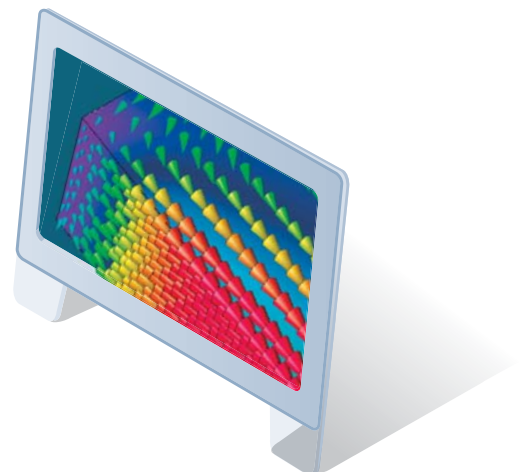


JMAG Newsletter

July, 2012

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 July Issue

This edition of the JMAG Newsletter features JMAG-Designer Ver. 11.1.

It is our pleasure to introduce JMAG-Designer Ver. 11.1, which was released on May 31, 2012.

Our developers talk about the background behind JMAG-Designer's development and its prospects for the future. For the latest version, we received many requests from our users and enhanced the manual mesh functions. We have introduced the new functions along with examples of how to use them, so feel free to try them out yourself.

The JMAG Newsletter covers all parts of the industry, and is perfect for beginners and veterans of simulation.

Take a look and see how it can contribute to your design process.

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

Electromagnetic Engineering Department,
Engineering Technology Division
JSOL Corporation

Product Report

Development and recent improvements to J MAG-Designer

This article describes some of the motivations behind the development of J MAG-Designer and some of the new features in J MAG-Designer 11.1. The new functions support the manual mesh operations that were available in J MAG-Studio so that J MAG-Designer now provides both the convenience of 3D modeling with automatic meshing and the detailed control that manual mesh creation provides. We also continue to add new capabilities and some of the functions that can be expected in future releases are briefly outlined.

Development of J MAG Designer

Before outlining some of the recent improvements in J MAG-Designer I would like to explain some of the motivations behind the creation of J MAG-Designer. When we started J MAG-Designer we could see several trends in the use of CAE tools which would be hard to follow just by improvements to J MAG-Studio. A significant increase in the popularity of 3D CAD programs meant we would need to have much better support for 3D models and links to CAD systems. Also, with 3D CAD now ubiquitous we would need our own 3D geometry editor for J MAG. One of the first features we added to J MAG-Designer to support 3D CAD models was the cut plane analysis feature. Full 3D simulations take time, so early in the design process it is preferable to run 2D simulations, but that used to require creating a whole new model. Using the cut plane analysis feature you can import an existing 3D geometry and automatically create a 2D model from a slice through the model. Support for 3D geometry extends beyond the interface as it puts extra demands on the mesh generator. Creating meshes for 3D geometries poses a challenge for the mesher since the accuracy of standard tetrahedral meshes has been insufficient for applications such as cogging torque

calculations. So far it has been necessary to rely on hand crafted manual meshes for such simulations. However, J MAG now includes the world leading mesher specifically created for rotating machines which enables accurate cogging torque calculations to be performed using the automatically created mesh from 3D CAD geometries (Fig 1).

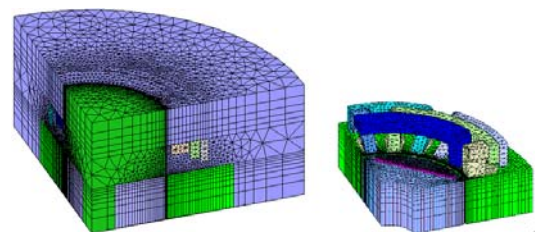


Fig. 1 Automatically created extruded mesh for rotating machines

The reuse of 3D data for 2D simulations is part of a general theme for J MAG-Designer – as a user we do not want you to have to enter the same information more than once. So, for example, we have a material database allowing materials data to be entered once and then re-used. Studies may be copied so that the same settings can be re-used. The analysis template function lets you create the settings for a simulation and save it to the template which can be re-used with different geometries.

This concept is being taken much further with the new JMag Virtual Test Bench which provides the templates for complex calculations involving multiple simulations.

Another trend we noticed was the increase in the number of analyses performed. Faster computers and improvements in the analysis speed mean that many more results can be obtained. When this is coupled with JMag-Designer's parametric analysis function a very large number of analysis runs can be created. This makes handing of the result data important. JMag-Designer introduced project files for grouping multiple analysis studies together and has some basic data management functions for organizing the result files. The new Virtual Test Bench and JMag Super Express extend this by providing a searchable database of previous analysis results. An overview of these results can then be displayed in a dashboard (Fig 2).



Fig. 2 Dashboard display from the Virtual Test Bench

Early versions of JMag-Designer concentrated on the CAD models and ease of use for common operations. However, with the retirement of JMag-Studio it was important that JMag-Designer also provide the detailed manual control over the

mesh and element level results (Fig 3) that was available in Studio. Now with the release of JMag-Designer 11.1 it is possible to have both the convenience of directly using 3D geometries while also having the fine manual mesh control when required. The geometry editor in version 11.1 supports many more functions for directly manipulating the mesh. Furthermore, the feature based meshing capabilities of the geometry editor allow the manual meshing functions to be used with the parametric analysis features. This makes it easier than ever to create accurate simulations for varying geometries.

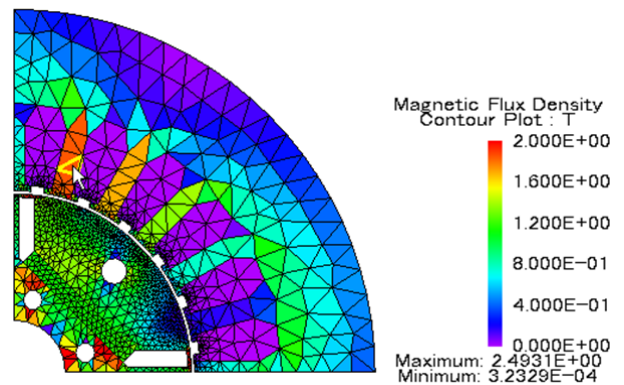


Fig.3 Per-element results in JMag-Designer 11.1

With JMag we want to be able to solve large models quickly and recent additions to the solvers have added new capabilities to speed up the analysis. For example the Explicit Error Correction (EEC) method significantly reduces the length of the initial transient period for certain time domain simulations so significantly reducing the simulation time. Our magnetic solver can now use the power of the GPU to speed up the calculation and the existing parallel solver has been incorporated into the thermal and electric solver modules.


Partnerships

Another exciting development for us has been the partnerships with other CAE vendors so that we can link J MAG's electromagnetic capabilities to other CAE software. We now have two-way coupling with Abaqus from SIMULIA for structural simulation and coupling to LMS International's Virtual.Lab for noise and vibration calculations. We have also introduced a link to MpCCI from Fraunhofer SCAI to couple J MAG to a wide range of other simulation codes.

✂ At this time only NVIDIA Tesla GPU cards are supported.

Future Developments

Looking forward to future versions of J MAG-Designer we have many new features planned. The parametric analysis capabilities already in J MAG-Designer will be extended to allow automatic optimization of user specified result parameters. Instead of creating a large number of cases manually, the system will be able create the cases automatically to find the optimal design. We also plan to make many improvements to the post processing capabilities to help drill down into the results to get the most out of the analysis.

Our goal is to provide more results and more precision in less time and with less effort so that you can concentrate on what matters, the design of your product, and not on the details of the finite element analysis. 

(David Dibben)

Issue 1

Induction Motor Simulation Technology

In this series, I would like to introduce various papers that present ways of using JMAG while performing electromagnetic field simulation. In this issue, I will introduce twelve pieces of literature that discuss simulation technology for induction motors, which have recently been attracting attention as motors that do not use rare earth materials.

