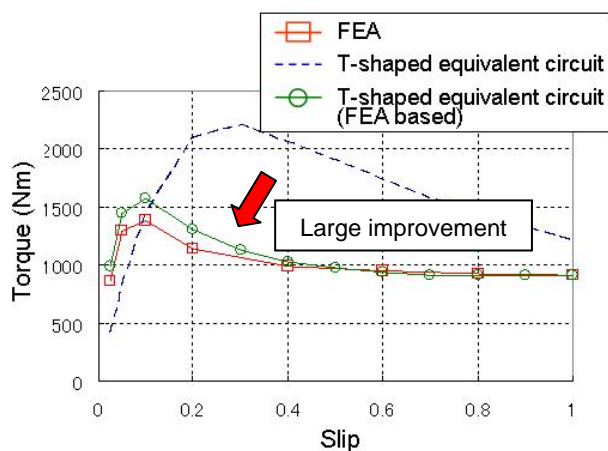



Fig. 7 Slip characteristics comparison 2

Here we introduced that by utilizing FEA in the initial design stage, it is possible to forecast induction motor characteristics that are highly accurate. The bar we used this time had simple geometry but in the case of a bar with complex geometry which we have not experienced design before, because of our lack of knowledge it would be difficult to estimate the equivalent circuit parameter, so FEA would be even more effective in estimating the equivalent circuit parameter.

In Closing

In the first issue of "Is FEA Effective in Motor Design?" we introduced examples FEA being utilized in the initial stage of motor design.

- Interior permanent magnet synchronous motor design has a high level of freedom and FEA utilization is essential to ensure restrictions are not placed on the level of freedom of the design.
- At the initial stage of the design of induction motors, characteristics are calculated using an equivalent circuit but by using FEA to estimate equivalent circuit parameters that account for current distribution, it is possible to greatly improve the accuracy of the calculations. 

(Katsuyuki Narita)

From the FAQ Files

Traditionally, JMAG has been used mainly by technicians specializing in electrical systems, but in recent years there have been more opportunities for mechanical designers and others to use it for electromagnetic designs outside of their own field. There are probably quite a few among those who have made the transition to this unfamiliar tool who worry about how they should use it to perform better analyses.

This section of the Newsletter deals with questions that we receive most often in order to help people who are having similar kinds of problems, and make JMAG a more user-friendly tool.

The questions here cover a wide range of topics, such as "Operation Methods", "Analysis Techniques", and "Troubleshooting". Please take a look at the topics that interest you.

OPERATION METHODS

Q1. Is it possible to apply settings such as Materials and Conditions from an already-analyzed model to another model with different geometry?

A1. Please use the Analysis Template function.

Even though models' geometries may be different, parameters such as material properties and conditions are often the same. In these cases, the Analysis Template function can be used to greatly reduce the amount of work needed for settings. Besides geometry, Analysis Template saves various settings information including materials, conditions, results display, etc. as a template, and can be used to apply these settings to a model with different geometry. The settings are automatically applied by part name. Other than part name, settings information can also be applied by solid face, edge, etc., using the Set function.

The Analysis Template function can also be used in JMAG-VTB. See the introduction to JMAG Designer Ver.12 in this Newsletter for more information on JMAG-VTB.

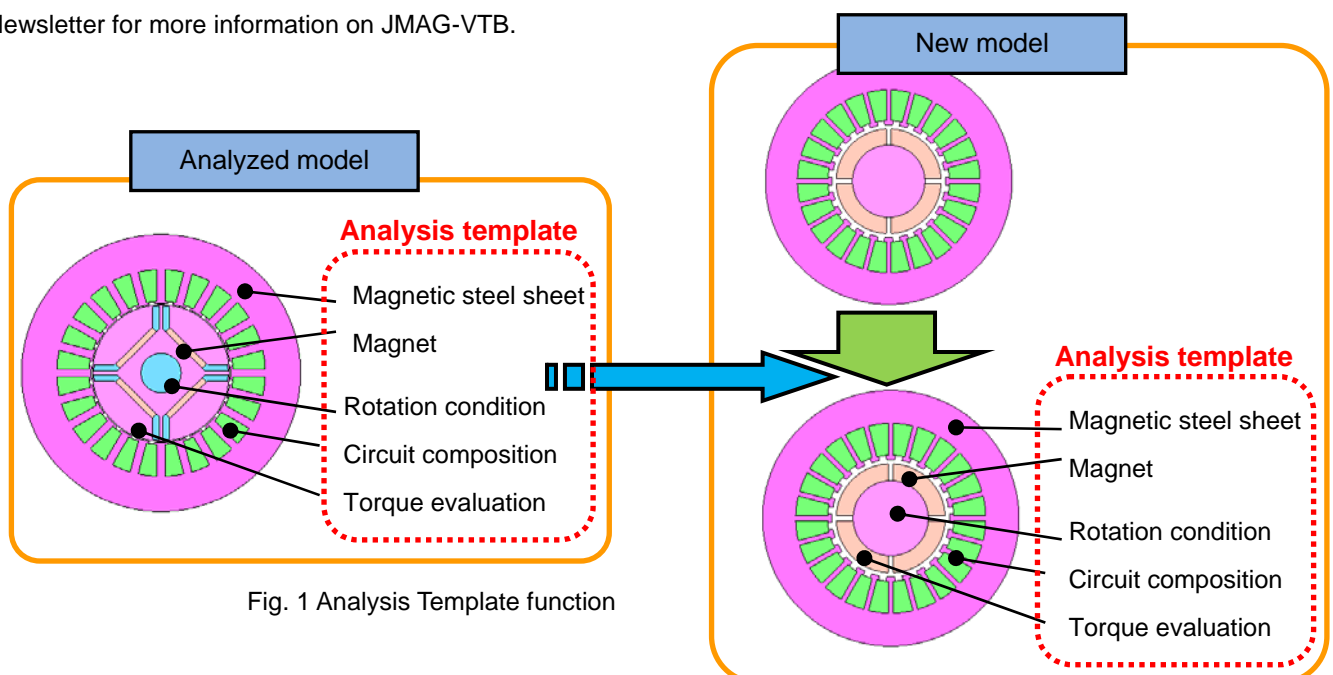


Fig. 1 Analysis Template function

<Other resources>

Analysis templates can also be found under Model Data in the Application Catalog on our Website. Be sure to check the analysis templates when using the Application Notes.

<http://www.jmag-international.com/catalog/index.html>

Please see the following Help items for more information regarding Analysis Template and Set.

[JMAG-Designer Help > Analysis > Analysis Template](#)

[JMAG-Designer Help > Analysis > Set](#)

OPERATION METHODS

Q2. Is it possible to add geometry in JMAG to previously-made SAT data?

A2. Geometry can be added using the Geometry Editor.

Using JMAG-Designer's Geometry Editor, it is possible to add or delete parts or parts of parts to models created in CAD. However, dimension data is not included when models are created as SAT data, so measurements cannot be changed.

To add a part, add a new part and create it with a sketch.

To delete a part, add the region of the sketch that you want to delete, and delete it with the [Extrude Cut] button. To remove an entire part from the analysis target, you may use suppression on the part.

To import a model into the Geometry Editor, either establish a CAD link after importing the SAT data into JMAG-Designer or import SAT data directly into the Geometry Editor.

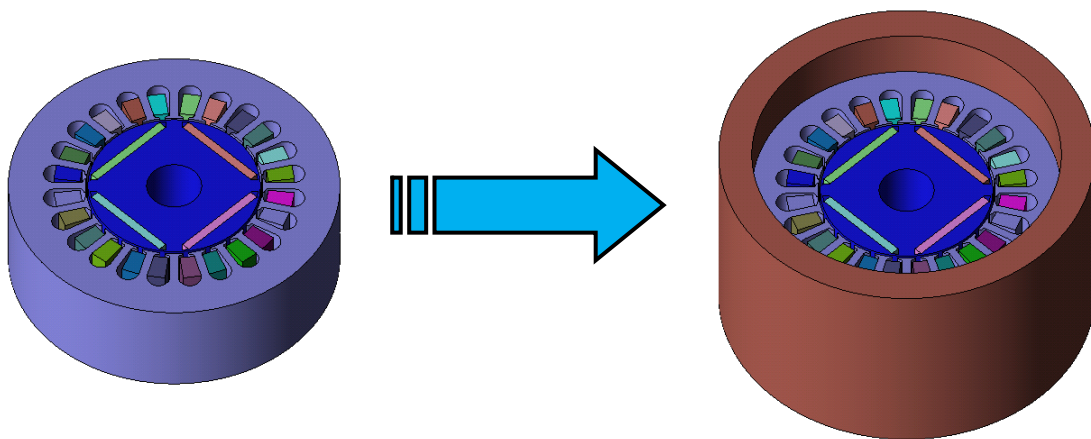


Fig. 2 Adding a case to a motor

<Other resources>

Please see the following Help items for more information regarding adding geometry in the Geometry Editor.

