JMAG Newsletter

Contents

Implementing JMAG

Honda R&D Co., Ltd
Employing JMAG as the Common Language of Motor Development
Devise Unique Solutions and Accelerate Creative Development

It's no exaggeration to state that eco-friendly hybrid and electric vehicle development will determine who comes out on top of the automobile industry this century. The core component of the vehicle is the motor, and Honda R&D leads the field in ingenious motor development.

JMAG serves as a "common tongue" for the magnetic circuits of motors and contributes to inspiring Honda's creativity.
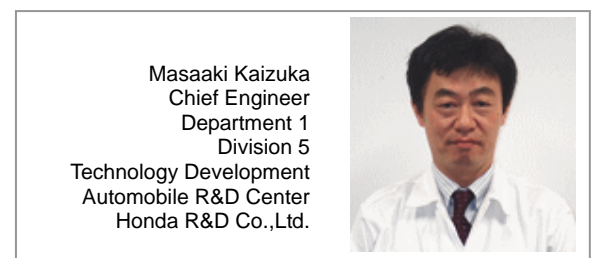
We discussed JMAG with Mr. Kaizuka, the motor development group leader and staff for Automobile R&D Center Technology Development Division 5..

Bestowing the fundamentals of vehicle creation with "bullseye" precision

- I understand that Mr. Kaizuka and his staff work in the " Automobile R&D Center Technology Development Division 5", but could go into a bit of detail about your jobs and responsibilities?

Kaizuka We develop electric power plants for hybrid electric vehicles (HEV), electric vehicles (EV), plug-in hybrid electric vehicles (PHEV) and fuel cell vehicles (FVC). To be exact, we work on motors, batteries, and inverters. Of all of these, we are primarily concerned with motor development and research. There are members of our team who work on development geared for mass production, and other members in charge of elemental technology with an eye on the future.

- At your research center, you are developing hybrid technologies in which one to three motors are used

Masaaki Kaizuka
Chief Engineer
Department 1
Division 5
Technology Development
Automobile R&D Center
Honda R&D Co.,Ltd.

in a vehicle, in accordance with its size. How do you make use of JMAG developing such highly unique technologies?

Kaizuka Our hybrid system equipped with FIT is characterized by a relatively moderately-priced motor with high environmental performance. Power is drawn from the motor when accelerating, while performing the regenerative power generation with the same motor when decelerating. Two separate motors aren't needed for both acceleration and regenerative power generation, so just installing relatively low volume specialized secondary batteries works.

Furthermore, this allows for a light, compact

design, so one of the merits is that this system can be used in a wide variety of vehicles. Motors are being manufactured internally based on these technological achievements, but if the development and design for the motors can't keep up with commercial production, the damage will be large. The requirements for development are extremely demanding; from the development stage to the start of production, not even a second's delay can be tolerated. JMAG is an essential tool for development and planning, as it can be used in these strict conditions.

- So you use JMAG for various levels of development.

Kaizuka It is considered normal that calculation results of torque, torque ripple, loss, and power match the measured values. With a background like that, JMAG is used to inspect various tasks in order to reduce the number of prototypes and realize high precision analysis from the initial stages of development.   In other words, calculating something without actually physically creating it, and then correctly making that item based on those calculated results is what we mean by "bullseye" precision, which is our goal.   Not all motors can be made creating only one prototype with JMAG, but we still strive to hit the bullseye, so to speak.

  Regarding how to use JMAG, our company has its own specialized uses, and this is shared amongst JMAG users. For example, with our unique modeling methods, instructions for usage, and discovering issues in our products under development, we are able to come up with unique ways of using JMAG for analysis, and we are proud to say that we have enabled JMAG to be used as an essential tool for motor development.   Currently we are delving in even further by working on

analyzing motor noise and heat with high accuracy.

Overcoming requirements with JMAG

Kawanami I work on EV and FCV motor development. For EV motors, there are several technological requirements for vehicles, such as implementing an efficient motor with high power performance to guarantee range as well as power performance and technological maturity. Especially in the area of efficiency, EV and FCV are vehicles ran by motors, so heating and cooling performance is an utmost requirement.   To create a design with a high accuracy heat calculation, heat generation and its areas must be well known. We calculate loss distribution calculations in magnetic field simulation by using JMAG's finite element method, and then perform a thermal analysis based on the obtained results.

- Are there any inherent challenges with FCV?

Kawanami Only the type of fuel for EV and FCV is different, so as motors there is no difference. In any case, motor development for EV and FCV clearly shows the difference of technological competence from other companies.   Motor efficiency is connected to electric efficiency and how the car feels when running. Magnet demagnetization in the motor is especially a big issue. JMAG is invaluable in taking design to its very limit and determining exactly where demagnetization is occurring.

Koji Kawanami
Role: Motor development of EV and FCV

Magnetic Flux Density[T]
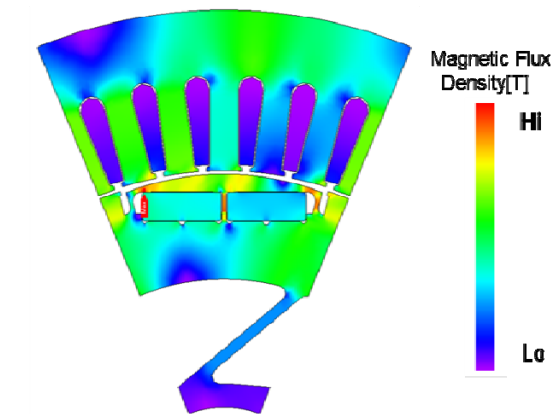
EV Motor Analysis Case
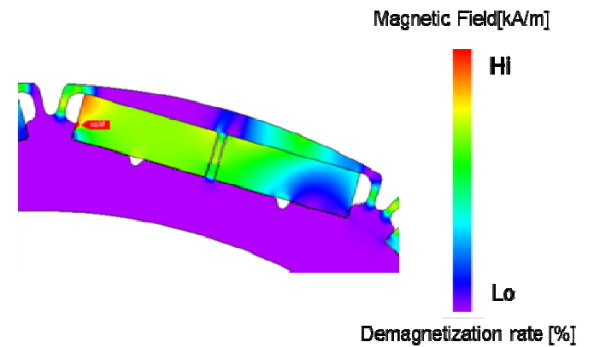*EV Compatible Car Series: Fit-EV

Magnetic Field[kA/m]

Demagnetization rate [%]

IMA Motor Analysis Case
*IMA Compatible Car Series: Insight / CR-Z

Soma   I work on one-motor hybrid vehicles such as "FIT" and "VEZEL". For one-motor vehicles, their motors require a high torque density.

  We want to make the installation space as small as possible, so we have put our utmost efforts into the size and geometry of the motor. Space between neighboring parts is also very tight, so heat-related requirements are also demanding. On other hand, as the amount of hybrid vehicles increase, so does volume efficiency, so I want to create designs that can cut costs by even one yen. For stringent design requirements, we use JMAG on a daily basis.

Shingo Soma
Role: Motor development of HEV (One motors)

- How is it used in development for more than two motors?

Inoue I am participating in the development of two-motor vehicles such as "Accord PHEV." Although it has two motors, it does not necessarily mean that there are two times the employees involved, but there is still a need to reduce development time, and this is made possible using JMAG. The software comes in handy when pinpointing exactly what it is that needs focusing in the development stage. The process involves a wide range of parameters for evaluation to suit various situations. We then need to assess the problems, find solutions and tie it into production. As a lot of weight is on thermal analysis, we make frequent use of it in JMAG.
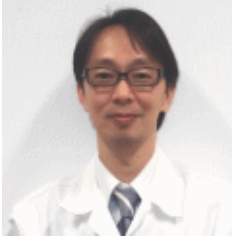
Masashi Inoue
Role: Motor development of HEV (two motors)

Highly reputed as "trustworthy because its results are derived from thorough analyses."

- This is going to be backtracking a bit, but could you explain how the history of motor development started, and what led you to using JMAG?

Kaizuka We obviously started motor development to develop electric motor cars and I believe this was at the start of the 90s. Conventional cars also equipped various types of motors but the motors for electric motor cars were completely different. However, we had absolutely no knowledge of motor design or magnetic field analysis to the level of "what kind of motor do we need to make, and how much torque can we expect from it."

As we accumulated knowledge, we incorporated magnetic field analysis software and was finally able to deliver our first motor, but the software we were using had difficulty in working with large models and analysis time took too long to meet our demands.

- And that is what led you to incorporating JMAG?