Background

What kind of impression do you have of induction motors? Do you think of them as traditional motors that have been widely used for decades? The induction motor was invented in the 1880s [1] and has been applied in a variety of areas, ranging from the industrial to consumer fields. The question, then, is whether the induction motor's design has been completed to the point where there is no longer any room for improvement. As can be seen from the number of cases in the JMAG application notes, permanent magnet synchronous motors, not induction motors, have been the main target of electromagnetic simulation over the last twenty years. One reason for this is that permanent magnet synchronous motor designers need to use electromagnetic simulation to study their designs in detail because this type of motor was developed relatively recently. In addition, electromagnetic field simulation methods like the finite element method, which can handle magnetic saturation with precision, are necessary because the saturation effects in the magnetic circuits of permanent magnet synchronous motors need to be taken into consideration, as even more powerful rare earth permanent magnets have been developed in recent years.

However, we feel that the situation is going to begin to change because of issues with the availability of the rare earth elements used for rare earth permanent magnets.

As their name suggests, rare earth elements are distributed unevenly across the globe, and their availability and cost are not stable. This is why induction motors that do not use rare earth materials have begun to garner attention, even in fields that require high output density and efficiency like hybrid/electric vehicles, which used to be dominated by permanent magnet synchronous motors [2]. Because the aforementioned fields require high output density and efficiency, new induction motor designs that differ from those of conventional induction motors are seeing an increase in demand, so the needs for design simulation are rising as well.

The Difficulty of Induction Motor Simulation

The next question is whether or not an electromagnetic field simulation of an induction motor is easier or more difficult than a simulation of a permanent magnet synchronous motor. Though they have many points in common, an induction motor simulation can be more difficult for the following reasons.

(1) A large number of time steps is required in a transient response analysis

This is because:

- A lot of time steps are required to get results in a steady-state when there is a long time constant of the induced current in the secondary side.

- A lot of time steps are required to get results for one period of 'slip frequency' when the slip is small. For example, when a synchronous frequency is 50 Hz and the slip is 0.01, a calculation for 2 seconds is necessary.

While the qualitative characteristics of an induction motor can be calculated in a frequency response analysis, there are problems like the fact that this kind of analysis cannot consider the effects of harmonics, as well as the fact that the analysis accuracy also decreases when the magnetic saturation is strong.

(2) The three-dimensional effects in a magnetic field are strong

- A squirrel-cage induction motor has an end ring in its secondary conductor, but a two-dimensional analysis cannot consider the effects of end rings.
- It is common to implement skew to reduce the influence of harmonics, and it is necessary to consider the effects of this skew in a simulation.
- The losses in induction motors are increased by 'inter-bar current' which passes between two bars. A two-dimensional analysis cannot consider this phenomenon.

The first reason means that a two-dimensional analysis with a short calculation time is best, but the second reason means that you cannot get accurate results with a two-dimensional analysis. These are the main dilemmas involved.

Approaches to These Problems

I would like to take this opportunity to introduce papers that discuss what kinds of approaches have been carried out so far to solve these problems.

Eliminating Transient Phenomena

The EEC method has been developed as a technique to let transient phenomena converge into steady-states for analyses like induction motors that can have long transient states. This method allows the simulation to

reach a steady-state earlier than an actual induction motor would. JMAG has adopted a similar technique. The EEC method can eliminate a transient phenomenon by adjusting the solution vector of the finite element method for every constant period. In paper [3], the authors introduce an example that applies it to induction motors and permanent magnet synchronous motors, and they show that, in the case of an induction motor, the analysis time before obtaining a steady-state result can be reduced to less than 10%. In addition, JMAG can use a method of converging a transient phenomenon quickly into a steady-state by starting a transient response analysis from an initial state that is close to the steady-state given by a frequency response analysis. This method is called 'Steady-State Approximate Transient Analysis.'

Considering End Rings

The end rings of a squirrel-cage induction motor influence the motor characteristics from the perspectives of secondary resistance and leakage inductance. It is well-known, however, that a two-dimensional analysis does not consider the end rings, meaning that it cannot provide accurate results. It is better to carry out a three-dimensional analysis that models the end rings, but a three-dimensional analysis takes an enormous amount of calculation time. For this reason, various kinds of technique have been examined in order to use a two-dimensional analysis to consider the influence of the end rings.

The simplest methods either revise the electric conductivity of the material characteristic of the bars to match the resistance of the end rings, or treat the cage like an equivalent circuit and the end rings as its lumped parameter (resistance) [4]. JMAG's 'Cage Macro Component' function can create an equivalent circuit for the squirrel cage that handles the end rings as resistance. These techniques are simple, easy to introduce and are widely used because they allow the

value of the revised electric conductivity or the end ring resistance to be obtained easily from the geometry of the end rings.

However, there is a problem that the resistance is underestimated when it is given from a geometry, because the current density in the inside of the end rings has distribution that depends on their shape or its own frequency, and is therefore not uniform.

The leakage inductance from the end rings is not taken into consideration, either.

With paper [5], I would like to introduce a technique that considers the current distribution in the end rings and obtains the revision amount of the electrical resistance. This method first evaluates the voltage drop from the end ring resistance in a three-dimensional analysis, and then uses that result in a two-dimensional analysis to determine the revision amount of the electrical resistivity in the bars. The three-dimensional analysis only models the bars and end rings, and it is performed with a linear frequency response analysis. This means that it can derive the revision amount in the two-dimensional analysis without using much time for the calculations.

Considering Skew

The 'Multi-Slice' method is known as a technique that uses a two-dimensional analysis to consider the effects of skew. In this method, two-dimensional analyses are carried out on several sections that are perpendicular to the rotation axis of an induction motor. Fig.1 shows an outline of this method. For example, in paper [6] five slices were taken out. In [6], these five two-dimensional analyses are unified into one matrix and solved at the same time. At this time, the circuit equation and the magnetic field matrix are coupled and solved so that the primary current and secondary current flowing through the bars are saved by each sectional analysis. Methods like this make it possible to incorporate the effects of skew in a much shorter calculation time than with a

three-dimensional analysis (On the computers of the time it took about 200 seconds). As a result, it was shown that skew can greatly reduce the harmonics in the primary current waveform. However, this method ignores magnetic flux in the axial direction caused by skew.

It is necessary to increase the number of slices in the multi-slice method to express the effects of skew more precisely, but on the other hand, doing this brings about an increased calculation time. To solve this problem, paper [7] applied the 'Transmission Line Modeling (TLM)' method to prevent an increase in calculation time by parallel computing on multiple PCs. The result was that the calculation time with seven slices hardly changed in comparison with one slice.

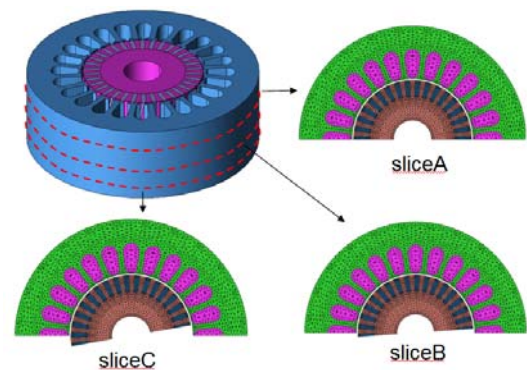


Fig.1 Outline of the multi-slice method

Analyzing Inter-bar Current

It is necessary to model electromagnetic steel sheets between bars to analyze the phenomenon of inter-bar current. However, it is almost impossible from the perspective of the calculation time scale to model an induction motor's structure precisely in three dimensions, because several dozen to several hundreds of pieces of electromagnetic steel sheet are usually laminated. Paper [8] provides an example of an analysis that simulates the inter-bar current in a practical amount of time. First, a two-dimensional transient response analysis is used to calculate the spatial distribution and time variations of the magnetic flux density in an induction motor's air gap. This data is input into a three-dimensional analysis

model as a boundary condition for the magnetic flux density, and then the inter-bar current is calculated in a three-dimensional frequency response analysis. Although each of the laminated electromagnetic steel sheets is modeled in the three-dimensional analysis, the calculation time can be reduced by considering the motor's periodicity and modeling only 1 rotor slot pitch, as well as by calculating only the main frequency component given by a Fourier transformation of the results from the two-dimensional transient response analysis. As a result, it was shown that total losses of the induction motor with skew increase slightly compared to a motor without skew because, while skew reduces the copper losses in the squirrel-cage, it increases the losses from the inter-bar current.

The Future of Induction Motor Analysis

When induction motors expand into fields where permanent magnet synchronous motors are currently widely adopted, such as hybrid or electric vehicles drives, what kinds of analysis technology will become necessary? There are several possibilities.