[JMAG-Designer Help > Creating Geometry > Creating 3D Geometry with Geometry Editor](#)

Q3. I would like to try a coupled magnetic field and thermal analysis to evaluate induction heating phenomena. The time constants in magnetic field analysis and thermal analysis are very different, so how can they be coupled?

A3. Coupling is done by positing that the temperature distribution does not change in magnetic field analysis.

For induction heating phenomena, at least with a power supply frequency higher than a few kHz applied, a steady state is reached within a few milliseconds in magnetic field analysis. However, changes occur from a few seconds up to several minutes in thermal analysis, making the difference between the two very large.

Because there is temperature dependency in the material properties used for magnetic field analysis, and a temperature distribution in fact exists, the produced temperature distribution must be considered in thermal analysis. However, for the purposes of magnetic field analysis it can be posited that the temperature distribution does not change, because temperatures do not change significantly in the few milliseconds to a steady state in magnetic field analysis.

The transfer of physical quantities in two-way coupled magnetic field and thermal analysis is diagrammed below. The loss distribution obtained in magnetic field analysis is used as a heat source in thermal analysis, and in magnetic field analysis material properties with temperature dependency are determined based on the temperature distribution obtained in thermal analysis.

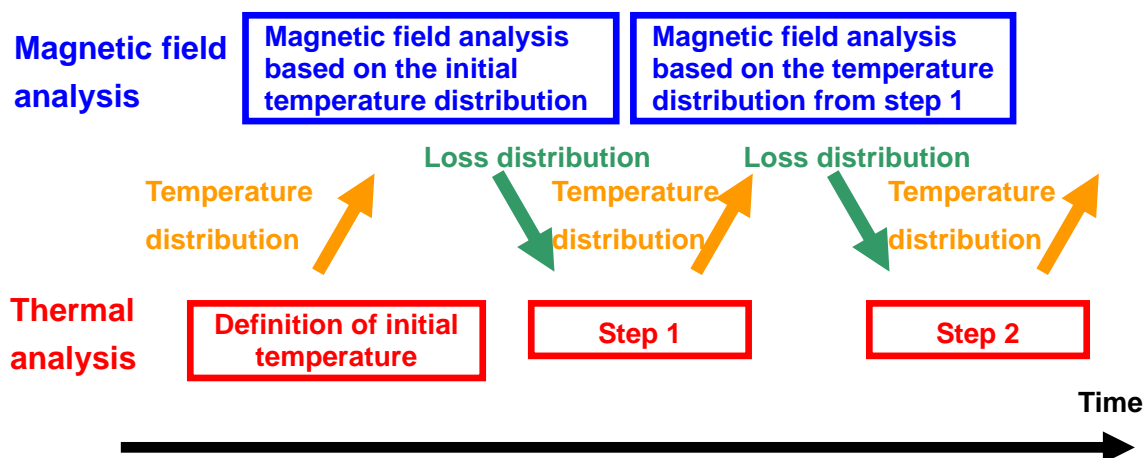


Fig. 3 Coupled magnetic field and thermal analysis

<Other resources>

A large number of examples of coupled magnetic field and thermal analysis can also be found in the Application Notes on our Website.

Please have a look through the Application Catalog.

<http://www.jmag-international.com/catalog/index.html>

Please see the following Help items for more information regarding coupled analysis.

JMAG-Designer Help > Functions of Analysis > Coupled Analysis

Q4. For actual measurements, I measure eigenfrequency with the motor hanging on a string. What kind of settings should I use for analysis?

A4. Run an eigenmode analysis without setting constraint conditions.

The eigenfrequency of a part varies greatly according to how it is fixed in place. The purpose of hanging an object by a string for measurement is to come as close to an unconstrained state as possible. In analysis, it is not necessary to set constraint conditions when seeking eigenfrequency. You can run your analysis without setting any constraint conditions.

If constraint conditions are not set, the analysis results for steps 1 to 6 will be output in rigid-body mode, and the frequency for each will be 0Hz or an extremely low frequency. The 7th step will be in first-order mode, so evaluate the results starting with step 7. Alternatively, the starting frequency of an eigenvalue calculation can be set, so enter a value lower than the frequency of the first-order mode (for example, 1Hz) here, and leave rigid-body mode out of your results.

The starting frequency for an eigenvalue calculation can be set under [Study] > [Properties].

<Other resources>

Please see the following Help items for more information regarding eigenvalue settings.

[JMAG-Designer Help > Analysis > Study Properties and Conditions of Structural Analysis > Study Properties for the Structural Analysis > Eigenvalue](#)

TROUBLESHOOTING

Q5 Can I ignore the "There is a circuit that does not have any voltage source." warning message?

A5. Electric potential is needed as a reference for a circuit. Please make sure there are no terminals for which electric potential is undefined.


Electric potential is needed as a reference in JMAG circuits, and components that specify electric potential such as Electric Potential Source and Ground are necessary. When this message appears, it means there is a terminal for which electric potential is not determined due to there not being a component that specifies electric potential or to the terminal not being connected to a component that specifies electric potential. Be sure to set a component that specifies electric potential even when using a Current Source. Please double-check the circuits used in your analysis.

When there is a switch in the circuit, make sure there are no terminals for which electric potential is undefined when the switch is opened. If there are no components to be evaluated in parts of the circuit that are cut off when the switch is open, you can ignore this warning.

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/en/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 also update the FAQ on our homepage regularly, and we hope that you can use them along with the JMAG Newsletter to help streamline your analysis operations. Please don't hesitate to use JMAG technical support if you have any questions when using JMAG. We hope you will fully master JMAG-Designer! 

(Tetsuya Hattori)

Fully Mastering JMAG

Issue 7 Understanding Conditions from A to Z

Has everyone mastered JMAG?

JMAG continues to evolve with each passing day. There may be functions in JMAG that even those who have already been using it will learn for the first time. There are also some useful procedures that are not well known yet. Why don't we aim at making operations more efficient by becoming familiar with new functions that we don't know about?

In this series, I would like to introduce "Things that we should know" in JMAG, as well as some advantageous applications.

Overview

Setting conditions is one job that needs particular attention when doing simulations. Often, when a simulation turns out different from real-world phenomena, or a calculation is run with improper physical conditions set, errors in conditions settings are not found until the calculation results are checked. In order to run accurate simulations efficiently, it is important to know what the conditions mean, and to set physically correct parameters.

In this and the next "A to Z," we will look at conditions that are frequently used in magnetic field analysis, their particular characteristics, and how they are used.

Confirming Conditions

Conditions in JMAG-Designer can be selected from the treeview in the toolbox on the right side of the screen. Fig. 1 shows the treeview with only the boundary conditions expanded. By clicking the "Show Descriptions" checkbox at the bottom of the toolbox, you can see a short description of what each condition means. If you would like to learn more, click the "Help..." button at the lower right to open the Online Help.

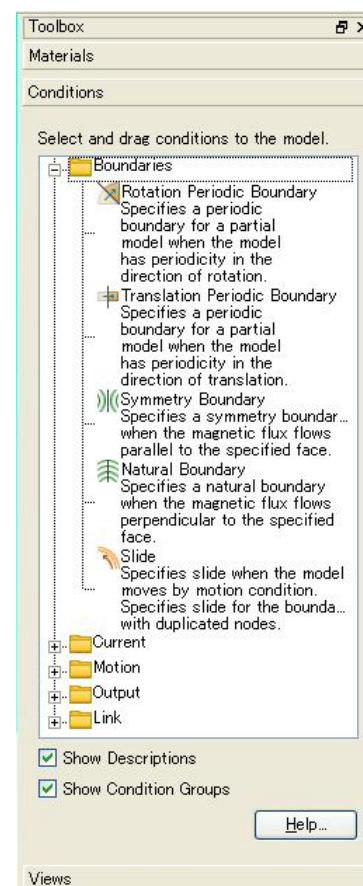


Fig. 1 Conditions treeview

Boundary Conditions

Boundary conditions must be set for simulations based on the Finite Element Method. If boundary conditions are not set correctly, convergence calculations can diverge, and simulation results

become physically unnatural. On the other hand, by setting appropriate boundary conditions, the calculation region can be limited, making the scale of the calculation (calculation time and results file size) smaller. We will now look at the boundary conditions handled by JMAG.