Kaizuka That's right. We began with only a few licenses of JMAG, but we were satisfied with the results that exceeded our expectations such as its usability, high accuracy, wide analysis range and helpful support team. JMAG users gradually increased within the company, and now most departments make full use of the software.
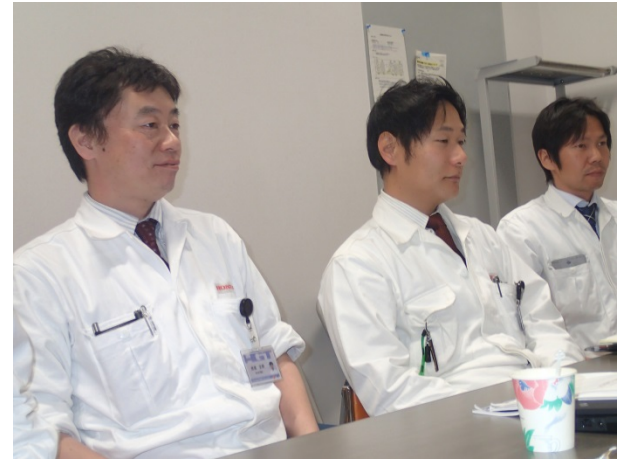
- How is JMAG's reputation inside and outside your company?

Iki I am responsible for the future of element technology. I use optimization calculation in designing more than a thousand patterns to research motor characteristics in response to various conditions. For this reason, designs evaluated with JMAG are said to be "highly trustworthy in design as it has been throughly evaluated in the analysis."
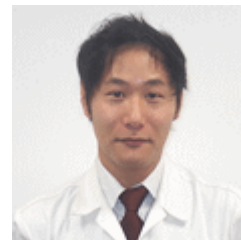
Tomotaka Iki
Role: Development of element technology for the future

Oya I am in charge of two regions including new generation motors and one-motor types. This includes finding the point where conditions and demands intersect. I narrow down ideal conditions from these limited design spaces. Instead of "let's just make it and see what happens," we start production using only one specification based on JMAG's analysis results. JMAG's analysis results

always delivers the output that we had in mind.
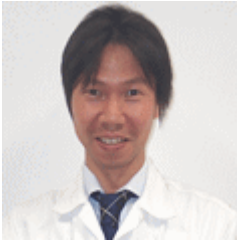
Satoyoshi Oya
Role: Motor development of new generation motors and HEV (1 motor)

Iki Even for themes that are extremely complicated, JMAG would prove to be a lot of help. The keywords that we always keep at the back of our heads are low-cost, compactness, and high efficiency; motors fulfilling these conditions can be used in both EV and HEV, and the development efficiency is increasing, as well as contributing to reduction of development costs. It is impossible to envision development without JMAG.

Kaizuka We must also note that the quality of JMAG lies in its compatibility with the production site.   As we have mentioned earlier, the production of motors in the company being delayed for even one second can be critical. Therefore, it will be vital for us to compare and adjust at the preliminary stage of production. With the magnetic circuit specification determined from analysis results of JMAG as the base, we would discuss with the production site the reasons behind the specifications, and make full use of JMAG in solving the issues that rise from inconsistencies. We feel that keeping consistent with overseas production sites will be increasingly important and using JMAG as a "common language" will be the key.

Hopes for JMAG to Evolve into an Integral Solution Combining Thermal Analysis and Structural Analysis

- It is great to know that JMAG is being used as an analysis tool, but also as developer's tool, as well as a tool to keep consistent with the production site. What do you expect of JMAG and its functions in the future?

Kaizuka We hope for its expansion into an "integral solution for motor development." JMAG has the most sales figures domestically in terms of electromagnetic field analysis. It is gaining recognition as an industry standard amongst developers. Evaluating using JMAG is already a trend in our field.

   However, as a user, we expect it to continually evolve as an integral solution. We hope thermal analysis and structural analysis in JMAG will be expanded further to the level that people will recognize JMAG as the only solution for motor development. For that reason, we feel that it is important for JMAG   to couple with analyses such as thermal and NV.. We look forward to a feature that will make integral evaluations linking JMAG's strength of magnetic field analysis and other types of analyses.

R&D

Honda R&D Co.,Ltd.

Company name: Honda R&D Co.Ltd

Established: July, 1960

Capital: 7.4 billion yen

Representative: Yoshiharu Yamamoto, President and Director

Business Overview

Founded after the division of the research / development department of Honda Motor Co., Ltd. Currently responsible for technical development as a research / development facility of Honda Motor Co., Ltd. It is involved in the development of two-wheel, four-wheel, general-purpose products, air craft engines and basic technology.

http://world.honda.com/RandD/

Product Report

Introduction of JMAG-Designer Ver.14.0

JMAG-Designer Ver.14.0 (hereinafter Ver.14.0) was released on December, 2014.

The main feature of Ver.14.0 is the improvement in performance of multiple cases including parametric analysis. With the realization of distributed processing in the entire work flow, acceleration of analysis speed by approximately 170 times has been achieved in scales for a few hundred cases. In addition, many functions have been added and enhanced for multiple case analyses including the acceleration of loading times for result files using 1000 cases, and reduction in memory usage. This document will be introducing the new features of Ver.14.0.

Introduction

We released JMAG-Designer Ver.14.0 in December, 2014.

Due to demands for portability and high efficiency of electric machinery, optimum design expanding the conventional design space is required. For these design evaluations, multiple case analyses allocated with parameters of geometries and conditions will be necessary. In Ver.14.0, distributed processing using cluster systems have reduced the time necessary in the entire work flow of multiple cases. Furthermore, loading times and memory usage of result files in multiple case calculations have been greatly reduced. Work efficiency has also been improved with the simultaneous process of mesh generation and table data output. With these new functions, it is possible to efficiently work with an even larger number of cases.

To efficiently use multiple models and result files obtained in analyses, new data management functions including JMAG-Explorer that realizes data management, search, and extraction have been added.

A function that enhances work efficiency has also been added in the geometry editor. A geometry model diagnosis function that checks whether mesh generation is possible has been added. With improvements in the constraint function, operation in geometry change has been enhanced. In addition, supported formats in CAD file import has been expanded, and the motor template has been added.

As for the external linking function, the motion linking function has been expanded and the multipurpose file input / output tool has been improved; this has strengthened the link with external software.

Multiple Cases / Parametric Analysis

Ver.13.0 has realized acceleration using solvers of 128 parallels, and Ver.13.1 has realized smooth operation of large scale models with 1000 parts and 10 million elements. Solver acceleration and operation improvements have been successful in single cases, but as for analyses with multiple cases, improvement in pre-post processing efficiency has been the theme. Ver.14.0 has prepared a distributed processing environment with a cluster system for creating geometry, setting conditions, and evaluating results on top of running

analyses; therefore the time required in the entire analysis flow of multiple cases have been greatly reduced.

To improve the operation of mesh generation and result evaluation of multiple case analyses, new functions have been added. Now simultaneous generation of mesh for all cases and simultaneous output of table data is supported, and required operation steps can be reduced to steps equivalent to one case. As for result processing, loading times of result files of 1000 cases and required memory have been greatly reduced and the operation of multiple case data has been enhanced.

Distributed Processing Using the Cluster System

With the provision of a Linux pre-post, distributed processing of an entire work flow that is not dependent on the platform of the cluster system has been realized.

An actual case where an efficiency map was created from a 2D motor model of 256 cases using a Linux cluster system will be explained here. When running a solver, 1 case only takes 20 seconds, but pre-post processing takes a total of 40 seconds (Fig.1). When pre-post distributed processing is not used, time equivalent to 256 cases will be required (Fig.2). For cases where pre-post processing takes a large proportion of the entire workflow, analysis time will reflect the number of cases. Through distributed processing, the increase in analysis time of pre-post processing has been controlled and results can be obtained in the time equivalent to one case.
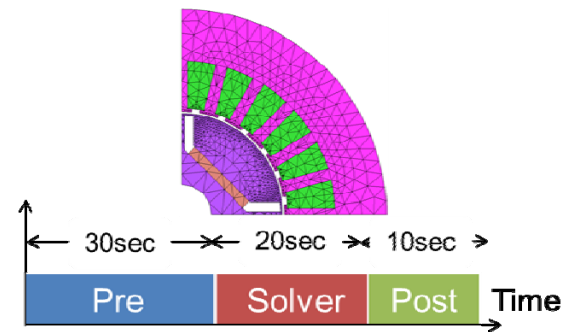

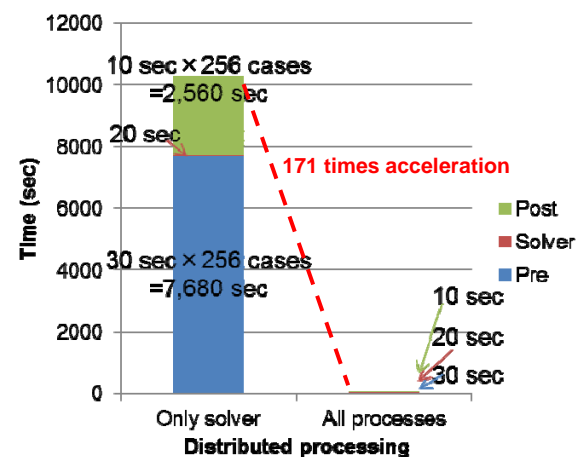Fig.1 Time required for 1 case of a 2D motor model