(1) Magnetic saturation becomes severe

When induction motors begin to be applied to fields that until now have been dominated by permanent magnet synchronous motors, they will be required to have output density equivalent to a permanent magnet synchronous motor. This density, however, could potentially cause magnetic saturation in the magnetic circuit in an induction motor. Until now, the main approach has been keeping the influence of magnetic saturation confined in the equivalent circuit constants of an induction motor that is expressed in an equivalent circuit like a T-type circuit. For example, in [9], the starting calculation of an induction motor was performed after considering the influence of magnetic saturation on leakage reactance (Leakage reactance usually decreases when magnetic saturation occurs). The authors said that it is important to

consider magnetic saturation because line starting causes a high current to flow at start-up.

In contrast, it does not appear that there has been sufficient testing to utilize electromagnetic field analysis effectively on the machine design side, or to optimize a magnetic circuit design that considers magnetic saturation. These tests, however, are being performed with permanent magnet synchronous motors. Will the role of electromagnetic field analysis grow larger in the future as induction motors attain higher output density?

(2) Vibration, noise analysis become important

Motors in hybrid/electric vehicles require a level of quietness that is higher than in motors for industrial or home appliances, so techniques to analyze and reduce the vibration and noise of induction motors will likely become increasingly important. Like with a permanent magnet synchronous motor, vibration and noise in an induction motor are thought to be caused primarily by resonance between the time variation of the magnetic attractive force on the stator and the mechanical eigenmode. The kind of frequency or mode shape in an induction motor's magnetic attractive force has always been inspected theoretically, or by using simulation. For example, in [10], the frequency and mode shape of the magnetic attractive force that can occur in a small induction motor were expressed using a numerical formula. Then, the authors measured the state of the vibrations in an actual induction motor that was running, and compared the sets of results to consider the sources of the vibration as well as the relationship between the magnetic attractive force and the mechanical eigenmode. As a result, the following became clear.


- Vibration at high frequencies is generated by time variations of the magnetic attractive force, caused by the interaction of the slots in the stator and the rotor.
- When vibration occurs because of resonance with a mechanical eigenmode, the induction motor vibrates

with the number of modes of the eigenmode, regardless of the number of modes of the magnetic attractive force.

In addition, [11] shows an example of investigating the influence of skew on the magnetic attractive force by using the multi-slice method introduced in the 'Considering Skew' section.

As indicated here, there are many examples of using a magnetic field analysis to calculate the magnetic attractive force or to measure eigenmodes and vibration, but there are not yet many examples that use a magnetic field-structural coupled analysis to examine the vibration and noise of induction motors. [12] shows a case in which a two-dimensional transient response magnetic field analysis was coupled with a modal method vibration analysis. After that, the actual vibrations were measured and compared with the analysis results at every frequency. Although there are places where the magnitude relationship of the vibration does not match the measured values because a two-dimensional analysis was used, the frequency where vibration was activated agrees well with the measured frequency. In addition, the mode shape of vibration that was activated by resonance is similar to the mechanical eigenmode, as shown in [10].

Conclusion

In this issue, I examined papers about induction motor simulation, and felt that this is a field where electromagnetic field analysis is not being utilized as much as it is with permanent magnet synchronous motors. I hope that in the future, electromagnetic field analysis will be utilized for the design of new induction motors with high performance. 

(Katsuyuki Narita)

Reference

[1]http://en.wikipedia.org/wiki/Induction_motor

[2][http://www.teslamotors.com/blog/induction-versus-dc-](http://www.teslamotors.com/blog/induction-versus-dc-brushless-motors)

[brushless-motors](http://www.teslamotors.com/blog/induction-versus-dc-brushless-motors)

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Common Questions for JMAG

Traditionally, JMAG has been used mainly by technicians specializing in electrical systems, but in recent years there have been more opportunities for it to take part in electromagnetic designs that do not fall within this area, such as mechanical design. There are probably quite a few among those who have made the transition to this unfamiliar analysis tool who worry about how they should use it to perform better analyses.

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

The questions here cover a wide range of topics, such as “Operation Methods,” “Analysis Techniques,” “Result Evaluation,” and “Troubleshooting.” They are sorted according to label, so start reading from the topic that interests you most!

OPERATION METHODS (BEGINNER)

Q1 . How do I arrange a component by rotating it in the Edit Circuit window?

A1 . Use the shortcut key [Ctrl] + R.

This shortcut key is a technique that even people who have been using JMAG for a long time often do not know about. Selecting the circuit component that you want to rotate and pressing [Ctrl] + R causes the circuit component to turn 90 degrees (Fig. 1). Run this operation twice to rotate it 180 degrees.

Of course, the same operation can be performed from JMAG-Designer’s GUI, as well. To run the procedure with the GUI, select the circuit component that you want to rotate and click the [Rotate] button on the tool bar.

As an extra tidbit, the backslash key is a popular shortcut because it collapses the treeview, making the project easier to see.

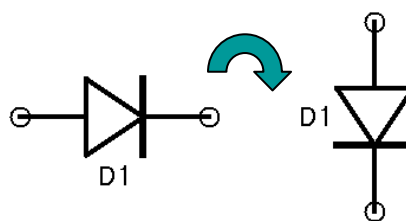


Fig. 1 Rotating a circuit component

OPERATION METHODS (BEGINNER)

Q2 . What settings do I need to examine the eddy currents in a part?

A2 . Set the “Allow Eddy Currents” flag to On in the part’s properties and set the electric conductivity.

To account for eddy currents in your analysis, confirm the item under [Check] and both items under [Settings] as follows:

[Check]

Confirm that the analysis type is either transient analysis or frequency analysis. A static analysis cannot calculate the eddy currents.

[Settings]

- 1) Set the “Allow Eddy Current” flag to On in the part properties (Fig. 2).
- 2) Set the electric conductivity (or electric resistivity) for the properties of the part or material, and select “Use Material Conductivity (Resistivity)” in the part properties if you have set the electric conductivity (or resistivity) of the material (Fig. 2).

The eddy currents are distributed in a narrow region around surface of the part due to the skin effect when the analysis is performed at higher frequencies. This situation requires a fine mesh around the surface to depict the current density distribution accurately. You can create fine meshes to account for the skin effect by using the meshing function “Skin Depth.”

If you need more information about the Skin Depth function, refer to Help as follows:

[JMAG-Designer Help > Agenda tab > Analysis > Generating Mesh \(Automatic\)](#)

[> Generating a Thin Layered Mesh for Skin Effect Modeling](#)

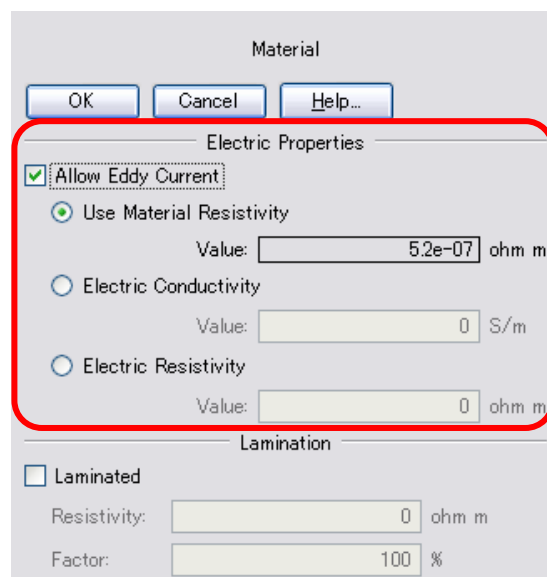


Fig. 2 The properties of a part

ANALYSIS TECHNIQUES (BEGINNER)

Q3. In the 2D analysis calculation methods there is FEM and FEM + BEM. What is the difference?

A3. The mathematical model used in the analysis is different. Use either method depending on your model.

The mathematical model used in the analysis is different depending on FEM and BEM, as they indicate either the Finite Element Method or the Boundary Element Method. I will leave the detailed explanations to the reference guide and focus on the differences between the methods here.