Periodic Boundary (Rotation / Translation)

For cases of a geometry such as a motor, where a physical quantity's distribution is repeated periodically in the direction of rotation or translation, the Periodic Boundary conditions can be used to reduce the calculation region. Periodic Boundary conditions apply not only to geometries but also to physical quantities, so it is necessary to estimate what sort of distribution of the physical quantity will be obtained from the calculation results.

When periodic boundaries are used, simulation is carried out on only a partial region. The phenomena of the partial region under simulation are treated as repeating in the periodic direction within the phenomena of the overall region. The Rotation Periodic Boundary condition is used in cases such as a rotating machine where there is periodicity in the direction of rotation, and the Translation Periodic Boundary condition is used where there is periodicity in the direction of translation, such as in a linear motor.

There are two types of Periodic Boundary condition, called a "Periodic" Boundary condition for phenomena that are repeated the same way, and an "Antiperiodic" Boundary condition for those repeated in the reverse direction. For the 24-pole, 18-slot motor shown in Fig. 2, a reduced calculation on a 1/6 model can be done using a Periodic Boundary condition. An Antiperiodic Boundary condition can be used for a reduced calculation on a 1/4 model for the 4-pole, 12-slot motor in Fig. 3.

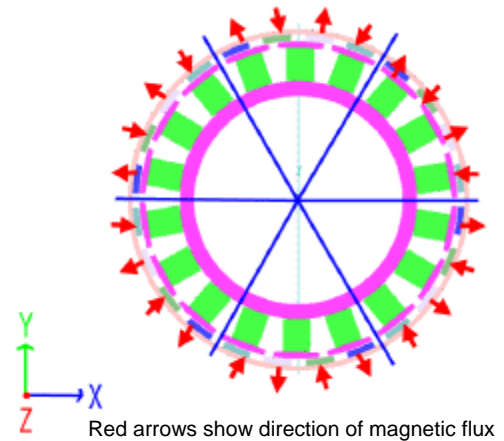


Fig. 2 Periodic Boundary condition in a 24-pole, 18-slot motor

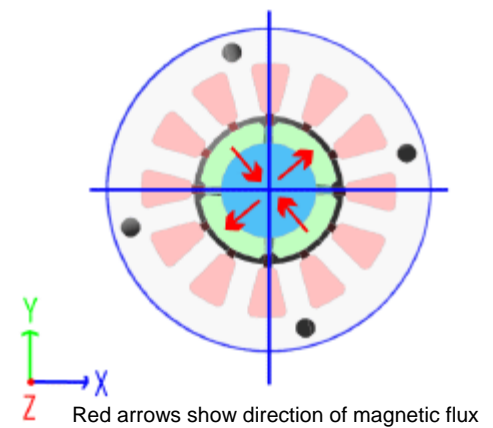


Fig. 3 Periodic Boundary condition in a 4-pole, 12 slot motor

Symmetry Boundary / Natural Boundary

If a physical quantity is distributed symmetrically, such as in electromagnets and transformers, a Natural Boundary condition or a Symmetry Boundary condition can be set at the plane of symmetry, and only one side used as the calculation region. For example, looking at the geometry and magnetic field flow in an electromagnet like the one in Fig. 4, a calculation on only an upper 1/4 of the region could be done, and the results for the remaining 3/4 gotten by translating the calculation results from the first 1/4. A Symmetry Boundary condition at the plane of symmetry, or Natural Boundary condition, must be

set in order to do a calculation on only a partial model like the one in Fig. 5.

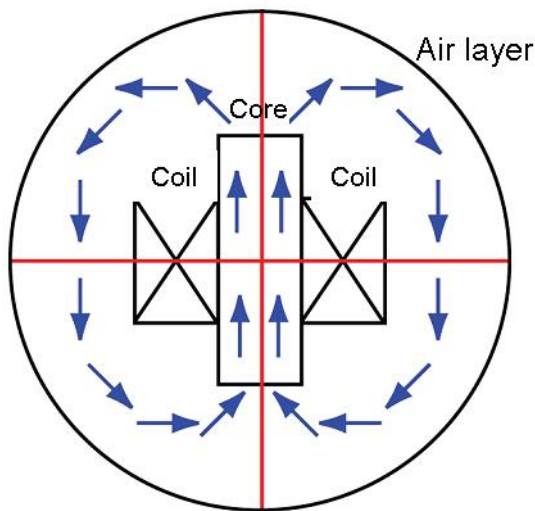


Fig. 4 Electromagnet model

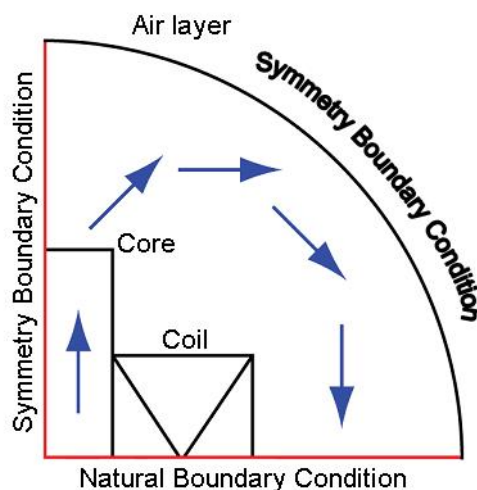


Fig. 5 Partial electromagnet model and Boundary conditions

In numerical analysis, a symmetry boundary condition is properly called a Dirichlet boundary condition, and a natural boundary condition a Neumann boundary condition, but they are called Symmetrical and Natural boundary conditions in JMAG to make it easier to see what they mean.

The Symmetry Boundary condition is set when the magnetic flux distribution is symmetrical on both sides of a specified face. To consider magnetic flux

continuity, the specified face must be one that the magnetic flux does not cross at all. A face that magnetic flux does not cross at all can be seen as an inflow and outflow face for perpendicular electric current. Because a face with a perpendicular electric current inflow must be selected as an inflow plane in the Current condition discussed below, an inflow plane must necessarily be selected for the Symmetry Boundary condition.

The Natural Boundary condition is set when magnetic flux distribution is symmetrical on both sides of a selected face, and magnetic flux density vectors are reversed. To consider magnetic flux continuity, the face must be one that magnetic flux flows across perpendicularly.

Symmetry Boundary conditions have one more application. For example, because the magnetic field of an electromagnet set in empty space theoretically reaches to infinity, an infinitely large calculation region must be set to run a magnetic field distribution analysis. But calculations on such an enormous region would not be realistic in terms of calculation costs (calculation time, results file size, etc.) Since the magnetic field is increasingly dampened with distance from the model, it is more realistic to posit that magnetic flux is not leaking outside of a certain range, and set the calculation region as small as possible. The Symmetry Boundary condition is set as the outer limit of the calculation region as a way of defining the place outside of which magnetic flux does not leak. This is a calculation technique that is frequently used to reduce the calculation region and at the same time improve the convergence of iterative calculations. In concrete terms, even when magnetic flux spreads into space - as in an electromagnet model - if a symmetry boundary condition is set to cover space around 5 times the length of the model as in

Fig. 6, there is almost no difference between the calculation and the real phenomena.

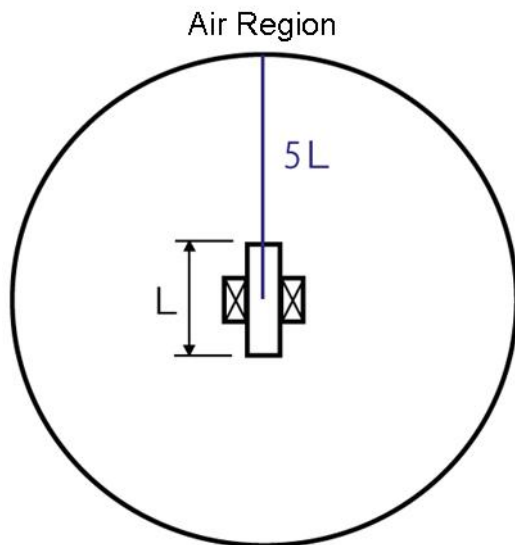


Fig. 6 Breadth of space needed for magnetic field analysis

Gap Flux Boundary

The Gap Flux Boundary condition is a specialized condition, used when the rotor inside or outside the gap in a rotating machine is modeled separately and the amount of magnetic flux flowing into the gap is applied from a different analysis - as in an analysis of 3D eddy currents generated inside magnets - and thus has limited applications.