Fig.2 Acceleration with distributed processing

Operation Enhancements of Multiple Case Data

After the analysis, the result file is loaded and the results are confirmed. In Ver.13.1, the time required in loading all case results after running multiple cases was the bottleneck of the work flow. By increasing the load speed of the result file, operation became smoother without being conscious of load from the number of elements and cases, such as 10 million elements and 1000 cases (Fig.3). Also, by controlling memory usage while loading the result file, even more cases within the range of the equipped memory could now be handled simultaneously (Fig.4).
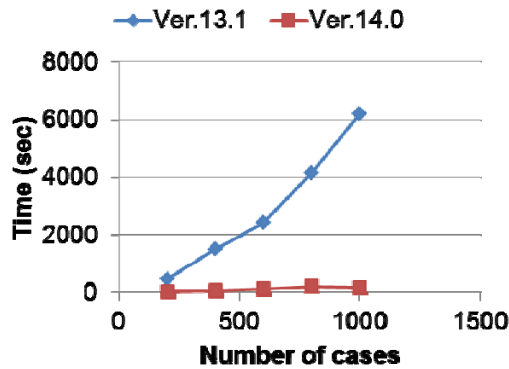
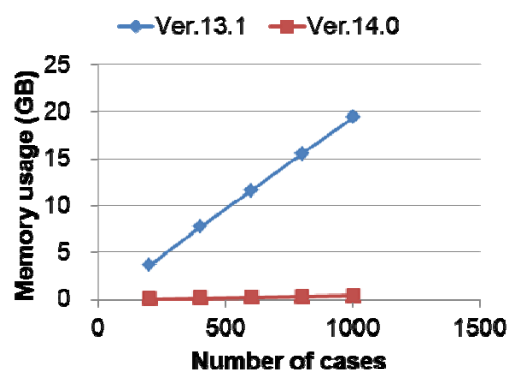Fig.3 Comparison of loading times of result files

Fig.4 Comparison of memory usage in loading result files

Simultaneous Mesh Generation for All Cases

A function that could simultaneously generate mesh for geometries of all cases has been added. There is no need to run mesh generation by switching the case each time any longer and as a result, work efficiency has been improved (Fig.5).
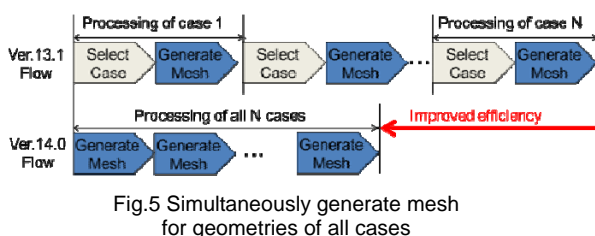

Fig.5 Simultaneously generate mesh for geometries of all cases

Simultaneous Output of Table Data for All Cases

The table data of all cases can now be simultaneously output as csv format from the result tree. As a result, processing for each result is no longer necessary, and results of all cases after parametric analysis can be output simultaneously as one csv (Fig.6).
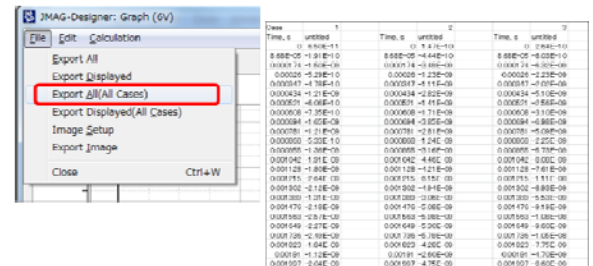

Fig.6 Specify table output of all cases (red outline), output csv file

Supports Variable Input

Definition of parameters such as dimensions, materials, and analysis conditions can be changed to variables. By using common variables for condition settings and step control, multipurpose models can be created. Using these shared variables in case control, parametric analysis can be run (Fig.7).

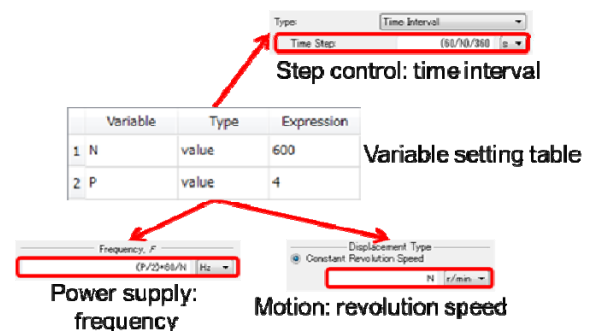

Fig.7 PM motor analysis example
(N: revolution speed (rpm), P: number of poles)

Data Management

By organizing data obtained in the past, and restructuring it, evaluation can be run from new angles. In addition, by reusing data from the past, new analyses can be run more efficiently. To efficiently use data, functions for data management, search, and extraction have been added, as well as

a function for re-use.

JMAG-Explorer

Due to operation enhancements in multiple case analyses, it has been made possible to incorporate more analysis cases than before allowing the handling of more models and result files. In addition, JMAG-Explorer has been added to efficiently use multiple data.

JMAG-Explorer lists and displays JMAG related files in the folder. Search file names, model names and study names, and check cases and conditions included in the file using JMAG-Explorer without opening JMAG-Designer. It also supports data deletion; therefore access and management of data will be much faster than before. The file can be directly selected and open in JMAG-Designer using JMAG-Explorer, allowing smoother transitions to the objective analysis (Fig.8).
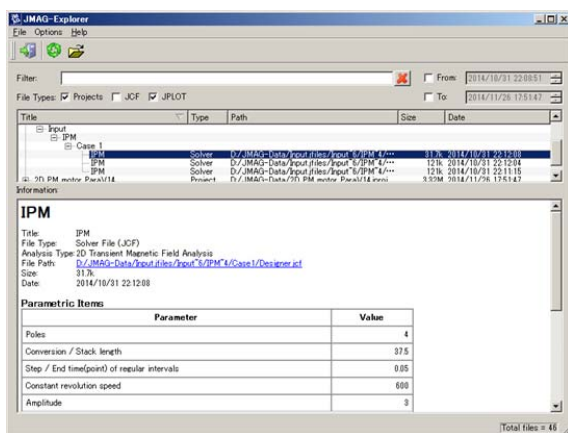

Fig.8 File list display using JMAG-Explorer

Project Export

When exporting the project, the models and studies to be exported can now be specified. By creating a new project only with the required models and studies, a new analysis can be run in a project that is the easiest to work with (Fig.9).
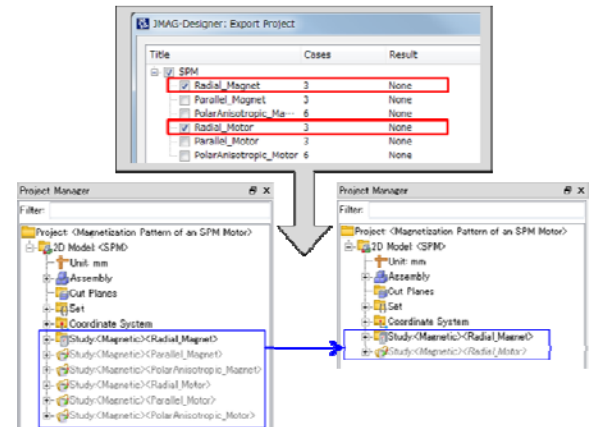
Fig.9 Export the specified studies (in the red frame)

Improvements to Study Duplication

Only the cases needed for duplicating a study can now be selected. For example, by duplicating only the best cases obtained in an analysis allows an analysis to be performed from new starting point, making work more efficient (Fig.10).

Fig.10 Duplicating studies

Geometry Editor

During the mesh generation and analysis stage, inadequate geometry requires it to be reviewed and fixed, causing decrease in efficiency. A new function

has been added to address this; a geometry model diagnostic function and an overdefined constraint detection function have been added.

Furthermore, constraint functions have been improved, more CAD file formats are now supported, and more motor templates have been added.