To begin with, a mathematical model selects how the physical analysis target is going to be expressed on a computer. FEM divides the model's interior into small pieces and regards it as an aggregation of elements that have small volumes (or areas in a 2D analysis). FEM is formulated by using the relationships between the elements next to each other. The model using BEM, on the other hand, is defined by elements that lie only on its boundary plane (or edge in a 2D analysis) and are divided into small pieces. BEM is formulated by the relationships between all of the elements, not just those adjacent to one other. If there is a gap between two parts when using FEM then a mesh is generated as an air region, but with FEM + BEM the mesh is created by FEM inside the part and its relationships with the parts around it are united with BEM. This is why an air region is not necessary with FEM + BEM.

Additionally, while an analysis with JMAG's FEM uses an iterative method, an analysis that uses FEM + BEM uses a direct method. The reference guide has more information about the iterative method and direct method, but here I would like to mention that the direct method has better analysis accuracy than the iterative method. Most people probably think that it would be better to use the direct method all of the time because it is more accurate, but using the direct method during an analysis uses a lot of memory and the amount of calculation processing is vastly greater than the iterative method. This is why in JMAG, FEM + BEM using the direct method is only used in a 2D analysis.

The following points are good to remember about the differences between FEM and FEM + BEM.

- FEM + BEM has better analysis accuracy than FEM.
- FEM is better than FEM + BEM when it comes to analysis cost (memory and time).
- An air region is not modeled with FEM + BEM.

ANALYSIS TECHNIQUES (BEGINNER)

Q4. I can't obtain the forces acting on the magnet accurately.

A4. Try taking another look at the mesh divisions for the magnet surface.

The electromagnetic force is calculated from the magnetic flux density, so in places where there are large changes in magnetic flux, the calculation accuracy of the force has a big effect on whether or not those changes are obtained accurately. Changes in the magnetic flux density distribution are generally large in areas near the magnet surface, so a sufficiently detailed mesh is necessary to obtain them correctly. When the magnet's geometry is symmetrical, both the symmetry and size of the mesh affect the analysis accuracy.

Pay close attention to the mesh divisions near the magnet surface when running a magnet analysis.

A good practice exercise for electromagnetic force calculation is obtaining the force on a magnet when only the magnet and coil are arranged in air that does not have a flux path. There is a tendency to think that the force acting on the magnet placed in the air can be calculated easily with a small mesh because the magnetic flux flow can be pictured without running an analysis. However, more attention actually needs to be paid to the mesh divisions, in the same way as with an analysis that obtains the force acting on the tips of the teeth in a motor that has parts made of strong magnetic material.

There is generally a high level of interest about mesh divisions, so there have been countless seminars that cover it.

There are some materials that have been used in past seminars published on the J MAG homepage, so see the following link:

<http://www.jmag-international.com/support/documentation/index.html> (User verification required)

“J MAG Users Week 2005 J MAG Practical Sessions” A-2 Mesh Generation for Precise Calculation

There is also a case that explains how to obtain the forces that act on a magnet in the Application Catalog, so refer to it as well.

http://www.jmag-international.com/catalog/72_SteelSheetMagnet_AttractiveForce.html

RESULT EVALUATION (INTERMEDIATE)

Q5. What does it mean that some elements have a negative permeance coefficient?

A5. It means that the operating points of the magnetic properties are in the third quadrant because of a large reverse magnetic field.

The permeance coefficient P_c that is output as a result of a magnetic field analysis is defined as follows:

$$P_c = -B_d / (\mu_0 H_d)$$

B_d [T], H_d [A/m]: The projection components in the magnetizing direction M of the magnetic flux density B and magnetic field H (Fig. 3).

The permeance shown as a magnetic property of the magnet is usually in the second quadrant. However, when a large reverse magnetic field is applied to the magnet, the operating point can be in the third quadrant (Fig. 4). When this happens, the permeance coefficient has a negative value.

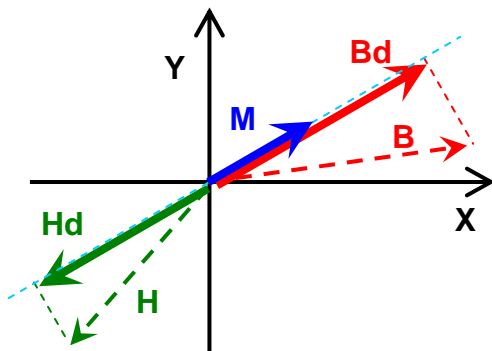


Fig. 3 The projection component in the magnetizing direction

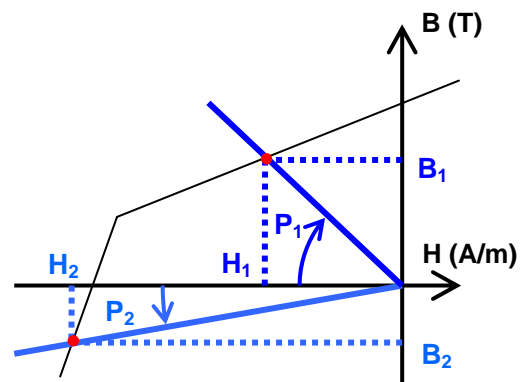


Fig. 4 The permeance coefficient

RESULT EVALUATION (INTERMEDIATE)

Q6. Why did the torque at a high rotation speed drop even though I switched to a material that has good magnetic properties?

I tried to improve the torque characteristics in the PM stepper motor shown in Fig. 5 by using SPCC instead of S45C as the core material. SPCC looks like it has better magnetic properties than S45C from its BH curve, and SPCC actually produced higher torque in the low speed region (Fig. 6). But in the high speed region, it had lower torque than S45C (Fig.

7). What is causing this?

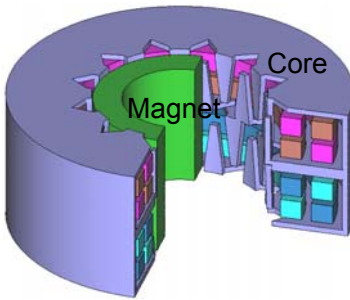


Fig. 5 A PM stepper motor (drive voltage DC24V)

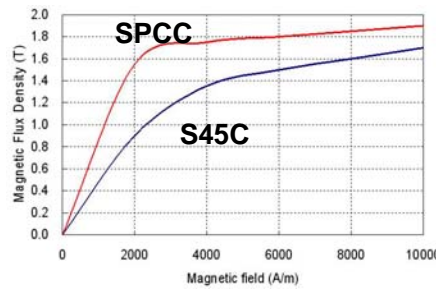


Fig. 6 Magnetic properties

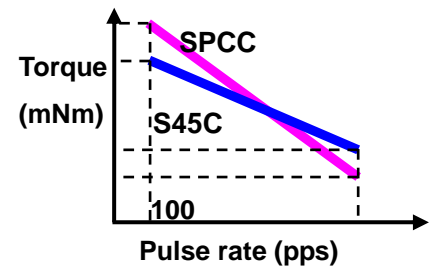


Fig. 7 Torque properties

A6. This happens because differences in the permeability near the operating point cause the responsiveness of the current to change.

The torque characteristics are almost entirely determined by the amount of magnetic flux passing between the rotor and stator, and the magnetic flux is generated by the current to begin with. (The magnet magnetic flux is assumed to be constant and is therefore removed from the evaluation.) This can be seen when the current waveforms from the low speed and high speed regions are taken and compared (Fig. 8). As can be seen from the graph, in the low speed region there is almost no difference in current responsiveness between the two core materials, but in the high speed region S45C's responsiveness is clearly superior.

The cause for the difference in current lies in the slope of the BH curve (the differential permeability). The magnetic field with SPCC has an extremely high differential permeability and time constant compared to S45C in the low region until around 1000 A/m. The operating point in this model was in the low region, so with SPCC's high differential permeability, when the pulse rate rises the current cannot catch up to the changes in voltage.

When there are no changes in current, SPCC can obtain a large torque because it allows a greater amount of magnetic flux to flow. However, S45C can obtain greater torque than SPCC in high speed regions where there are large changes in current, even when accounting for its inferior magnetic properties.