For example, when running magnet eddy current analysis in an IPM motor like the one in Fig. 7, simply running a 3D transient response analysis will result in high calculation costs. However, in an eddy current analysis using The Gap Flux Boundary condition, with only 2D analysis results from the IPM model in Fig. 7 and by creating a 3D model of the rotor as seen in Fig. 8, a magnet eddy current calculation as seen in Fig. 9 can be done in a few minutes or a few hours.

However, there are several points to keep in mind when using the Gap Flux Boundary condition, such as that the other analysis referred to must be 2D, the rotor must be made as a solid model, etc.

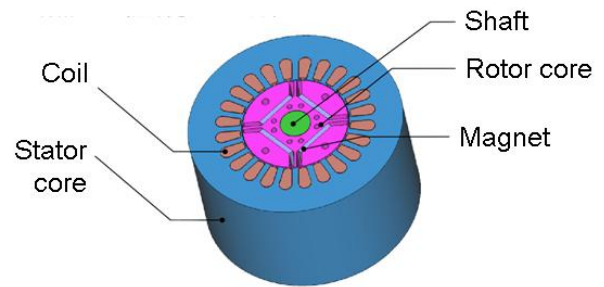


Fig. 7 IPM motor model

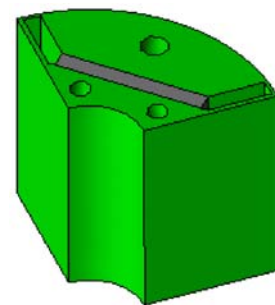


Fig. 8 3D partial model needed for a magnet eddy current analysis using the Gap Flux Boundary condition

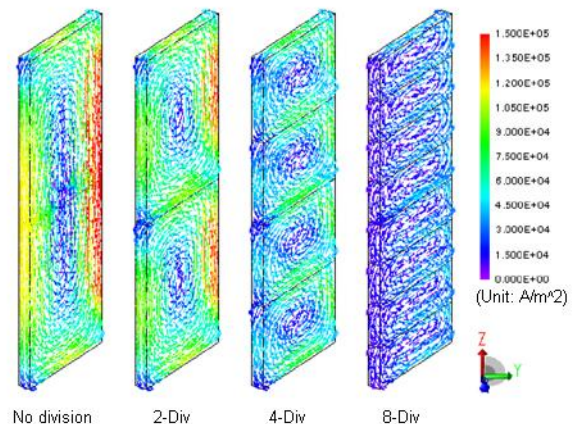


Fig. 9 Reduction in magnet eddy currents from division of magnets

Slide

In cases where a mover changes from moment to moment, such as a running electric motor, it is necessary to prepare a mesh model with separate mover and stator. The Slide condition connects the area of contact between mover and stator. Users of JMag's automatic mesh generation function do not need to pay attention to the Slide condition because

it is automatically added when generating a mesh. However, when a variety of rotor and stator mesh models have been created in advance and their various combinations are being evaluated, after merging each mesh model, the Slide condition must be set for the contact area between rotor and stator.

The Slide condition can only be used on models in which the mover--either a cylindrical face or a flat face--and the stator can be completely separated. For spindle motors in which the rotation axis and the magnets of the outer rotor are bound together in the case, since the mover and the stator cannot be completely separated at a cylindrical face, the Slide condition cannot be used. In these cases, the motion can be handled using the Patch Mesh Option, as discussed later.

If the Slide condition is not set, the model will be treated as if the stator and mover are completely separate, and calculation results will be as though magnetic flux were blocked in the gap. For the Slide condition, the mesh must be uniform on the specified face in the rotational or translational direction as shown in Fig. 10. If the mesh is not uniform, as in Fig. 11, there will not be a facing element on the stator side when the rotor turns, and calculation errors will occur.

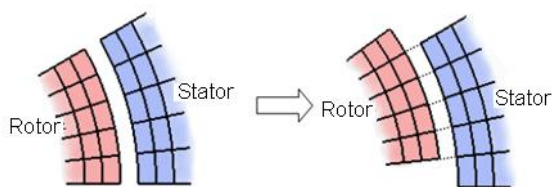


Fig. 10 The slide face is uniform in the rotation direction

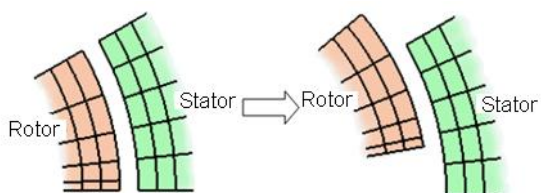


Fig. 11 The slide face is not uniform in the rotation direction

Current

JMAG provides a variety of ways of defining current depending on its use. Below are descriptions of the different ways of defining current and their particular characteristics.

Current

This is the most intuitive way of defining current in JMAG. It can be used by simply setting the current value flowing in the coil, the number of coil turns, and the direction of current flow. The number of coil turns is entered because the coil is treated together as one bundle, rather than each wire in the coil as a separate object. When an inflow and outflow face appears on a model's sectional face (the specified face for a Symmetry Boundary condition), as in a partial model, the current direction is determined by setting the inflow face; otherwise current direction in the coil part is set automatically by JMAG. When a current inflow face cannot be set, as in a complete model, if the current direction is set for a point inside the coil, JMAG will automatically set the current direction for the entire coil.

One particular characteristic to keep in mind when using the Current condition is that a bias can arise in the current inside the specified part (the coil). In reality, because the current in a coil flows in individual wires, this bias does not occur when looking at a section of the coil, but because the coil is treated as one block, or one big wire, the current tends toward the side where it flows more easily. Where the magnetic flux distribution near the coil does not have a particular effect on analysis results for the whole model, the current's bias under the Current condition does not cause problems, and so the Current condition can be used in most cases for magnetic field analysis.

Current Density

When looking at magnetic flux distribution around the coils, particularly when the coil current has to flow uniformly, the Current Density condition can be used instead of the Current condition. To set the current density value $[A/m^2]$ in the Current Density condition when using it for a coil, the current density value must first be converted from the current value and coil bundle cross sectional area. Also, to set the direction of current flow as a vector, in cases where the direction of current flow is likely to change, separate Current Density conditions must be set for each.

FEM Coil / FEM Conductor

The Current and Current Density conditions can be used when the current flowing in the coil is known, but FEM Coil and FEM Conductor are used in situations where the current changes from moment to moment with responses inside a circuit. FEM Coil and FEM Conductor, like the Current and Current Density conditions, are linked to circuit components in JMAG's Circuit Editor when set for an analysis model. In magnetic field analysis, the magnetic field effects felt by FEM coils and FEM conductors are reflected in the circuit components as inductance. In other words, coupled magnetic field and circuit analysis is run with FEM Coil and FEM Conductor as shown in Fig. 12.

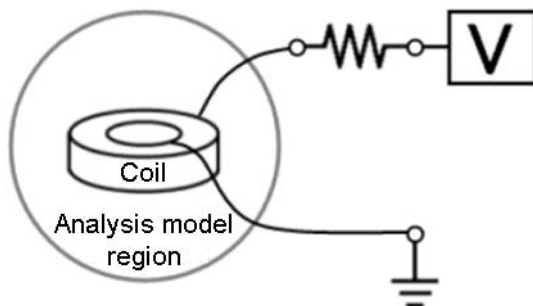


Fig. 12 Coupling of magnetic field and circuit analysis

The difference between FEM Coil and FEM Conductor lies in whether the direction or distribution of current in a coil is influenced by the magnetic field acting on the coil. For FEM Coil, the same bias in distribution as in the Current condition occurs, but the current direction itself is not affected by an external magnetic field. In contrast, current direction and distribution are determined with influence from the external magnetic field in FEM Conductor. When carrying out an analysis of the inclination of current distribution generated inside the wires of a coil or the wires' proximity effects on each other, the calculation can be done by modeling each wire separately and setting FEM Conductor for each wire.

Motion

Motion must be dealt with in most magnetic field analyses, and JMAG provides many different ways of defining motion. I will now look at the different types of motion handled by JMAG.