Geometry Model Diagnosis

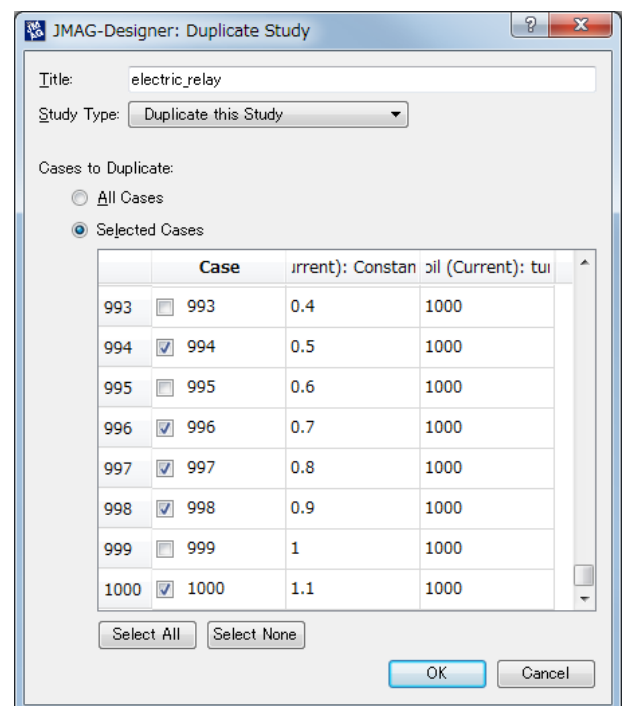In the geometry editor, mesh can now be checked if it can be generated. This means that prior to importing mesh into JMAG-Designer, the mesh can be verified if it can be generated, decreasing the times mesh needs to be returned to and worked on again (Fig.11).
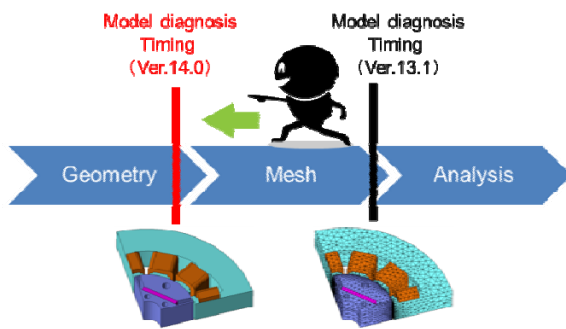

Fig.11 Model diagnosis timing during the workflow

Detecting Overdefined Constraints

A function has been added which highlights areas with overdefined constraints in orange and displays a notification. Overdefined constraints interfere with geometry and dimensions from being modified. Overdefined restraints keep geometry from being correctly modified when a parametric analysis is performed with modified geometry. Overdefined constraints created unknowingly can be checked for (Fig.12).

One of the following constraints is not required
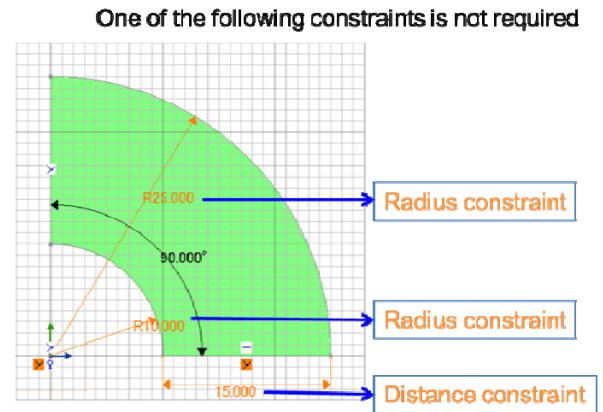
Fig.12 Example of over constraint status

Adding Constraints between Parts and Sketches

Distance, angle, parallel, and perpendicular constraints can now be set between parts and sketches. Distance constraints between the parts of geometry models can be used, and a parametric analysis can be performed with the relative positions between the parts as parameters. For example, by specifying the skew angle between magnet parts as a parameter, step skew results can be verified in a parametric analysis (Fig.13).

Fig.13 Parametric analysis for the changed skew angle between magnets

Dimension Measurement Improvements

Dimension measurement functions have been improved. Dimensions and angles can now be measured much easier than before. The distance between entities, the distance between an entity and a point, and the angle of two points with the center as the origin can now be measured (Fig.14).

Fig.14 Distance measurement between entities

Support for More CAD File Formats

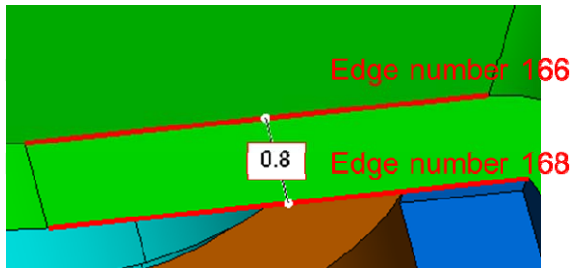More CAD file formats can now be imported into the geometry editor (Table 1) NX, Parasolid, SolidWorks, SolidEdge, and STEP files are now supported. Check the JMAG homepage (*1) for the most recent information on system requirements.

Table 1: CAD file formats supported in Ver.14.0

CAD files	Supported file version
NX	NX 1 – NX 9
Parasolid	10.0 – 26.01.211
SolidWorks	V18 – ST6
SolidEdge	2003 – 2014
STEP	203, 214

*1 System requirements page URL
http://www.jmag-international.com/products/specification.html#LinkedSoftware

Motor Templates

Templates have been added to the rotor and stator parts for IPM and induction motors. Currently over 250 motor templates are supported (Fig.15).
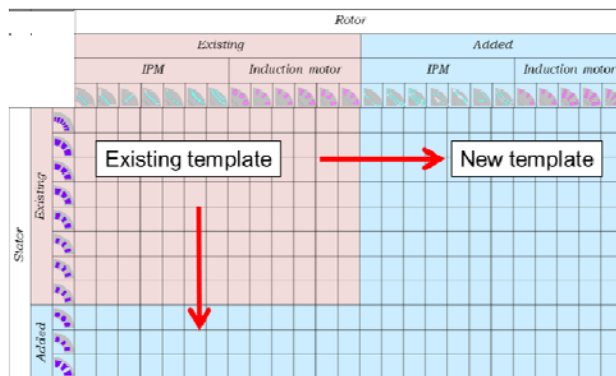

Fig.15 List of IPM and induction motor templates

Material

To increase JMAG's versatility, we are always improving the material data. New material data added to Ver.14.0 is shown below.

Permalloy, Permendur Materials

Permalloy and permendur material data provided by Aperam has been added (Table 2).

Table 2 Material data provided by Aperam (as of December 2014)

Permalloy materials	Permendur materials
Cryophy-1170_-269deg	AFK1-850
Cryophy-1170_20deg	AFK18-850
Mumetal-1170	AFK502-760
Permimphy_SP-1170	AFK502-850
Phytherm120-1150	AFK584-600
Phytherm230-1150_160deg	
Phytherm230-1150_20deg	
Phytherm260-1150_160deg	
Phytherm260-1150_20deg	
Satimphy-1170	
Supermimphy_L-1170	
Supermimphy_LSS-1170	
Supra36-1050	
Supra50-1150	

External Linking

Linking external software with JMAG has been improved. As an improvement to interfacing in order to expand the types of analysis performed by linking, linked analysis functions for rigid body motion with other software have been expanded. The multipurpose file input / output tool has also improved to support passing analysis data.

Motion Coupling

Coupling functions for rigid body motion with other

software have been expanded. Electromagnetic force can now be passed from JMAG to external software, and external force can be passed from external software to JMAG. This allows for motion to be expressed even more accurately (Fig.16).
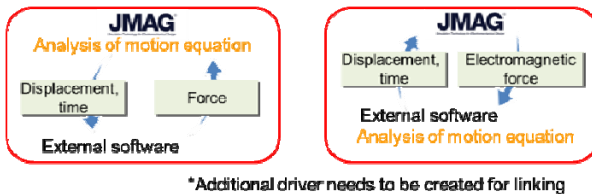

Fig.16 Linking motion with external software

Improvement of Distribution Amount Import Function Using Multipurpose File Input / Output Tool

Distribution amounts received externally and conditions set in JMAG can now both be used in the same model.

For example, for heat transfer coefficient settings, heat transfer coefficient distribution amounts received externally can be set to a part of a model, and JMAG heat transfer conditions can be set to other parts of the model (Fig.17). Temperature, displacement, and stress are also supported.
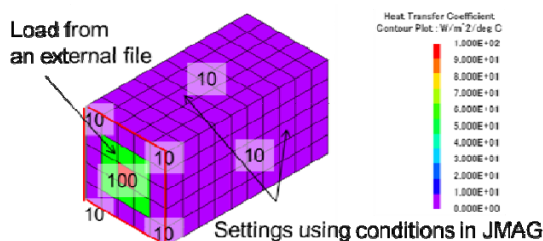

Fig.17 Setting the heat transfer coefficient by using both external files and JMAG conditions

Document

In order to make the manual easier to use and understand, we are constantly reviewing its contents. In Ver.14.0, function explanations, technical explanations, function limitations, and script explanations have been revised.