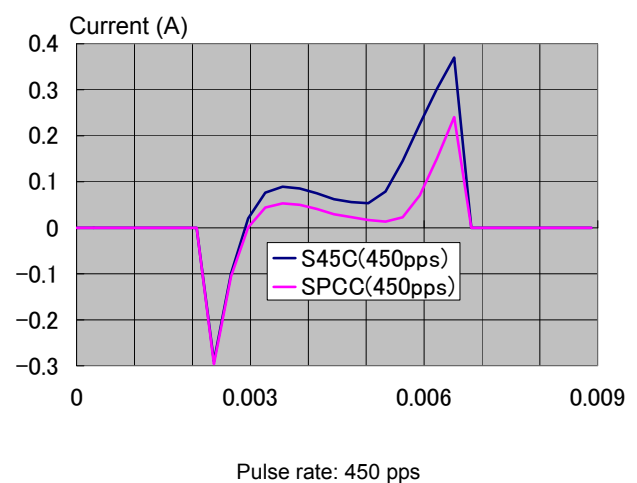
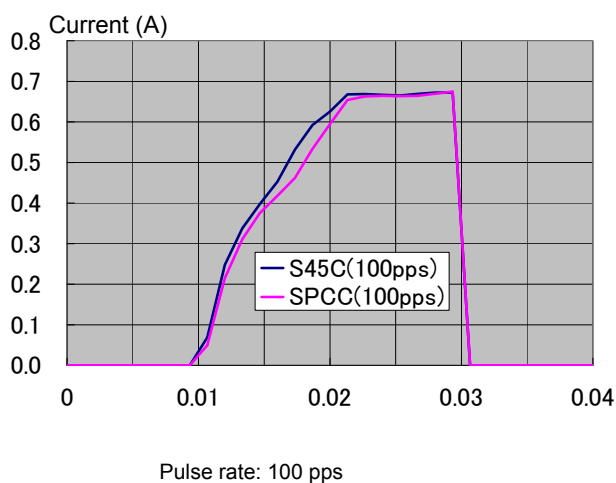


Fig. 8 On/off waveform of the excitation current

RESULT EVALUATION (INTERMEDIATE)

Q7. The coil inductance obtained with the inductance calculation tool does not match the actual inductance that I measured.

A7. Check whether or not the inductance calculation methods are the same between the actual measurement and the analysis.

There are several definitions of inductance, so the calculation method also changes depending on the definition that you are using. Commonly used methods are: obtaining it from the phase relationship between the current and voltage, and obtaining it from the current and the coil's flux linkage amount. The method of obtaining the inductance from the current and flux linkage can be further subdivided into obtaining it from the current and flux linkage in a certain instant and obtaining it from the change in flux linkage caused by a tiny current variation. The following are formulas for these calculation methods:

1) $L = \phi / I$

2) $L = d\phi / dI$

* L: Inductance, ϕ : Coil flux linkage amount, I: Current value

The coil inductance calculation tool obtains the inductance from the current and flux linkage amount in the coil, so the user can specify which of the above formulas to use.

The first step in comparing analysis results with actual measurements is to confirm whether the values were obtained using the same methods. In this case, "method" indicates normal modeling methods, material settings, and condition inputs, and when it comes to inductance, the analysis and measurement both have to have the same calculation methods, as well.

The physical quantity of inductance is generally used as a circuit constant, but its value is actually a distribution constant determined from the relationship between the current density distribution and magnetic flux density distribution. Consequently, approximating the inductance distribution allows you to obtain the circuit constant, which is the inductance value. Understanding that differences in the calculation method equate to differences in the approximation method makes it possible to comprehend the importance of using calculation methods that agree.

There are detailed explanations in the seminar materials for inductance calculation methods, as well, so look through them for more information.

<http://www.jmag-international.com/support/documentation/index.html> (User verification required)

"JMAC Users Week 2005 JMAC Practical Sessions" A-4 Conception of Inductance

TROUBLESHOOTING

Q8. An error occurred in a control simulation using a JMAC-RT model.

I can't run "Vector Control Analysis of an IPM Motor Using Control Simulator and the JMAC-RT System" in the Application Catalog because the following error occurred:

Error in S-function 'JAC037IPM_RT_02/Subsystem/JMAC_RT_pmsm/S-Function': S-Function 'RT_simulink' does not

exist.

A8. The error message indicates that the DLL for the JMAG-RT model calculation cannot be read.

These days it is not rare for electrical appliance designers to use a circuit simulator to perform control simulations. This trend has brought with it an increase in inquiries because the designers are using tools and data formats that they are not familiar with. First of all, check the following confirmation items:

- The folder with the MATLAB/Simulink and JMAG-RT model files is set to the current directory.
- The DLL (RT_simulink.dll) for the JMAG-RT model calculation is in the current directory. If it is not there, copy it from the JMAG installation folder.

JMAG installation folder/JMAG_RT/Simulink/en/RT_simulink.dll

- The correct type of DLL is being used. If the version of MATLAB/Simulink (Mathworks) that you are using is 64 bit, then a 64 bit version DLL is necessary. It is included in the 64 bit version of JMAG. Pay attention to the extension.

JMAG installation folder/JMAG_RT/Simulink/en/RT_simulink.mexw64

- The same error sometimes occurs when Microsoft's redistribution package has not been installed. Microsoft Visual C++ 2010 Redistributable is necessary especially in JMAG-Designer Ver. 11.0 and later. The redistribution package can be downloaded from the Microsoft homepage.


E.g.) Microsoft Visual C++ 2010 x86 Redistributable

<http://www.microsoft.com/en-us/download/details.aspx?id=8328>

Technical FAQ on the WEB

The technical FAQs are available on our website as well, so you can refer to them for further information.

URL: <http://www.jmag-international.com/support/faq/index.html> (User verification necessary)

The Technical FAQs are a collection of questions from actual customers, so looking through them may allow you to make new discoveries about how to use JMAG. We update the FAQ on our homepage regularly, so browse them and streamline your analysis operations. If you have any questions or concerns while using JMAG, do not hesitate to use Technical Support. Let's fully master JMAG-Designer. 

(Takashi Kondo)

Fully Mastering JMAG

Issue 5 Understanding Material Modeling from A to Z

Have you mastered JMAG?

JMAG continues to evolve with each passing day. There may be functions in JMAG that even those who are already using it will learn for the first time, as well as some useful procedures that are not well known yet. Why don't we make operations more efficient by becoming familiar with new functions and operations 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 that you can try.

Overview

Precise material modeling is one of the factors that can significantly affect the accuracy of a variety of analyses, including electromagnetic field analysis. Most people, however, feel that it requires a lot of time and experience to create precise material modeling that reproduces the behavior of materials by assigning each material property to each analysis objective.

JMAG-Designer has developed material modeling that is not only easy to handle, but can also model the behavior of materials more accurately and easily.

In this issue, I will introduce functions for material modeling in JMAG-Designer that can help make operations more efficient. By all means, use this opportunity to take your modeling abilities to the next level.

Management of Material Properties Using the Material Database

JMAG-Designer provides a material database that includes many material properties that are frequently used in electromagnetic field analysis. The material properties do not need to be modeled for each analysis because they are defined

independently. All materials that can be used are displayed in [Toolbox] > [Materials] (on the right side of the screen), and are categorized by manufacturer, material type, etc. (Fig. 1). JMAG has more than 700 types of materials from 14 companies, giving a wide range of material data provided by the leading material manufacturers. This data can be used directly in simulations.

The properties of the materials can be viewed by right-clicking a material in the material list. Select [Details] if the material is provided by a manufacturer, or select [Edit] if the material has been created by a user. After this, the properties of the selected material are displayed in the [Material Editor].

JMAG-Designer defines material properties by dividing them into five categories: "Magnetic Properties," "Electric Properties," "Mechanical Properties," "Thermal Properties," and "Iron Loss Properties." Because these various properties are collectively defined to a material, the material data can be used jointly in different analyses, such as a magnetic field analysis and a thermal analysis. It is especially useful for a coupled analysis.

The numerical data of a material's magnetic properties and iron loss properties are concealed if

it has been provided by a manufacturer, but they can be viewed in a graph. This graph can be enlarged by clicking and dragging the mouse across it, and the detail of its display can be customized by specifying an axis range or grid line from the graph properties (Fig. 2).