Motion (Rotation) / Motion (Translation)

In JMAG, simple Rotation and Translation Motion can be used without any particular restrictions. As well as motion type, in addition to constant speed, a point sequence can be set and the number of rotations, speed, etc. can be changed for each interval. Also, through Equation of Motion, it is possible to define motion that changes position moment to moment from the electromagnetic force calculated in magnetic field analysis. In such cases, external loads such as load torque and friction torque can be set at the same time.

User subroutines can be used to handle more complicated forms of motion. By customizing a part of the source code released by JMAG and rebuilding JMAG's solver module, a user can create a custom solver module to define a unique motion.

However, please be aware that a programming environment is needed for this.

As an example of motion other than the simple rotation or translation movement of a single mover, in the case of analysis of a rotating machine, the eccentric motion when a rotor's center deviates from the center of rotation (as shown in Fig. 13) can be handled.

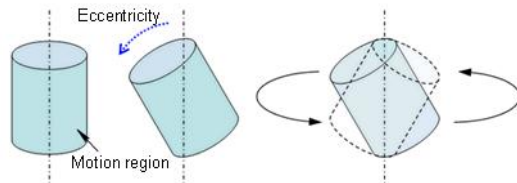


Fig. 13 Motion including eccentricity

For Motion in multiple movers, 2D analysis can be done using FEM + BEM as analysis methods. 3D analysis is possible using a method of remeshing at each analysis step, called the Patch Mesh Option.

Cases in which a mover and a stator make momentary surface contact due to motion can only be handled in 3D analysis.

Output

In magnetic field analysis, electromagnetic force and loss from the magnetic field distribution obtained at each analysis step are needed for post-processing. We will now look at the characteristics of physical quantities obtained as Output.

Electromagnetic Force / Torque

There are three methods of calculating electromagnetic force: Nodal Force, Surface Force, and Lorentz Force. Nodal Force and Surface Force are obtained from magnetic flux density, and Lorentz Force from current density. The calculation precision of Nodal Force and Surface Force are in correlation to the square of the calculation precision

of the magnetic flux density value. However, the calculation precision of Lorentz Force correlates with the calculation precision of the current density itself. Therefore, Nodal Force and Surface Force require a higher level of calculation precision than Lorentz Force, and errors can occur more easily. When seeking the force working on a coil, it is generally easier to calculate with higher precision by selecting Lorentz Force.

Nodal Force is the most commonly used method of calculating electromagnetic force. It is limited by being unable to obtain the attraction force of contacting objects. In such cases, Surface Force is used.

Surface Force can be used in the same way as Nodal Force, and the attraction force of contacting objects can be calculated by setting the calculation region as shown in Fig. 14.

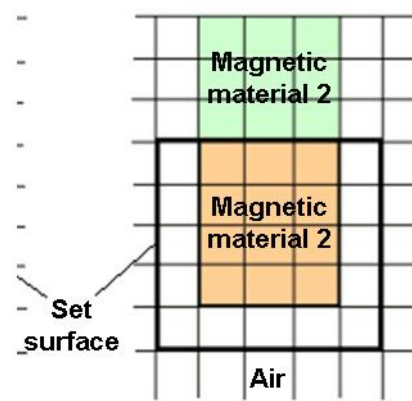


Fig. 14 Setting the calculation region for Surface Force when seeking the attraction force of contacting magnetic materials.

However, when Surface Force calculation is set for surfaces in which the magnetic flux distribution changes drastically, calculation accuracy can become noticeably worse. Because of this, we recommend that an air region be laid over the electromagnetic force calculation region, and the Surface Force calculation be set for the air region's

surface.

Heat Source

This is set when the heating in magnetic field analysis is transferred to thermal analysis. This condition is only used in coupled magnetic field and thermal analysis.

As mentioned earlier, the current distribution can become biased when using the FEM Coil condition. If this biased current distribution is used as the basis for finding joule loss and transferred as a heat source to a thermal analysis, the temperature of individual wires in the coil--which actually generate heat uniformly--can be far off. In the Heat Source condition, a trick to avoid this problem is, taking into account the different characteristics of magnetic field analysis and thermal analysis, to use the average of the joule loss obtained from magnetic field analysis inside the coil to transfer as a heat source in thermal analysis.

Iron loss Calculation

Iron loss is calculated in post-processing based on the magnetic flux density distribution obtained in magnetic field analysis. Because of this, the effects of iron loss on torque are not accounted for, and strictly energy balance is not achieved. However, hysteresis loss, which is normally extremely hard to calculate in magnetic field analysis, can be estimated with a high degree of precision. Iron loss is calculated by separating hysteresis loss and joule loss, so it is useful for comparing the proportion of each of these. Also, because it can be verified as a distribution in JMAG, it is possible to see in which areas a large amount of iron loss is generated.

Iron Loss is calculated in reference to highly precise iron loss data provided by materials

manufacturers. Further, users can add and create their own data for their calculations. The calculation method can be chosen from a number of options, and a suitable method found for the analysis target.

Magnetic Flux

This calculates the amount of magnetic flux passing through a face. When the Current condition or FEM Coil condition is set, the magnetic flux linked to them is automatically calculated in JMAG. If you forget to apply the Magnetic Flux condition in advance, JMAG-Designer v12.0 allows later recalculation using Results Calculation, as shown in Fig. 15.

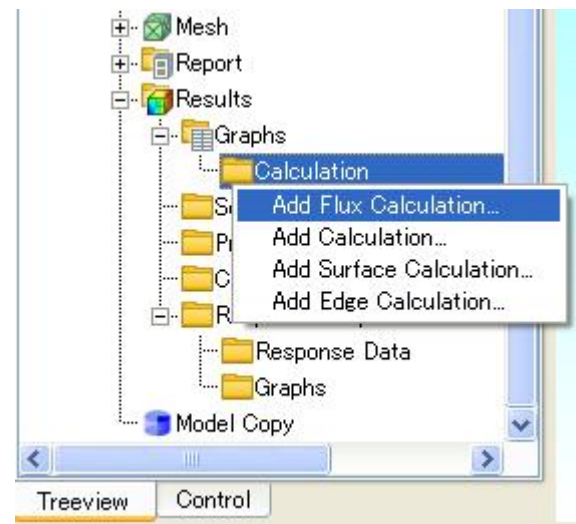



Fig. 15 Addition of magnetic flux calculation

In Closing

Here, I have discussed the meaning and usage of some of the more important and commonly used conditions in magnetic flux analysis. There are still many conditions that I would like to explain, and I will talk about them next time. Be sure not to miss it. 

(Masahiko Miwa)

Event Information

Report on the JMAG Users Conference 2012

We were fortunate to hear presentations from a large number of users at the JMAG Users Conference 2012. The newest solutions were introduced at the workshops. Exhibitions were also planned and presented by our technical partners.

In this report, we will look back at the JMAG Users Conference 2012 and the presentations, workshops, and users' voices that we heard there.

JMAG Users Conference 2012 Conference Outline

Host : JSOL Corporation

Dates : Tuesday, December 12 - Wednesday, December 13, 2012

Venue : Tokyo Conference Center - Shinagawa

URL : <http://www.jmag-international.com/event/conference2012/>



Presentations

We invited presenters who are active in the front lines of various fields, and they spoke about the latest topics, their experiences using JMAG, and their successes and difficulties in development and in their business.



Keynote Presentation (December 12 10:40 - 11:40)

The keynote presentation was given by Professor Katsumi Yamazaki from the Chiba Institute of Technology. Rotating machines are becoming more advanced year by year, and greater efficiency and loss reduction are achieved through loss analysis in different types of machines using electromagnetic field analysis. Dr. Katsumi shared his insight and presented successful examples of properties improvements using geometry optimization based on knowledge gained from this analysis.

Loss Analysis and Geometry Optimization in Rotating Machines

Chiba Institute of Technology,
Faculty of Engineering
Dept. of Electrical, Electronics and Computer
Engineering
Professor Katsumi Yamazaki



Motor Design1 Session (December 12 12:40 - 14:10)

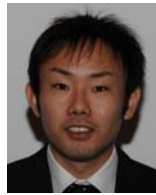
We heard presentations about a wide variety of uses of magnetic field analysis in motor design. It was a very active session with a lot of questions asked after each presentation.