Furthermore, 15 application catalogs have been added for this release. Please visit our homepage (*2) to view the application catalogs.

*2 Application catalog homepage URL:

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

Manual Revisions

The manual has been revised by making explanations for conditions more clear, and displaying the setting items in a list which allow the needed items to be found in a single glance. Each item has a link which leads to more information when a more detailed explanation is required (Fig.18).
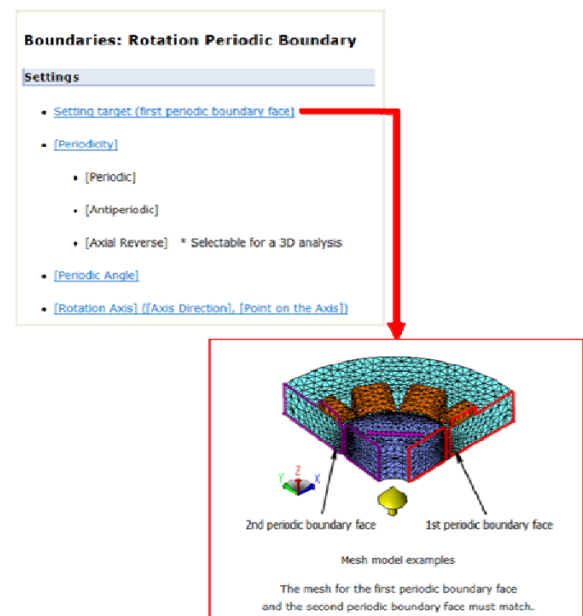
Fig.18 Condition setting item (upper), detailed explanation (lower)

Script Manual Revisions

A command index has been added to the script manual, and the content has been changed to allow for easier access for required information. Inheritance relationship between classes and required argument information held in the script functions have been added (Fig.19).
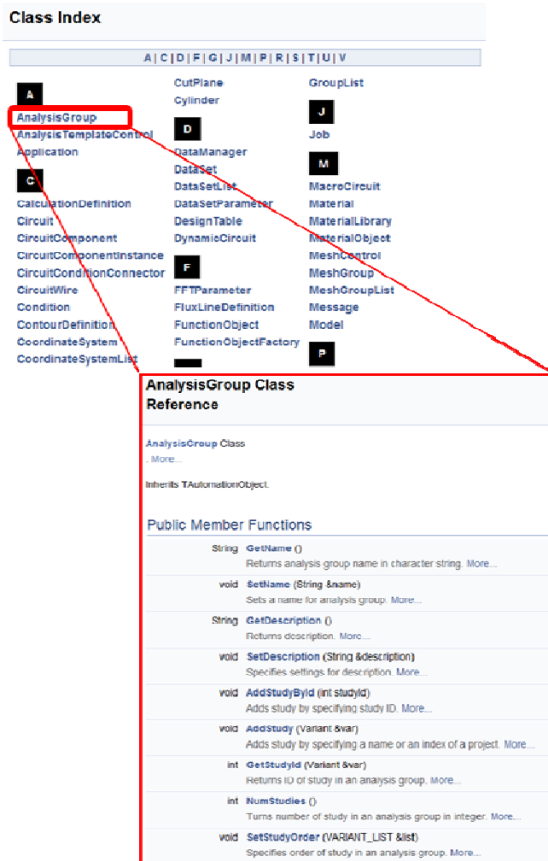
Fig.19 Class index (upper), class explanation (lower)

Conclusion

We hope you like the new version. We have introduced some of the new features in Ver.14.0, but we will also have more detailed information posted on our website. Features will be introduced with videos, so please watch them.

We hope that all of the latest features in JMAG are useful for you.

(Mari Nakamura)

Fully Mastering JMAG

Common Questions for JMAG

We will be introducing 4 items related to circuit coupling from the FAQ posted on the JMAG website. We have divided the questions into three categories of "Operation Methods," "Analysis Technologies" and "Troubleshooting." Please select the category in which you are most interested.

ANALYSIS TECHNOLOGIES FAQ-995

## Q1. How does the subcycling function that can be used in a direct link with MATLAB/Simulink (Mathworks Co.) or PSIM (PowerSIM Co.) work?

I am thinking of shortening the simulation time using the subcycling function, but I do not know how rough the settings could be for [Interval Step] or [Current Threshold]. Please tell me what kind of effects the settings of the threshold value has on the calculation flow.

A1. The subcycling function is a feature that adjusts the calculation frequency of JMAG. Adjust the threshold value in the range where magnetic properties such as inductance can approximate to linear.

When the subcycling function is used, the circuit information set in JMAG is passed on to the control / circuit simulator, and a circuit will be structured in the control / circuit simulator side. Here, the FEM coil component will be replaced with the 3 components of inductance, resistance, and voltage source. The voltage source is expressed as an induced voltage component for this case. The equation of motion will also be solved on the control / circuit simulator side when the control system is given feedback from the motion amount such as the rotation angle of the motor. The role of JMAG is to contribute torque input to the inductance of the circuit constant, update of induced voltage, and equation of motion. By updating the parameters of each with a higher periodicity than a calculation period of a control / circuit simulator, the calculation time is reduced (Fig.1).
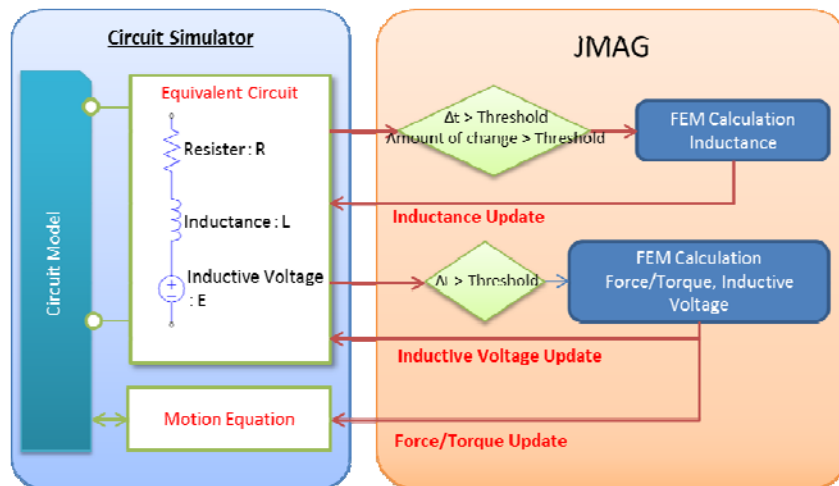
Fig.1 The structure of subcycling

The torque and induced voltage are updated by the specified interval step. Therefore, [Interval Step] settings can be assisted by current - torque characteristics and the periodicity of the torque ripple. Since the sensitivity of inductance is lower compared to the changes of current and displacement, the calculation frequency can be adjusted with transformation amount as the threshold value in addition to interval steps. This also assists the settings of the current-inductance characteristics and the [Current Threshold].

If characteristics information such as current - torque characteristics and current - inductance characteristics are obtained beforehand, it will not only assist in the settings but will also be useful in the evaluation of the simulation results.

【Other references etc.】

For more information regarding the link function with the control / circuit simulator, see the help below.

JMAG-Designer Help> Analysis>Magnetic field analysis study properties and condition settings>External Circuit Link 1&2

OPERATION METHODS FAQ-994

Q2. Is there a function to confirm line voltage?

I am trying to obtain line voltage in a delta connection circuit, but I can only confirm terminal electric potential in an electric potential probe.   Is there a need to obtain line voltage with manual calculations? Please tell me if there is a function to confirm line voltage.

A2. After an analysis, the arbitrary voltage difference between two terminals can be added to the history graph.

Line voltage is the arbitrary voltage difference between two terminals. Two terminal electric potential or temperature difference can be added, and confirmed in the history graph of electric circuit or thermal circuit of JMAG. Confirmation methods are explained with the delta connection as an example.

1) The analysis ends, and confirms that the analysis results are incorporated in the study.

2) The [Edit Circuit] window will be displayed.

3) The terminal electric potential of each FEM coil will be added to the table. Once the terminal is selected, it will be highlighted in red. Right-click on the highlighted terminal, and select [Add Terminal to Table]. Set the terminal name in [Label Name] to allow easier confirmation of results.

4) Select two terminals to obtain electric potential difference, and add the difference between terminals to the table.

5) Select one of the terminals added in 3) and select [Add Terminal to Table] from the right-click menu. The [Terminal Difference Setting] dialog box is displayed, and the combination of two terminals to measure the electric potential difference is set.

6) Return to the tree of the project manager and confirm the voltage between terminals from the history graph. Close the [Edit Circuit] window and go back to JMAG-Designer. Confirm that [Electric Potential Difference] in the [History Graph] under [Analysis Results] of [Project Manager] is added.