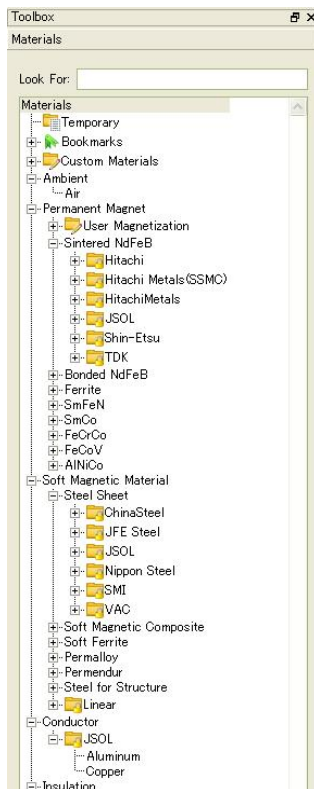


Fig. 1 Material database

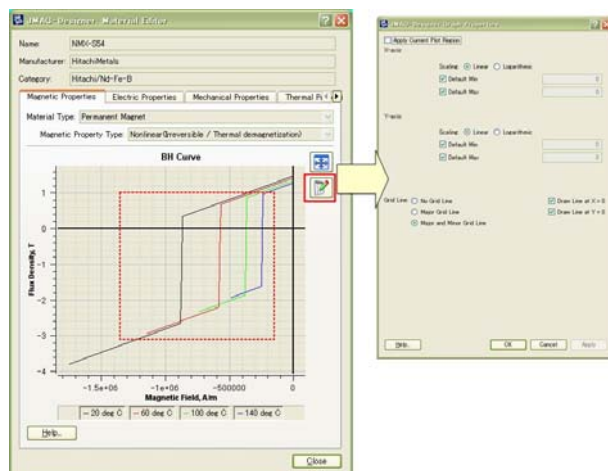


Fig. 2 Property graph of a material provided by a manufacturer

Defining Original Material Properties

Of course, your own material properties can be added to the material database in JMA AG. A material that is either not in the material database or is based on a measured value can be created. Because the material is added to the material database, it does not need to be modeled for each analysis. To define your own material properties, set their values after creating a custom material.

Creating a Custom Material

A custom material can be created by right-clicking [Custom Materials] in the materials list and selecting [Create New] (Fig. 3). The following five categories of properties can be defined, like with the materials provided by manufacturers.

(1) Magnetic Properties

Select the material type first in this category.

The magnetic properties can be defined for a permanent magnet. Temperature dependent properties such as [Nonlinear (Reversible / Temperature Dependent)] and [Nonlinear (Irreversible / Thermal Demagnetization)] can be defined as its magnetic property.

Both the anisotropy settings and the magnetic properties can be defined for a soft magnetic material. The temperature dependent and stress dependent properties can be defined as its magnetic property.

These properties are used in a magnetic field analysis.

(2) Electric Properties

The conductivity and permittivity can be defined in this category. These two properties are used in an electric field analysis, and the conductivity can be used in a magnetic field analysis, as well.

(3) Mechanical Properties

Physical properties such as density and Young's

modulus can be defined in this category. In addition to each component, the anisotropic properties can be defined by a matrix, as well.

All of these properties are used in a structural analysis, and the density can be used in a magnetic field analysis and thermal analysis, as well.

(4) Thermal Properties

The thermal conductivity and specific heat can be defined in this category.

These two properties are used in a thermal analysis.

(5) Loss Properties

The loss properties are used for iron loss calculations in a magnetic field analysis.

Select the loss type, and then set the properties. The loss type can be selected from [Iron Loss Equation], [Hysteresis / Joule Loss Table] or [Iron Loss Table].

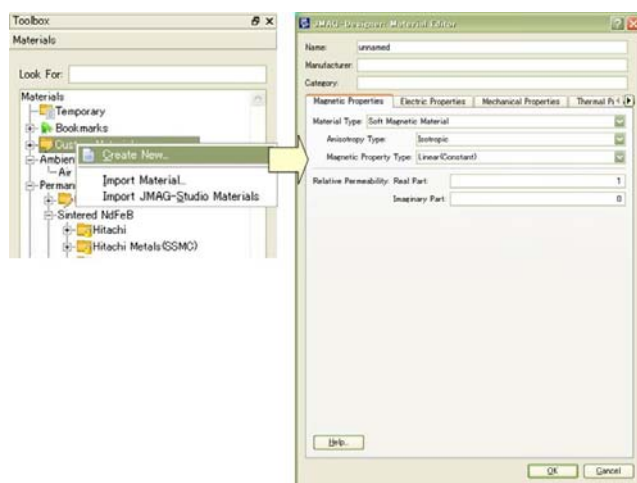


Fig. 3 Creating a custom material

Importing External Material Data

Numerical table data like measurements or experience values can easily be imported to the properties when creating a custom material. Use the following three methods to import numerical table data to J MAG-Designer:

(1) Importing a numerical data table

Though this is not limited to creating materials, the right-click menus of all [Edit Point Sequence] dialog boxes have an [Import] function. This function can import the numerical data table from a text or csv file (Fig. 4). Table data in programs such as Excel can also be copy-and-pasted into the [Edit Point Sequence] dialog box.

(2) Importing materials created with J MAG-Studio

The hb, hbt, hbs and hbp files created in J MAG-Studio can easily be imported and used in J MAG-Designer. Select [Import Material] after right-clicking [Custom Materials] in the material list, or click the import button on the [Edit Point Sequence] dialog box.

(3) Installing the SMMA material database in J MAG-Designer

J MAG has prepared an Excel macro tool that easily imports the magnetic steel sheet data provided by America's SMMA (The Motor & Motion Association) (Fig. 5). The Excel macro tool is in the following folder.

(Installation folder)\%sample %scripts

[File name] MaterialDataConverter.xls

For more information about the detailed operating procedures, open Help in J MAG-Designer and look at Analysis > Creating a Material (Using the Material Database) > Installing the SMMA Material Database in J MAG-Designer.

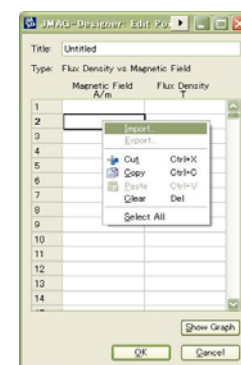


Fig. 4 Importing an external numerical data table

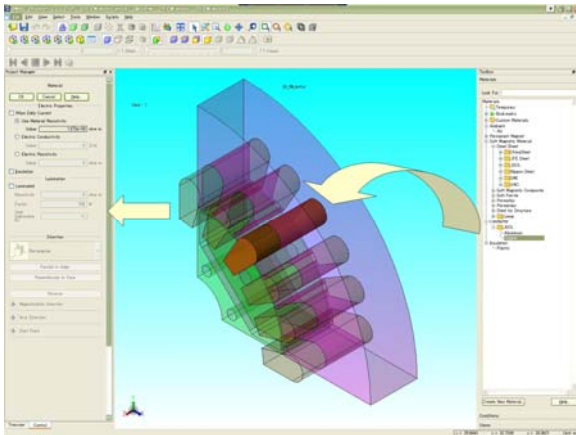


Fig. 6 Assigning to a part in the graphics window

Assigning to a Part in the Project Manager

You can also drag-and-drop the material to a part icon under [Study] > [Parts] in [Project Manager]. If an analysis model has complex geometry or many parts, it can be hard to assign to a target part in the graphics window. To avoid that trouble, this function can be used to assign a material directly to a target part while avoiding operations like rotating the model.

Assigning a Material in a Study to a Part

The materials added to the study (these are under [Study] > [Materials] in [Project Manager]) can be assigned to parts from the right-click menu: Select the part in the graphics window, right-click its material icon under [Study] > [Materials] in [Project Manager], and select [Apply to Selected] (Fig. 7).

This operation is useful when a material needs to be assigned to several parts. Select the parts that need to have the same material assigned to them in the graphics window, and then use this function.