Development of Cylindrical Linear Motors for Lift-Motion

Yaskawa Electric Corporation

Energy Conversion Technology Group

Mr. Akihito Toyota



Magnetization Analysis for Magnets in Small Motors

Nihon Denji Sokki Co., Ltd.

Technical Development Dept.

Mr. Michitaka Hori, Director



Taking On Torque Ripple Analysis and Torque Ripple Reduction in SR Motors

Samsung Yokohama Research Institute

ER Center, AR-1 Lab AR-11

Mr. Futoshi Yamane, Senior Researcher



Large Rotating Machine Design using FEM Analysis

Toshiba Mitsubishi-Electric Industrial

Systems Corporation

Rotating Machinery Systems Division

Design Section, Large Rotating Machinery Department 1

Dr. Yuichi Tsuboi, Specialist



The Design of Superconducting Magnet using JMAG

Sumitomo Heavy Industries, Ltd.

Technology Research Center,

Engineering Physics Group

Dr. Jun Yoshida



Power, Large Machinery Session (December 12 12:40 - 14:10)

We heard presentations about large transformers, large generators, and superconducting magnets.

This was the first time this type of session was held at our Users Conference, and it helped us to get a sense of the particular difficulties in doing numerical analysis of large machinery. We will continue to strive to eliminate these kinds of difficulties.

Magnetic Field Analysis of Parts of an Oil-Immersed Transformer Full-Scale Analysis Model

Fuji Electric Co., Ltd.

Design Section 1

Transformers Department

Mr. Takayuki Suzuki



Designers Distribution Session (December 12 16:30 - 18:00)

We heard presentations on the theme of how magnetic field analysis techniques are distributed within companies where analysis has a leading role in business. Many users are working hard at not only deepening analysis techniques, but also distributing analysis operations effectively within product-development operations and developing their human resources, so the presenters received many questions and requests for advice.

Efforts to Make Magnetic Field Analysis-Centered CAE Prevalent at Miki Pulley Co., Ltd.

Miki Pulley Co., Ltd

Development Department

Mr. Shigeyuki Hattori



Practical Use of JMAG-Designer in Motor Development

Ryobi, Ltd.

Engineering Department

Mr. Kengo Takao



Development of IPM Motor using JMAG-SuperExpress

Panasonic Corporation, Appliances
Company
Engineering Division, Motor
Development Center
Mr. Takashi Ogawa



Coupled/Linked Analysis Session (December 12 16:30 - 18:00)

We received presentations from members of corporations that are active on a global scale, and heard about themes such as coupled analysis.

The simulation world has expanded beyond simple electromagnetic fields, and the importance of evaluations that link and couple multidisciplinary regions such as control, thermal, vibration, and sound is growing year by year.

Creating Simulation Models based on Measuring Results of Brushed DC-Motors using JMAG-Designer

Valeo Wiper System Bietigheim
R&D Center
Dipl.-Engineer Mechatronics
Mr. Matthias Schondeling



Miniaturization Design Method and Performance Evaluation of Prototype Permanent-Magnet Synchronous Motor Optimally Designed by Thermo-Magnetic Field Coupling Analysis

Hitachi, Ltd.
Research & Development Group, Hitachi Research Lab.
Mr. Norihisa Iwasaki



Operation Technique Session (December 13 9:30 - 11:30)

Presenters spoke on a variety of topics regarding ways of using JMAG, such as incorporating JMAG into

an in-house design system, automation of development processes, and efficient use of JMAG's high-speed solver.

It was clear that JMAG is not just a specialist tool for dedicated analysis experts, but is being widely used as a vital design tool by designers.

Efficient 3-Dimensional Design Optimization Technology for High-Precision Magnetic Rotation Angle Sensors

Tamagawa-Seiki Co., Ltd.
Technical Quality Generalization Section
Dr. Takaomi Kojima, Doctor of Engineering



Case Study of JMAG Application at Mitsuba Corporation

Mitsuba Corporation
Technical Development Department
Section No.1
Mr. Ryuichi Takakusagi, Team Leader



Development of an Automation System for Preliminary Design of HEV and EV Motors

Suzuki Motor Corporation
Electric Drive Vehicle Design Dept.
UNIT Group
Advanced research team
Mr. Masahiro Aoyama



Electromagnetic Field Analysis of the High-Speed Electric Motor Using the JMAG-GPU Solver

Shimadzu Corporation
Aircraft Equipment Division
Mr. Daisuke Mitsuoka, Senior Engineer



Motor Design2 Session (December 13 9:30 - 11:30)

We heard presentations from a variety of angles about PM motors for hybrid and electric vehicles and for household devices by users from Japan and abroad.

These covered a wide range of topics, from selecting

magnetic steel sheet, to reducing rare earths, to countermeasures for vibration and noise, to real-time simulation, and gave us a sense for how simulation is being used in the actual design process.

Evaluation of Different Electrical Steels and Iron Loss Evaluation of Inter-locks vs. Welds vs. Bonded Lamination Cores in IPM Hybrid Motors using JMAG.

Tempel

Sr. Electric Motor Design Engineer

Mr. Charles R. Frontczak



Development of Reduced Rare Earth Magnets by Partial Diffusion Method

Honda R&D Co., Ltd.

Automobile R&D Center

Mr. Masashi Inoue



Vibration Optimization of Concentrated Stator and IPM Rotor

Emerson

Hermetic Motor

Mr. Alvin Lee, Section Manager



Simulation of the IPM Motor in a HILS Environment

Toshiba Corporation

Corporate Manufacturing Engineering

Center, Control Technology Research

Center

Mr. Nobuyuki Suzuki, Research Scientist



**Utilization Technique Session
(December 13 14:40 - 16:40)**

Some people may think that JMAG is only for motor design, but in fact, it can be used in a variety of fields.

In this session, we heard how designers are using JMAG in many different fields and about its use as a means to avoid prototyping.

Electromagnetic Field Analysis for Digital AV Equipment

Panasonic Corporation

AVC Networks Company

Digital Manufacturing Group

Mr. Hirotsugu Fusayasu, Manager



Development of Advanced Keyless System Using Magnetic Field CAE

Mazda Motor Corporation

Electrical & Electronics Development

Mr. Toshihide Yoshida, Senior Staff



Residual Magnetic Field Analysis Using JMAG

Usui Kokusai Sangyo Kaisha, Ltd.

Function Components Division

Mr. Yoshiaki Shinozaki



**Motor Design3 Session
(December 13 14:40 - 16:40)**

In this session, we heard about ways in which JMAG is being used in the development of advanced motors.

The application of electromagnetic field analysis was the research theme for presentations on cutting edge developments such as the design of drive motors for electric vehicles, high-speed evaluation of magnet eddy currents, and the development of switched-reluctance motors. We also received a large number of user requests regarding JMAG. The session made clear how strongly the presenters feel about their efforts to develop higher-performance motors.

Characteristics Improvement of Skewed Permanent-magnet Motors

SIM-Drive Corporation

In-Wheel Motor Development Division,

Motor Development Section

Mr. Kenji Endo, Manager



Analysis of Eddy-current Loss in Permanent Magnets Using JMAG-SuperExpress

Mitsubishi Electric Corporation

Himeji Works, EM Design Group

Mr. Shinsuke Kayano



Design of Switched Reluctance Motor by JMAG for Automotive Traction Application

Nidec Corporation

Automotive Motor & Electronic Control

R&D 2nd

Mr. Yusuke Makino



Partner Seminar

(December 12 14:20 - 14:50)

High Fidelity HILS and RCP for Motor Control Development

dSPACE Japan K.K.

Mr. Takashi Miyano, Director



(December 12 14:50 - 15:20)

Ideal to Electrical Implementation: SaberRD & JMAG-RT Case Study in a Motor Drive System

Synopsys, Inc.

Mr. Alan Courtay, Mr. Kurt Mueller



(December 12 16:30 - 17:00)

Integrated Acoustic Simulation of a Switched Reluctance Motor Drivetrain as part of a Multi-physics approach to Electric Vehicle Optimization

LMS International

3D Simulation Division

Mr. Koen De Langhe, Productline Manager



(December 13 14:40 - 15:10)

Multi-physics Simulation between JMAG and Abaqus, and its Applicability to Three-field Simulation of Cell Phone Speaker Acoustic Response

Dassault Systemes SIMULIA

Mr. Brad Heers



Presentations by JSOL

(December 12 9:40 - 10:40,

December 13 16:40 - 17:20)

Development Planning of JMAG I, II

JSOL Corporation

Dr. Takashi Yamada



(December 13 9:00 - 9:30)

Introduction to new features of the JMAG series

JSOL Corporation

Tetsuo Ogawa



(December 13 9:00 - 9:30)

JMAG for Machinery Design in Electric Power Generation Systems

JSOL Corporation

Hiroyuki Sano



We received comments such as "It was hard making the presentation materials. We made them while using JMAG's newest functions, so it was a good thing that we had support from JSOL," "I was surprised because it was a good place for users to share their opinions even more than at my academic society," and "It was a good chance to meet other people who could relate to the issues I face in my business," and were told that it was worthwhile to create presentation materials along with the usual workload and then give presentations.