Temperature differences can also be confirmed with the same operations.

【Other references etc.】

Please see the help below for more information regarding the function to add potential difference to the table.

JMAG-Designer Help>Result Display>Result Table>Potential Difference or Temperature Difference is added to the table

OPERATION METHODS FAQ-961

Q3. I would like to learn about how the [Offset Angle] of a three phase synchronous motor set in a JMAG-RT block used for MATLAB/Simulink (Mathworks) is defined.

A3. [Offset Angle] offsets the initial position of a JMAG-RT model.

The initial position of a JMAG-RT model is the same position as the direction of the magnetic flux which the U phase coil creates, and the direction of magnetic flux created by the magnet (Fig 2).
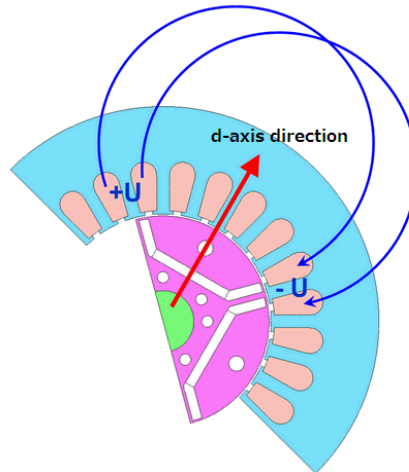
Fig. 2 Initial position of the JMAG-RT model

In [Offset Angle], enter the offset amount from the initial position in the mechanical angle. The phase advancement β is 0 degrees when the three phase current is given so that the [Offset Angle] is 0 degrees and the U-phase initial position is 180 degrees.

The model information of the JCF file used when creating a JMAG-RT model file does not affect the initial position. The initial position is determined from the magnet magnetic flux linking the coil. Because of this, even if the rotor position or the initial position of the motion conditions for the model data are changed, the JMAG-RT model with the same characteristics can be obtained.

TROUBLESHOOTING FAQ-951

Q4. An enormous amount of the same CPU nodes are registered on a remote system;
is there a problem with this?

I am creating a remote system to be used for creating JMAG-RT models. When registering machine-a as a CPU node, several machine-a's appeared in the CPU group. They seem to be growing in number as time passes. How do I resolve this?

A4. The hosts file may be set incorrectly.

The hosts file is plain text system file, which maps host names to IP addresses on TCP/IP network.
The location of the host file for each OS is listed below.

Linux:

    /etc/hosts

Windows:

    C:¥Windows¥System32¥drivers¥etc

If the same machine name is assigned to multiple IP addresses in the hosts file, this will cause the same CPU node to be registered multiple times on the remote system. Fixing the hosts file as described below may allow this issue to be avoided.

Note that a system level file is being edited, so it is recommended to create a backup of the original hosts file prior to editing it.

Example of a hosts file with the machine name appearing multiple times:

    127.0.0.1 machine-a

    10.157.0.1 machine-a

Example of a hosts file which works around the machine name appearing multiple times:

    127.0.0.1 localhost

    10.157.0.1 machine-a

Note that 127.0.0.1 is a special IP address which refers to the local host, which means any packets sent to this address are looped back to the originating machine. Usually the assigned host name is "localhost".

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 regularly update our website FAQ. Use this together with the JMAG Newsletter to make your analysis work more effective. Please don't hesitate to use JMAG technical support if you have any questions when using JMAG. We hope you will fully master JMAG!

（Takashi Kondo）

JMAG Users Conference Report

The JMAG Users Conference put focus on communication between participating engineers.

We have prepared a wealth of contents again this year, enabling all participants to spend a worthwhile time regardless of their proficiency with JMAG, so it's accessible to everyone those using the software for the first time through to veteran JMAG users. This issue has focused largely on reporting users conferences held in Japan, Europe, North America, and China.

JMAG Users Conference
Conference Outline

Host: JSOL Corporation

Date: Wednesday, December 3 - Thursday, December 4,

Venue: Tokyo Conference Center - Shinagawa

URL: http://www.jmag-international.com/event/conference2014/

The JMAG Users Conference is not only known for unique user case studies and partner exhibitions, but it is also an opportunity for users to evaluate JMAG and its development policies. We have received frank opinions from many users regarding the current functions, support, and future development policies. With these opinions in mind, we would like to continue improving JMAG.

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

Presentations

We welcomed Mr. Mizutani from TOYOTA MOTOR CORPORATION as the keynote speech, in addition to a total of 37 presentations and 14 sessions by JMAG users. Their presentations covered the latest topics, case studies using JMAG, as well as points they had the most difficulty such as with development results and the process. We received input from participants saying it helped in "understanding the recent market situation" and "knowing the fact that they had difficulties with similar issues."

Development planning
(December 3 10:00-11:00)
Development planning of JMAG
Dr. Takashi Yamada
JSOL Corp.

Keynote speech
(December 3 11:00-12:00)
Application-Oriented Motor Design by using the electromagnetic field analysis in TOYOTA
Dr. Ryoji Mizutani
TOYOTA MOTOR CORPORATION

Motor 1 session

(December 3 13:00-14:30)

Influence of the manufacturing process on the behaviour of a claw-pole generator
Jean-Claude Mipo
Valeo Equipement Electrique Moteur FRANCE

JMAG case examples for developing electric components for motorcycle engines
Masahiro Yamamoto
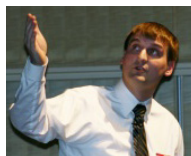YAMAHA MOTOR ELECTRONICS CO.,LTD.
 (reading for Wataru Matsuyama)

Magnetic feedback sensor positioning and determination of harmonic distortion
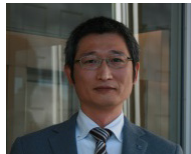Ryan Spindler
SL Montevideo Technology, Inc.

Electric power session

(December 3 13:00-14:30)

Electromagnetic force as a noise source generated by leakage flux in transformer tank
Kiyoshi Wakimoto
MEIDENSHA CORPORATION

Vibration analysis of transformer core with magnetostriction by using JMAG
Naoyuki Kurita
Hitachi Ltd.

Practical application of stress analysis of stator coil-end portion of turbine generator
Takayuki Mizumoto
Fuji Electric Co.,Ltd.

Induction heating session

(December 3 13:00-14:30)

**Applied cases to production technology development using magnetic field
- thermal coupling analysis**
Masaya Fukuda
OMRON Corporation

Computer simulation of high-frequency induction heating using a coupling of JMAG, FLUENT and ANSYS.
Ayaka Nakata
KOYO THERMO SYSTEMS CO., LTD.

Electromagnetic and heat transfer analysis of HFW steel pipe
Akira Kawanishi
JFE Techno-Research Corporation

Multiphysics session

(December 3 16:10-17:40)

Thermal simulation of an oil-cooled permanent magnet synchronous motor
Zeng Jinling
CHINA FAW CORPORATION LIMITED R&D CENTER

Temperature analysis of the outer rotor type AC generator using JMAG-Designer and STAR-CCM+
Kanji Shinkawa
Mitsubishi Electric Engineering Company

Development plan of co-simulation framework of Star-CCM+ and JMAG
CD-adapco
Steve Hartridge, Shigetoshi Maeda
/JSOL Corporation   Takashi Yamada

Industry applications session

(December 3 16:10-17:40)

JMAG analysis for litz wire
Koji Tani
JSOL Corp.

Development of a rail brake for railway vehicles derived from linear motor technology
Yasuaki Sakamoto
Railway Technical Research Institute

Large-scale numerical analysis of induction motors
Makoto Matsushita
Toshiba Corporation

Solenoid session

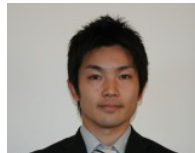### (December 3 16:10-17:40)

Attraction force analysis of a solenoid valve and system control simulation
Yusaku Suzuki
JSOL Corp.

Magnetic field analysis of Solenoid actuator using JMAG-Designer
Shoji Ishikawa
Mitsubishi Electric Corp.

Analysis of responsiveness of air pressure solenoid valves using JMAG-Designer
Shinji Ito
CKD Corporation

JMAG-Express session

(December 3 16:10-17:10)

Study of SPM,IPM,IPM vernior Motor using JMAG-Experss
Yasuhiro Kondo
Electric Motor Consulting

A case of benchmarking of brushless motor using JMAG-Express
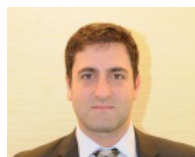Takayuki Ochiai
NSK Ltd.