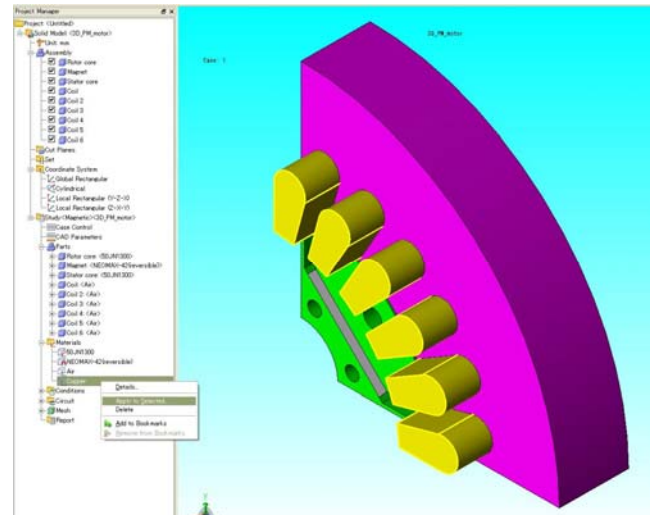


Fig. 7 Assigning a material in a study to a part

Setting Part Properties for the Assigned Material

When a material is assigned to a part, a setting dialog box like [Material] or [Permanent Magnet] is displayed. The setting properties can be defined for each part in these dialog boxes. For example, this operation can be used for a part that needs to have a defined lamination direction that goes along with the magnetic properties of something like a laminated steel sheet. These properties can be used for precise material modeling in each analysis. JMAG-Designer provides highly precise and efficient material modeling by separating the properties that are material-specific from those that need to be defined for each part.

Soft Magnetic Material Properties

[Electric Properties], [Lamination] and [Magnetic Properties Correction] can be set for a soft magnetic material. [Loss Calculation] also can be set if a material has loss properties. Although an iron loss calculation can be performed in a separate loss study, it can also be performed in a magnetic study together with the magnetic field analysis. This requires that the [Iron loss Calculation] condition is

set to the magnetic study and the loss calculation is assigned to the target material.

Permanent Magnet Properties

[Electric Properties], [Magnetization Pattern], [Magnetization Direction], [Skew], [Magnetic Properties Correction] and [Anisotropy Type] can be set for a permanent magnet.

[Transfer Table] can also be set if the material is one of the user's magnetization materials. [Transfer Table] is the mapping setting used when assigning a part in a different position from the magnet in a magnetization analysis. This function allows for general usage of the user's magnetization material.

Magnetization Properties

[Complete Magnetization] and [Material Type] need to be set first in the magnetization properties. There are three types of magnetization: Complete magnetization for isotropic magnetization material, incomplete magnetization for isotropic magnetization material, and incomplete magnetization for anisotropic magnetization material. In addition, the magnetization field and [Electric properties] can be set, as well. [Orientation] needs to be set for anisotropic magnetization material.

Useful Functions Using the Material Database

Although the material database is categorized by manufacturers and material types in the [Material] list, the large number of materials can make it time-consuming to find the material for each analysis. This is why JMag-Designer provides convenient functions to help with using the material database.

Searching for Materials

The [Look For] text box can be used to filter a list of materials that are displayed by material name or manufacturer name. This makes it easier to find a material (Fig. 8).

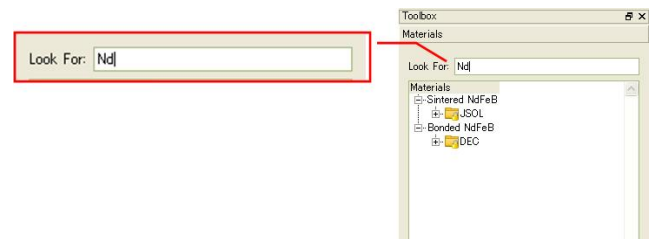


Fig. 8 Searching for materials

Marking Functions

Frequently used materials can be selected quickly by using marking functions. There are two ways of marking:

(1) Adding to the bookmarks

Adding frequently used materials to [Bookmarks] speeds up the search process because it makes them easier to find. To add a material to [Bookmarks], right-click the material and select [Add to Bookmarks].

(2) Adding to the study

Materials can be added to a study without assigning them to a part. These materials under the study are saved in the project file, so custom materials can be used in computers other than your own.

These marking functions are closely linked to material parametric analysis because it is too hard to select a material if all of them are displayed. This is why JMag-Designer only displays the materials under the study and [Bookmarks] when parametric analysis settings are involved (Fig. 9).

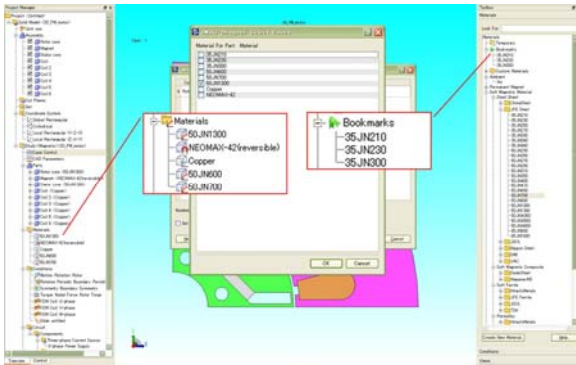



Fig.9 Marking functions in a material parametric analysis

in your own work operations? By all means, take this opportunity to use them and get the maximum benefit from their application.

Next time I plan to introduce an A to Z for creating geometry. Be sure not to miss it. 

(Masayuki Kawai)

Temporary Folder

JMAG-Designer has a material database for each user account on a computer. How can a custom material be used on someone else's computer?

The JMAG-Designer project file (*.jproj files) also saves material properties under the study. Materials are saved by adding them to the study without assigning them to a part. When this project file is loaded by JMAG-Designer on another computer, the materials under the study will be added under [Temporary] in the material list. Right-click a material under [Temporary] and select [Move to custom] to move the material to [Custom Materials], and save it in the material database of that computer. Doing this makes it possible to share the custom material.

In Closing

In this issue, I took the opportunity to introduce JMAG-Designer's various material modeling functions. Were there some functions that you will be able to use to increase productivity or accuracy

Event Information

Event Introduction for July and August, 2012

JMAG is taking part in events both in Japan and overseas. Come take a look at JMAG's activity. In this issue, we will introduce exhibitions held in July and August of 2012.

JMAG Users Conference in Germany

Conference Outline

Host: Powersys Solutions

Date: July 3, 2012

Venue: STEIGENBERGER AIRPORT HOTEL (Frankfurt, Germany)

URL: http://www.powersys-solutions.com/usersconference_jmag_2012.php

This year, we are holding JMAG Users Conferences in countries all over the world.

At this conference, in addition to hosting presentations of case studies by JMAG users, we had the first unveiling of JMAG-Designer Ver. 11.1. We would like to thank all those who came to Germany to see the latest version of JMAG. The program at this JMAG Users Conference emphasized the opportunity for engineers to communicate with each other. It was a good chance to collect information about how electromagnetic field analysis is being used in Europe.

JMAG-Designer Workshop


Conference Outline

Host: Graz University of Technology

Date: July 11, 2012

Venue: Graz University of Technology (Graz, Austria)

URL: <http://eam.tugraz.at/en/aktuelles/aktuelles-details/article/jmag-designer-workshop.html>

We held a JMAG-Designer workshop at Graz University of Technology. This workshop made it possible to get a basic understanding of the operating procedures for electromagnetic field analysis using JMAG. Attendees included both JMAG users and people who were planning to start using electromagnetic field analysis in the future. We were grateful to see participation from companies centered in Austria as well as from other parts of Europe. 

(Tomomi Igarashi)

Event Information

Event Report

The following are reports written by those who attended events in May and June of 2012. Please attend next time if you get the chance!

SMMA 2012 Spring Conference Outline

Host: SMMA - The Motor & Motion Association


Dates: May 1 - May 3, 2012

Venue: Sanibel Harbour Resort (Florida, America)

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

SMMA is the manufacturing trade association for the electric motor and motion control industries. More than 120 member companies include manufacturers, suppliers, users, consultants and universities. They hold two conferences each year, with the spring conference focusing on management and the fall conference focusing on technology.

This conference held a management meeting, and around 80 people attended. The meeting started with a short course from Daniel B. Jones of Incremotion Associates that covered the basics, including comparisons of each type of motor: induction, brushless DC, SR, etc. There was also business training that included ways of finding customer needs, status reports and predictions about the motor and motion control markets, and the market reaction toward rare earth pricing. Additionally, a motor supervisor from UL Standards gave a report about additional standards for traction motors, putting the final touch on a conference that had a wide range of variety.

Making use of group discussions and break times during the conference, there were spirited debates about business challenges and technical problems with motors between motor design and production companies and engineers who specialize in motor consulting. 