Attendees told us that "There was a wider variety of topics covered than other years," and "I could understand easily thanks to the interpretation on both

days." We will try even harder to provide you with excellent presentations again next year.

Workshops

The section meetings and JMAG seminars of previous years were held as workshops this time in order to fill out the program outside of the main presentations and help attendees spend their time in an enjoyable and worthwhile manner. Rather than only presenting information from JSOL, we had a lively sharing of techniques with attendees speaking freely about the future direction of analysis technology, requests for JMAG, and other topics. Attendees commented that "I was able to get information that I did not hear anywhere outside of the workshops," "It was easy to understand because they explained things in words that even a beginner could understand," and "I now see how the new functions will be useful." We will continue to work on improved ways of making your time at the Users Conference meaningful.

List of Workshops

- W-01 What You Want to Know about New Features of JMAG-Designer Ver.12
- W-02 Getting the Analysis Results You Want Easily with JMAG-VTB
- W-03 Making Full Use of JMAG-Designer
- W-05 Let's Talk About Motor Design Part 2
- W-06 The Current Situation and Issues in Magnetless Motor Analysis
- W-07 Approaches to Vibration Noise Analysis of Electric Machinery
- W-08 JMAG-RT Seminar
-Aiming to Achieve High Fidelity, Highly Secure Motor Models-
- W-09 Introduction to Optimization Functions in Ver.12
- W-10 Tips for Utilizing the Parametric Function
- W-11 Achieving More Accurate and Faster Electromagnetic Field Analysis
- W-12 Techniques for Evaluating Analysis Results with New Post-Processing Functions
- W-13 Making Full Use of the Geometry Editor
- W-14 On Material Properties in Electromagnetic Field Analysis, Especially Iron Loss

- W-15 Making Full Use of Analysis Features for Induction Heating
- W-16 How Well Has CAE Solved Issues in Large Transformers?
- W-17 A Multiphysics Analysis Using Link and Coupling Functions
-Methods to Link to Other CAE Software-
- W-18 All about JMAG-Express



Exhibitions

23 different technical partners of JMAG provided exhibitions. Between the scenes of sharp inquiries being made about the newest solutions in the presentation halls, and scenes of attendees chatting pleasantly with their lunch held in one hand, we are certain that everyone was able to get some good information about the latest techniques.

The 5-minute presentations by exhibitors were popular, with people saying "It was fun, and we had a chance to win a prize," and "I was glad I could see it while eating lunch."

At the JMAG booth we had an introduction of JMAG-Designer Ver.12, as well as meetings for those who wanted to transition to JMAG-Designer to consult with us.

For the first time this year, we gave attendees the chance to win a prize, which everyone seemed to enjoy.

People who listened to presentations and visited

booths told us "It was good to hear about examples of JMAG's coupling," and "I got some good advice about prototyping," and that they thought it was a worthwhile experience. We would like to take this opportunity to thank all of those who provided exhibitions.

List of exhibitions

Materials

JFE Steel Corporation

Shin-Etsu Chemical Co., Ltd.

Hitachi Metals Ltd.

Measurement

Yokogawa Meters & Instruments Corporation

Hardware

SCSK Corporation

NVIDIA Corporation

Kobe City/Foundation for Computational Science

Prototype/Design Consulting

Motion System Tech Inc.

CAE

IDAJ Co., LTD

Cybernet Systems Co., Ltd.

LMS Japan K.K.

MBD

A&D Company, Limited

DSP Technology Corporation

dSPACE Japan K.K.

NEAT Co., Ltd.

Nihon Synopsys G.K.

National Instruments Japan Corporation

Myway Plus Corporation

Mentor Graphics Japan Co., Ltd.

Catalog Exhibitions


Daido Electronics Co., Ltd.

TDK Corporation



Were those who attended the Users Conference able to enjoy it to the fullest?

I hope that the people who attended, as well as those who were unable to attend, were able to see what a meaningful experience the Users Conference was.

Our entire staff is looking forward to seeing everyone at next year's Users Conference! 

(Tomomi Igarashi)



Event Information

Event Report

Attendees report on events held from October to December, 2012. We hope you will attend an event soon.

JMAG Users Conference 2012 in the USA Conference Outline

Host : Powersys Solutions

Date : Tuesday October 16, 2012


Venue : Westin Detroit Metropolitan Airport Hotel (Detroit, USA)

URL : http://www.powersys-solutions.com/usersconference_jmag_usa_2012.php



We held the first JMAG Users Conference in North America in Detroit. In the two-day program, the first day was dedicated to training, including hands-on training, and the second day saw 13 presentations. Attendees included around 70 people from the business world, universities, and technical partners.

The keynote address was given by Professor Toliyat of Texas A&M University, who spoke about magnetic gears, and, with the conference held in Detroit, we were also able to have presentations from the automobile industry including Toyota, Chrysler, and General Motors.

This being America, the question and answer sessions were extremely active, and we were able to see attendees communicating with each other a great deal. We plan to hold it in Detroit again around the same time next year, so please join us if you can. 

(Yusaku Suzuki)

Program

9:00	Magnetic Gears Hamid A. Toliyat, Texas A&M University (Keynote Speaker of the conference)
9:45	Resistivity analysis of stacked planar Litz structure using Finite Element Method Tsuyoshi Nomura, Toyota
	Inductor loss-simulation using JMAG-Designer and comparison with measurement results Kayoko Seto, Toyota
10:30	Estimating the effects of partial flux linkages on the resistance of PMAC motor windings John Suriano, Nidec
11:15	High Fidelity Hardware-in-the-Loop Simulation with JMAG-RT and NI VeriStand Nick Keel, National Instruments
11:45	Flux Focusing Magnetic Gear Design Using JMAG Jonathan Bird, University of North Carolina - Charlotte
13:15	Designing Novel Doubly-Fed Machines using JMAG

	Andy Knight, Alberta University
13:45	Effects of manufacturing process on IPM motor losses Hossein Dadkhah and Anand Sathyan, Chrysler
14:15	Multiscale Noise and Vibration models for a Switched Reluctance-based drivetrain for EV and HEV Ramana Kappagantu, Ph.D. - Sr. Technical Specialist, LMS Americas
15:00	Evaluation of Different Electrical Steels in IPM Hybrid Rotating Machines C.R. Frontczak, Tempel
15:30	Highlights of the latest developments of OPAL-RT solutions Sebastien Cense, OPAL-RT Technologies Inc.
16:15	JMAG Roadmap and Introduction to JMAG V12 JSOL Corp.
17:00	Electric Machine Design and Selection for General Motors e-Assist Light Electrification Technology Sinisa Jurkovic, General Motors
17:30	Multi-Physics Applications and Opportunities Enabled Through JMAG and Abaqus Co-simulation Brad Heers, Simulia

SIMULIA Regional User Meeting

Conference Outline


Host : Dassault Systemes SIMULIA

Date : Thursday October 18, 2012

Venue : St. John's Golf and Conference Center

URL : <http://www.3ds.com/company/events/gl-mi-regional-user-meeting/>

Simulia gave exhibits and presentations about JMAG at its Regional User Meeting, which is held in various countries and moved from Germany to America this time.

Particular attention was paid to linking JMAG with Abaqus with Abaqus' Co-Simulation Engine (CSE). It was clear that the need for coupled structural and magnetic field analysis is growing steadily. 

(Toshie Furubayashi)

Basics and Electromagnetic Field Analysis Techniques for Wireless Power Supply Technology

Conference Outline

Host : J-TECHNO INC

Date : Friday October 19, 2012


Venue : Training Room, J-TECHNO INC (Nihonbashi, Japan)

URL : <http://www.j-techno.co.jp/> (only in Japanese)

We at JSOL try to actively disseminate our information at seminars held by other companies, too.