RT/Material session

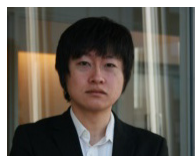### (December 4 10:35-12:40)

JMAG-RT as a Tool in the Development of EV/HEV Powertrain Components
Markus ozbek
DENSO International Europe

Introduction to magnetic field design support system using JMAG
Manabu Kawaji
Aisin Seiki Co., Ltd.

Design of switched reluctance motors considering manufacture impact
Sheng-Yang Lin
CHINA STEEL CORPORATION
/Min-Fu Hsieh
Electric Motor Technology Research Center

Demagnetization analysis of IPM motor with Dy diffused magnet using JMAG-Designer Ver.13.1
Mitsutoshi Natsumeda
Hitachi Metals, Ltd.

HPC session

(December 4 10:35-12:40)

Multi-objective optimization with wide-range shape parametric design space for IPM motor
Norio Tomiya
AISIN AW Co., Ltd.

GPU computing research initiatives of Japan Automobile Manufacturers Association, Inc.
Yoshihiko Sunayama (SUZUKI CORPORATION)
Japan Automobile Manufacturers Association, Inc.

Large scale 3D electromagnetic field analysis for electric machine design
Masayuki Hirayama
YASKAWA ELECTRIC CORPORATION

Fast numerical simulation of 3D electromagnetic analysis using HPC
Masashi Inaba
DENSO CORPORATION

Motor 2 session

(December 4 15:10-16:40)

Analysis of brush motors by JMAG
Naohiro Hashidume
Nidec corporation

Measurement of magnetic flux density on permanent magnet surfaces for IPM motor
Hirohito Matsui
SOKEN INC.

Development of the new motor for SPORT HYBRID i-DCD system for the Fit3 Hybrid
Satoshi Shikata
Honda R&D Co., Ltd.

Converter session

(December 4   15:10-16:40)

High-precision iron loss analysis using JMAG
Yuji Sato
TABUCHI ELECTRIC CO.,LTD.

Gap loss analysis of cut core inductor
Takahiro Tera
DENSO CORPORATION

Accuracy evaluation of litz wire resistance by using transformer analysis module
Masato Kabetani
Toyota Industries Corporation

Partner seminar

(December 3   14:35-15:05)

Power measurement technique for inverter and motor evaluation
Eiichi Odaira
Yokogawa Meters & Instruments Corporation

(December 3   15:35-16:05)

Noise and vibration problems in mechanical systems driven by electric motor
Takanori Watanabe
NewtonWorks Corporation

(December 4   09:00-09:30)

Virtual motor-drive development & validation platform suite : SaberRD + JMAG-RT
Kurt Mueller
Synopsys, Inc.

(December 4   13:40-14:10)

JMAG solution: Higher fidelity motor HILS of FPGA-based by model-based development
Koji Fukusumi
dSPACE Japan K.K.

(December 4   14:35-15:05)

Motor control improved by using JMAG-RT
Yoshihiko Ozaki
DSP Technology Co.,Ltd.

(December 4   09:45-10:25)

Model-based Development of PMSM control systems
Yusuke Minami
National Instruments Japan Corporation

Open forum

(December 4   16:40-17:10)

Development planning of JMAG
Dr. Takashi Yamada
JSOL Corp.

Poster Exhibition

   The poster presentations were revived this year. More than 80 posters in regards to introductions of analysis technologies to troubleshooting were posted.

   This time, we focused not only on transferring information but communication as well. Since it made it easy to question JMAG developers and engineers regarding problems and analysis tips, it seemed like it helped in understanding the content of the posters.

   We exhibited operation procedures of JMAG for not only those that are experienced, but also the basics of electromagnetic analysis so beginners could understand the physical phenomena in each application. Some have mentioned that they "acquired important information necessary in making full use of JMAG through this."

Seminar, Workshop, Development Board

On top of presentations from our technical partners, we introduced ways in which users could bring out the full potential of JMAG.

We felt that it would be useful in understanding JMAG even deeper through flexible discussions in directions of analysis technology and function requests for JMAG, as well as introductions of the functions by the developers themselves.

For beginners that have experienced difficulty with the model settings in the hands-on seminar, we taught them how to learn necessary modeling and condition settings. We received opinions saying "it helped in understanding the basic operations in JMAG."

Titled "Development Plan Created by All," we exhibited a development board where users could freely write their input. We received various suggestions from the participants. With all opinions in mind, we hope to continue with its development.
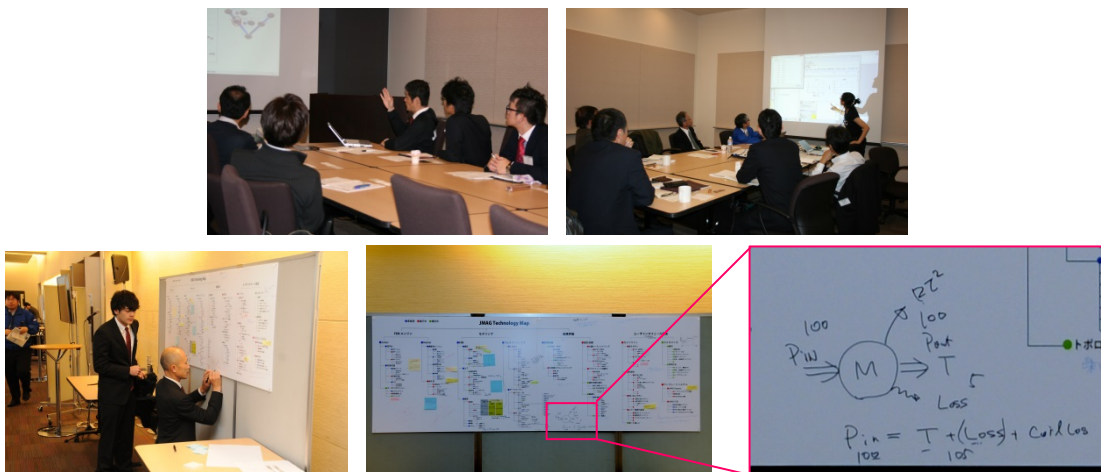
Exhibition

Prior to the launch of JMAG-Designer Ver.14.0, we presented the latest version at our JMAG booth. We hope you were able to get a taste of the new and improved functions, as well as experiencing the most flexible JMAG yet.

Partner Exhibitions

In addition to material makers who have contributed to the material DB, many of our technical partners have had exhibitions as well.

Our premium sponsor, SCSK Corporation brought in a cluster machine and demonstrated a calculation competition with a workstation. For those who are thinking of clusters, it was a great opportunity to not only see the results, but through real experiences. We have also received feedback that seeing an actual cluster machine was really helpful.

The JMAG Users Conference conveys through its partner companies a variety of worthwhile information about electronic
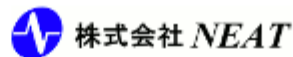
machinery development.

Premium Sponsor

SCSK株式会社

Exhibitors

JMAG Users Conference in Germany
Conference Outline

Host: POWERSYS

Date: Tuesday, September 23 - Wednesday, September 24, 2014

Venue: Steigenberger Airport Hotel (Frankfurt : Germany)

URL: http://www.jmag-international.com/event/2014/2014_EuropeanUC.html

In preparation for JMAG Users Conference in Europe, we hosted JMAG Users Conference in Germany as an opportunity to share knowledge and experiences of electromagnetic field simulation.

Day one was Technical Day. This was training meant for participants to acquire techniques in JMAG through three workshops and one-on-one technical consultations.

Day two was case study presentations. In addition to user presentations, we have had our technical partners presenting real experiences of pros and cons in the process, as well as link case studies with JMAG.

JMAG, on the other hand, introduced the latest functions in JMAG-Designer Ver.14.0 that is expected to be released in Winter, 2014.

We will be hosting the next event on spring, 2015. We hope to see participants from this year, and those who have not yet joined us.

（Corinne Rocherieux）

JMAG Midwest Regional Meeting in USA
Conference Outline

Host: POWERSYS Inc.

Date: Tuesday, October 14, 2014

Venue: HILTON LISLE/NAPERVILLE (Chicago, United States)

URL: http://www.jmag-international.com/event/2014/2014_USA_jmag-seminar.html

In mid-October when the footsteps of Halloween are closing in on Chicago, JMAG Midwest Regional Meeting was held.

With JMAG users located in the mid-west of the United States as the main audience, we presented case studies and trends in the latest technologies, as well as providing technical assistance. Latest functions in JMAG including high-accuracy analyses of iron loss and high-speed parallel solvers seem to be a point of interest for many in the United States. In addition, there were many interactions between participants who rarely see one another, as well as with the JMAG staff. It was a day that got me excited for hosting another event in the United States.

(Tetsuo Ogawa)

IDAJ CAE Solution Conference 2014
Conference Outline

Host: IDAJ-China Co., LTD.