(Yusaku Suzuki)

PCIM Europe 2012

Conference Outline

Host: Mesago Messe Frankfurt

Dates: May 8 - May 10, 2012

Venue: Nuremberg Messe (Nuremberg, Germany)

URL: <http://intermagconference.com/2012/>

At PCIM Europe 2012 in Nuremberg, Germany, POWERSYS introduced JMAG Designer Ver. 11. Most of the people we met were interested by co-simulation between PSIM software and JMAG Designer. This event gave the opportunity to introduce JMAG for the first time in PCIM.

With a 3 % increase in its number of visitors, PCIM Europe 2012 closed its doors. 6,874 trade visitors visited the stands of 363 exhibitors to see the recent developments and trends in power electronics, intelligent motion technology, renewable energy and energy management. The conference was attended by 744 delegates. 

(Corinne ROCHERIEUX: POWERSYS)

5th Conference Simulation and Testing for Automotive Electronics

Conference Outline

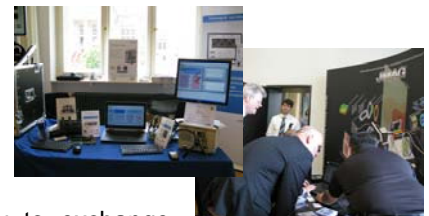
Host: IAV Automotive Engineering

Dates: May 10 - May 11, 2012


Venue: TU Berlin ScienceMarketing Lisa Hertel (Berlin, Germany)

URL: <http://www.iav.com/en/events/iav-tagung/5th-conference-simulation-and-testing-automotive-electronics>

Around 200 engineers and designers from companies interested in vehicular technology, testing, and simulation attended IAV Automotive Engineering. The presentations and exhibitions were about a variety of themes, from FPGA simulation to proposals for driving assistance systems focusing on sensor technology. The presenters, exhibitors, and attendees all took the opportunity to exchange information, leaving the impression that it was an extremely active conference.



At the JMAG booth, we explained that JMAG-RT is a high-fidelity motor model for HILS. Because there were so many people involved in testing, we also emphasized the fact that it can be used in forecast evaluations of accidents in actual machines or breakdown simulation verifications. National Instruments Corporation, one of our partners, also gave a presentation about linking with JMAG-RT. They got across all of JMAG-RT's key points by showing that it can provide accuracy equivalent to FEA in less time.

The conference was held in a classical building, making it somewhat surprising that it provided a venue for discussions about modern topics like software and electric vehicle technology. 

(Ryoko Imamura)

2012 SIMULIA Customer Conference

Conference Outline

Host: SIMULIA

Dates: May 14 - May 17, 2012


Venue: Rhode Island Convention (Rhode Island, America)

URL: <http://www.3ds.com/company/events/scc-2012/overview/>



The 25th anniversary Simulia User's Conference was held from May 15th -17th in Providence, Rhode Island and attracted over 200 attendants representing a variety of industries. It was exciting to discuss Electromagnetic modeling with customers and find out what project they are working on as well as how we can improve J MAG.

The conference's focus was on the new release of Abaqus 6.12 and the potential and possibilities of today's simulation software. During the conference there were a number of customer presentations demonstrating how Abaqus could be used to develop accurate system models.

To facilitate even more accurate system models, JSOL and Simulia are working to improve the link between Abaqus and J MAG with the goal of making the connection as seamless as possible. Dr. Takashi Yamada of JSOL presented several examples of linked models where the Electromagnetic results from J MAG were coupled to Structural/Thermal results in Abaqus. The growing importance of multiphysics simulation is recognized by both companies. Simulia's Multiphysics Lead, Karl D'Souza had this to say about the JSOL/Simulia partnership, "the new co-simulation capability between Abaqus and J MAG significantly expands the scope of real-world problems that can be addressed today, especially in the challenging area of hybrid/electric vehicle development. Simulia continues to work closely with JSOL and our common customers to define and develop the next generation of multiphysics simulation." We couldn't agree more, and look forward to extending J MAG's modeling capabilities! 

(Dave Farnia: POWERSYS)

31st Annual WEMPEC review Meeting


Conference Outline

Host: WEMPEC (Wisconsin Electric Machines and Power Electronics Consortium)

Dates: May 15 - May 16, 2012

Venue: University of Wisconsin-Madison (Wisconsin, America)

WEMPEC is a consortium related to electrical equipment and power electronics, and currently 81 sponsors take part in planning it. Once a year they have a meeting for the sponsors, where they introduce the latest technology for power electronics and motors, give research progress reports, and have discussions built around poster sessions. This year was the 31st time they have held the meeting, and approximately 300 people attended.

At the meeting there were eight presentations and 48 posters on display by students, and Professor Lorenz and Professor Jahns introduced their latest technology by summarizing the research from these presentations and posters. J MAG is contributing to this research, and is assisting with both dynamic loss evaluations and optimization system construction for motor designs that combine with distributed calculations. 

(Yusaku Suzuki)

5/30 Users Conference in Taiwan

Conference Outline

Host: Flotrend

Date: May 30, 2012


Venue: Taipei University Hospital Conference Center (Taipei, Taiwan)

URL: http://www.flotrend.com.tw/2012_seminar/jmag02/



This J MAG Users Conference was held by Flotrend, a member of the J MAG Group in Taiwan. Around 70 people who either already use J MAG or are thinking about starting to use it attended.

JSOL introduced the new solutions J MAG-VTB and J MAG-SuperExpress. Those who saw demonstrations of these new products participated actively in the Q&A session held afterward, so their keen interest in J MAG was apparent.

There are a lot of users in Taiwan who have been utilizing J MAG for a long time, but we were still able to see cutting-edge techniques, including 3D analysis user case studies with J MAG-Designer that applied the latest functions. 

(Hiroyuki Sano)

ITEC 2012 (IEEE Transportation Electrification Conference and Expo)

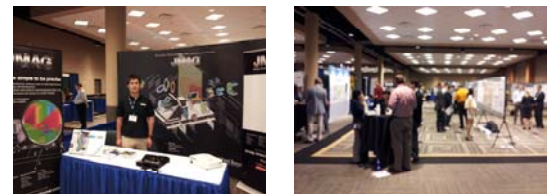
Conference Outline

Host: IEEE

Date: June 17 - June 20, 2012


Venue: Hyatt Regency Dearborn (Michigan, America)

URL: <http://itec-conf.com/>



The first ITEC was a conference and exhibition that focused on components, grid interface technologies, and power conversion for EV/HEV transportation. Of the 800 attendees, most were auto manufacturers based in North America and vehicle component manufacturers. GM's Chevrolet Volt and Ford's FOCUS were on display, and Powersys, J MAG's distributor in North America, exhibited as well.

There were ten keynote presentations from leading companies and figures in the automotive industry, fifteen panel discussions, and presentations accompanied by poster sessions that were divided into ten fields. Among these there were reports and debates about challenges facing electric vehicles, as well as the latest technology in power electronics, batteries, and motor drives involved with these challenges.

We followed suit in the J MAG booth, and exceeded simple motor electromagnetic field simulations by introducing multidisciplinary simulation technology that coupled heat and structure, as well as system simulation technology that linked motor drives and power electronics. Attendees actively participated in the following exchange of opinions. 

(Yusaku Suzuki)

2012 LMS America Vehicle Conference Conference Outline


Host: LMS International

Dates: June 19 - June 20, 2012

Venue: Detroit Athletic Club (Michigan, America)



The LMS America Vehicle Conference is an NVH and System/Control simulation conference held every year, primarily aimed at the North American automotive industry. Keynote presentations and panel discussions were held on the first day, and the second day was split into each session (Virtual.Lab, Imagine.Lab, and Test.Lab), where introductions of new functions and case studies from users were performed. Around 300 people attended.

JMAG has linked with Virtual.Lab with the objective of performing detailed noise and vibration simulations of electrical equipment. Powersys, JMAG's distributor in North America, gave exhibitions and presentations on behalf of the JMAG group. The presentation focused on worsening problems with rare earths and introduced simulations of noise and vibration caused by the electromagnetic force in SR motors. Questions after the presentation and opinion exchanges in the booth expressed needs for electromagnetic noise analysis for servo motors, actuators, and electrical equipment like sensors, in addition to motors that produce traction. These created even higher expectations for a JMAG-Virtual.Lab link as a solution to these problems. We will continue to introduce functions and case examples in order to meet these expectations. 

(Yusaku Suzuki)