We served as a presenter at the "Basics and Electromagnetic Field Analysis Techniques for Wireless Power Supply

Technology" seminar put on by J-TECHNO INC, a company that holds technical seminars in a wide range of fields. The seminar consisted of two parts, the first of which was given by Dr. Ida of Technova, Inc., who talked about the basics and latest trends in wireless power supply, introducing the newest technological trends in contactless power transfer and experimental results regarding the contactless power transfer equipment being developed at Technova.

The second half was by JSOL, and we discussed contributions that JMAG's analysis functions can make to developments in the field of contactless power supply, including example analyses. The seminar was attended by wireless power supply technicians, and it was a meaningful seminar with a great deal of dialogue. 

(Yoshiyuki Sakashita)

GT-SUITE Conference Day

Conference Outline

Host : GAMMA TECHNOLOGIES


Date : Monday October 22, 2012

Venue : Steigenberger Airport Hotel: Frankfurt, Germany

URL : <http://www.gtisoft.com/training/conference-event.php?id=320>

We took part in Gamma Technologies' European GT-SUITE Conference.

With this fall's release of GT-SUITE, it is now possible to link GT-SUITE with JMAG. In preparation for the release, Gamma Technologies provided us with explanations of JMAG and JMAG-RT solutions at the European GT-SUITE Conference.

GT-SUITE is a world-leading total automotive simulation platform developed by Gamma Technologies. It is used for evaluation of engine characteristics such as fuel efficiency and noise, and also for cooling systems and others. By handling a JMAG-RT motor model in GT-SUITE, detailed motor drive simulation becomes possible. 

(Toshie Furubayashi)

Integrated Electrical Solutions Forum (IESF) China Automotive 2012

Conference Outline

Host : Mentor Graphics


Date : Thursday October 25, 2012

Venue : Sheraton Shanghai Hongkou Hotel (Shanghai, China)

URL : <http://mentorg.com.cn/aboutus/view.php?id=165>

A JMAG exhibition was given at the Integrated Electrical Solutions Forum (IESF) held by MentorGraphics in Shanghai.

The IESF had various products handled by MentorGraphics and presentations in a wide variety of fields, and a very large number of people attended.

For JMAG, we presented the possibilities for JMAG-RT solutions used with SystemVision. In addition to SystemVision users, there were also many people who were familiar with JMAG, and we could see that the importance of high-fidelity plant models is growing in this field as well. 

(Hiroyuki Sano)

PSIM Users Conference 2012

Conference Outline


Host : Myway Plus Corporation

Date : Friday October 26, 2012

Venue : Shin Yokohama Grace Hotel (Yokohama, Japan)

URL : <http://www.myway.co.jp/products/psim/seminar/user/2012/index.html> (only in Japanese)

PSIM's Japan distributor, Myway Plus Corporation, held its 2012 PSIM Users Conference. Around 50 people attended, mainly users of PSIM for motor drive analysis.

JSOL gave a presentation and an exhibit. In the presentation, we discussed the JMAG-RT motor modeling that is necessary for completing model-based development of motor drive systems. After the presentation, many people told us that they want to use JMAG-RT in the future, and we saw the need for high-fidelity motor models. 

(Tetsuya Hattori)

MATLAB EXPO2012

Conference Outline


Host: : MathWorks Japan

Date : Tuesday October 30, 2012

Venue : Grand Pacific Le Daiba (Daiba, Japan)

URL: : <http://www.matlabexpo.com/jp/> (only in Japanese)

MATLAB EXPO is a conference held by MathWorks. It was a big success this year, with exhibits by around 20 companies.

A number of demonstrations using JMAG-RT were given at JMAG partner booths, particularly by HILS vendors. We received a lot of inquiries at the JMAG booth, and so we felt that JMAG has become a fundamental presence in the HILS field. 

(Takayuki Nishio)

LMS Conference Japan 2012

Conference Outline

Host : LMS Japan K.K.

Date : Thursday November 1, 2012

Venue : Tokyo Conference Center - Shinagawa

URL : <http://www.lmsjapan.com/lmsconferences2012> (only in Japanese)




The LMS Conference is held by LMS in countries around the world. It was held at the Tokyo Conference Center - Shinagawa in Japan on November 1. JSOL gave a presentation and an exhibit. The conference was overflowing with nearly 300 enthusiastic people.

Many of the presentations at the conference were about dealing with vibration and noise in devices, and many attendees were engineers dealing with vibration and noise. Also, the presentation on system simulations using AMESim

showed how cars will be integrated into a smart grid in the future.

For JSOL, we presented the results of our comparison between actual measurements and simulation of vibration and noise of motors done in collaboration with Shibaura Institute of Technology and LMS Japan K.K., and had discussions with a number of engineers about structural analysis techniques for electric motors.

We introduced JMAG products at our exhibition booth, and we received a large number of questions about JMAG-Express from system simulation engineers. System engineers, who are not very familiar with electrical-machine design, seemed very interested in having a tool that would allow them to easily calculate motor characteristics. 

(Yoshiyuki Sakashita)

CEFC2012 **Conference Outline**

Host : IEEE


Dates : Sunday, November 11 - Wednesday, November 14, 2012

Venue : Oita Oasis Tower Hotel (Oita, Japan)

URL : <http://www.cefc2012.org/>

CEFC is an international conference on electromagnetic field computation held by IEEE. Attendees were those conducting the latest research on numerical analysis, mainly at universities, and around 500 topics were presented.

Presentation contents included issues around motors and other electromagnetic products such as transformers and antennas, and also proposals for new numerical analysis techniques. There were especially many presentations on magnetic properties modeling for materials, with panels on proposals for E&S models and Jiles-Atherton models and parameter identification being noteworthy.

JMAG is a numerical analysis simulator, so we are continuing to provide useful functions for users' design, keeping an eye on fundamental analysis techniques, research, and issues such as those found at this conference. I recommend the conference for anyone with an interest in the future of numerical analysis. 

(Hiroshi Hashimoto)

IDAJ CAE Solution Conference 2012・GT-SUITE Conference Day **Conference Outline**

Host : IDAJ Co., Ltd.


Date : Friday November 16, 2012

Venue : Pan Pacific Yokohama Bay Hotel Tokyu (Yokohama, Japan)

URL : <http://www.idaj.co.jp/icsc2012/gtsuite.html> (only in Japanese)

JSOL's own Mr. Yamada gave a presentation entitled "JMAG-RT for high-precision motor models promoting model-based design" at the GT-SUITE Conference Day held by IDAJ Co., Ltd. He introduced JMAG-RT, a solution that makes it possible to handle JMAG's electromagnetic field analysis software - already well established as a development tool - and motor models created by motor designers directly in GT-SUITE.

We will continue to promote JMAG-RT as an accurate motor modeling tool to meet the need for more advanced, higher

current, and more complex motor drive systems for electric and hybrid vehicles in various settings. 

(Tomomi Igarashi)

IDAJ CAE Solution Conference in China

Conference Outline

Host : IDAJ Co., Ltd.


Dates : Monday November 19 - Tuesday November 20, 2011

Venue : Shanghai Zhongyou Hotel (Shanghai, China)

URL : <http://www.idaj.cn/CAEconference2012>

The JMAG Group's China member, IDAJ China, held a JMAG Users Conference.

User Conferences for other products related to JMAG, such as GT-Power and modeFrontier, were also held at IDAJ China's Users Conference.

Like last year, the JMAG Users Conference lasted a whole day, with both morning and afternoon sessions. Both current users and those who plan to use JMAG in the future attended. Large companies such as FAW and research facilities including Shanghai University presented their use of JMAG, and we introduced the new version. In the afternoon, we had a lively discussion for engineers called the "JMAG Salon." Please attend next year if you can. 

(Hiroyuki Sano)

JMAG-LMS Virtual.Lab Seminar


Conference Outline

Host : LMS International Cosponsor : Powersys (JMAG's Europe distributor)

Dates : Thursday November 22, 2012

Venue : LMS France office (Paris, France)

URL : <http://www.powersys-solutions.com/seminar-LMS-2012.php>

We held a training seminar for motor vibration and noise in cooperation with LMS. Training using JMAG and LMS Virtual.Lab at the same time is unusual, and it was received well by both JMAG and LMS Virtual.Lab users. There was a lively exchange of questions at the seminar, which showed the growing attention to vibration and noise. 

(Toshie Furubayashi)