Date: Monday, November 17 - Tuesday, November 18, 2014

Venue: China: Shanghai

URL: http://www.jmag-international.com/event/2014/2014_ChinaUC.html

IDAG, JMAG's technical partner, hosted a users conference in Shanghai, and a session for JMAG users took place in one

of the two days.

There were more than 40 participants, and is successful every year.

Analysis case studies of motors and injectors were introduced from popular automobile maker, FAW. Also, there were presentations of research results from universities such as Nanjing University of Aeronautics and Astronautics.

During the session, there was a commendation ceremony of the JMAG contest held last year, as well as an introduction of usability and analysis cases using JMAG.

Compared to last year, there seemed to be an increase in active discussions between participants. For those who were not able to participate this time, we hope to see you in the coming year.

(Hiroyuki Sano)

JMAG Users Conferences are held in cities around the world. We hope to see participants of this year, as well as new users, in one of the users conference next year. We are sure you will be able to make the best of your time.

Writer: Tomomi Igarashi

Event Information
Event Report for September - December 2014

Attendees report on events held from September to December, 2014. We hope you will attend our next event.

`Exhibition` International Conference on Electrical Machines (ICEM 2014)
Conference Outline

Host: VDE Pruf- und Zertifizierungsinstitut GmbH

Date: Tuesday, September 2nd - Friday, September 5th, 2014

Venue: Andel's Hotel (Berlin, Germany)

      Booth number: 2

URL: http://conference.vde.com/icem/pages/welcome.aspx

  In ICEM 2014 hosted in Germany, there were more than 400 presentations and approximately 200 poster presentations. More than 400 participants dropped by the exhibition area, which featured various products and solutions including JMAG. Many of the participants were specialists in electric machinery design, including engineers, researchers, university professors, and doctoral students.

  The presentation area not only focused on the electromagnetic side but also shared the spotlight with structural and thermal design as well. Applications and academic research results that would assist in optimization were also introduced.

  The JMAG booth introduced functions that may be the solution in resolving technical issues, such as the demonstration of the latest features and the link function. Frequent technical debates with the participants brought excitement to the exhibition.

（Thiebaud PFISTER）

`Exhibition` IEEE Energy Conversion Congress and Exposition 2014（ECCE 2014）
Conference Outline

Host: IEEE

Date: Sunday, September 14th - Thursday, September 18th

Venue: David L. Lawrence Convention Center (Pittsburgh, U.S.)

URL: http://2014.ecceconferences.org/

  A booth was open in the academic meeting hosted by the IEEE.   This year, there were more than 1400 presentations, and 40 companies had a booth open. With more than 1300 participants,
the exhibition was livelier than it was last year. Many presenters were passionately speaking of the future in the energy market.

  The JMAG booth held demonstrations of JMAG-Express and the JMAG-RT Viewer, starting with introductions of features and case studies in JMAG. It is our wish to continue having booths in lively meetings.

（David Cottini）

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

Conference Outline

Host: i2i Events Group

Date: Tuesday, September 30th - Wednesday, October 1st, 2014

Venue: DE Stephens Convention Center (Chicago, U.S.)

Booth number: Hall 1-5 / 1815

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

A JMAG booth was open in CWIEME CHICAGO hosted in the United States. This is one of the world's largest exhibitions in the fields of various component elements including motors and transformers, winding that forms electric machinery, laminated steel, magnet, and insulation. Approximately 120 companies had a booth open this time.

Solutions for motor designers and solutions for large-scale transformers, particularly using JMAG-Express, were introduced in presentations at the JMAG booth.

（David Cottini）

Exhibition MATLAB EXPO 2014 Japan

Conference Outline

Host: MathWorks Japan

Date: Wednesday, October 29th, 2014

Venue: Tokyo Grand Pacific Le Daiba (Japan: Daiba, Tokyo)

URL: http：//matlabexpo.com/jp/

A booth was open in MATLAB EXPO 2014. Many partner corporations of JMAG also held exhibitions, and made suggestions on link solutions. We introduced JMAG-RT after receiving many demands for high-precision plant models including motors, from many participants who dropped by at the booth and those involved in control design. Through conversations, we noticed the potential of JMAG-RT linked solutions. We are proceeding with development so that it would continue to be used in model-based development.

（Yusaku Suzuki）

Presentation Synopsys Saber Seminar 2014

Conference Outline

Host: Synopsys (Japan)

Date: Friday, October 31st, 2014

Venue: Nagoya Marriott Associa Hotel (Japan: Aichi)

URL: http://www.synopsys.com/Japan/events/Pages/saber-seminar.aspx

We held a presentation at Synopsys Saber Seminar 2014 hosted together with our technical partner, Nihon Synopsys.

The presentation by Nihon Synopsys introduced new functions of SaberRD (Synopsys Corporation) and breakdown solution for function safety of products. In addition, as a high-quality model for system level simulation, JMAG-RT was introduced. We introduced a link solution between Saber (Synopsys Corporation) and JMAG-RT and its usability.

Through this seminar, we hope the Saber users were also able to understand the usability of JMAG-RT. In the near future,

we hope that clients will have JMAG-RT operating on Saber.

(Koji Tani)

Exhibition Siemens PLM - Simulation & Test Performance Engineering Conference
Conference Outline

Host: Siemens Industry Software Simulation and Test K.K.

Date: Thursday, November 13th, 2014

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

URL: http://www.plm.automation.siemens.com/ja_jp/about_us/events_webinars/seminars/simulation-and-test-conference2014.shtml

We opened a booth in Siemens PLM - Simulation & Test Performance Engineering Conference hosted by Siemens Industry Software Simulation and Test K.K., which are technical partners.

With approximately 200 participants, the CAE simulation session including sessions and duplicated regions related to MBD were introduced, and was full of energy.

Through introductions of LMS Imagine.Lab AMESim of the next version to the linked solution of JMAG-RT that will be supported at the JMAG booth, its usability has been proven.   Also, after the link function with the currently supported LMS Virtual.Lab was introduced, we received many inquiries from participants. We will continue to strengthen the link function. Please look forward to the improvements.

(Takayuki Nishio)

Presentation Exhibition -Introducing virtual motors and controllers using MATLAB with JMAG coupling abilities-
MATLAB・JMAG・RTSim Motor Solution Seminar 2014
Conference Outline

Host: Hodaka Denshi, Co., Ltd.

Double hosts: DSP Technology Corporation, JSOL Corporation

Date: Tuesday, November 18th, 2014

Venue: Aichi Industry & Labor Center Winc Aichi (Japan: Aichi / Nagoya)

URL: http://www.hodaka.co.jp/motorseminar/2014_11.php

We had a presentation and a booth open in the seminar hosted by Hodaka Denshi.

There were 40 participants at the venue, and they listened very carefully to the presentations. JSOL introduced a presentation by the title, "Introduction of High-Precision Motor Model JMAG-RT that Drives Model-Based Design."

According to the feedback for JMAG-RT that we received at the beginning of the presentation, approximately 100% of the attendees were aware of the software, and we were able to realize the increasing usage of JMAG-RT in this field.

We were also able to feel the high interest level for JMAG-RT simulation when we received multiple inquiries from customers asking about the creation method of JMAG-RT data (rtt file) from actual measurement data.

We introduced coupling cases with solution "JMAG-RT" that made it possible to incorporate MATLAB/Simulink/RTSim at the JMAG booth. We will continue development through responding to the demands for motor drive systems.

(Takayuki Nishio)

Presentation Exhibition **Integrated Electrical Solutions Forum（IESF 2014）**

Conference Outline

Host: Mentor Graphics Japan Co., Ltd.

Date, Venue: Tuesday, December 2nd, 2014 Midland Hall (Japan: Aichi / Nagoya)

     Friday, December 5th, 2014   Station Conference Tokyo (Japan: Tokyo / Chiyoda)

URL: http://www.mentorg.co.jp/events/iesf/iesf2014/

 IESF2014 Japan is a conference related to system simulation that targets automobiles hosted by Mentor Graphics Japan.

 With "connected engineering" as the keyword this year, total solutions in expansive fields ranging from the evaluation of ECU and electric architecture of automobiles to development of car-equipped applications, thermal / electromagnetic analysis were suggested.

 JSOL introduced a presentation by the title, "Introduction of High-Precision Motor Model JMAG-RT that Drives Model-Based Design."

 We also introduced high-precision simulation of MILS/SILS/HILS using high-precision motor models with JMAG-RT. In response to the suggestions of high-precision control simulation through JMAG, many control designers who have yet to use JMAG seemed to show high interest.

<div align="right">(Masahiko Miwa, Takayuki Nishio)</div>

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

<div align="right">Writer: Tomomi Igarashi</div>

JMAG®

Simulation Technology for Electromechanical Design