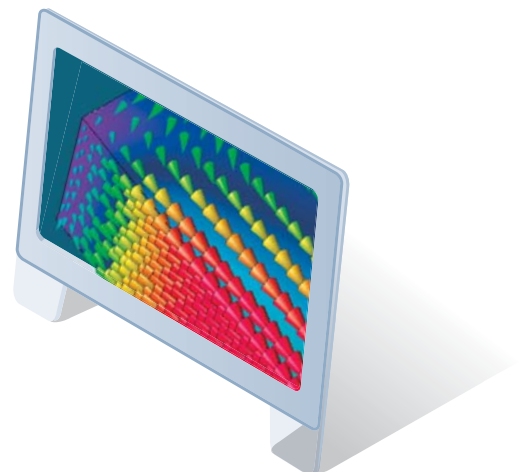


JMAG Newsletter

2011 Winter

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.



Contents

[1] Implementing JMAG

Institute for Electrical Energy Conversion, Technische Universität Darmstadt

[2] Product Report Special Edition

- The release of JMAG-Designer Ver.11 -

[3] Explanation: Model-based Development

- Final Issue: Model-based Development Requires the Ability to Expand, Shrink, and Share the Model -

[4] Explaining FEA: Effectiveness of FEA in the Development Process

- Final Issue: Failure Mode Simulation Using FEA -

[5] Fully Mastering JMAG

- Issue 3 Shortening Calculation Time from A to Z -

[6] Fully Mastering JMAG

- An Introduction to JMAG Technical Support -

[7] Event Information

- 2012 Event Introduction -
- Event Report -



Europe
North America
Oceania
India
Vietnam
Thailand
Singapore, Malaysia
Taiwan
Korea
China
Japan

Powersys Solutions
Powersys Solutions
Impakt-Pro Ltd.
ProSIM R&D Center Pvt. Ltd.
New System Vietnam Co., Ltd.
JSIM
PD Solutions
FLOTREND Corp.
EMDYNE Inc.
CD-adapco JAPAN Co., LTD.
JSOL Corp.

www.powersys-solutions.com/
www.powersys-solutions.com/

www.pro-sim.com/
www.nsv.com.vn/
info@j-sim.com
<http://www.pdsol.com/>
www.flotrend.com.tw/
www.emdyne.co.kr
www.cdaj-china.com/
www.jmag-international.com/

The names of the products and services are the trademarks or registered trademarks of the copyright holder

JMAG Newsletter: Highlights of the Winter Issue

It has been a little while since the last issue, but we are happy to present the latest edition of the JMAG Newsletter.

The series that we started in the spring of last year to explain model-based development will come to an end with this issue. We took four issues to consider exactly what model-based development is and how it should be used. It would be wonderful if you could use the explanations from this series to make new discoveries that streamline your development process.

The previous parts of this series can be viewed here: <http://www.jmag-international.com/newsletter/mbd.html>

This issue also contains the final chapter of the series Explaining FEA (Finite Element Analysis). In this series, we took the opportunity to introduce the characteristics and application methods of FEA's simulation techniques in order to take a look at the advantages that they bring to the analysis field. We would be happy if this report creates new added value for your work environment.

The previous parts of this series can be viewed here: <http://www.jmag-international.com/newsletter/fea.html>

We have also included an extensive report of the JMAG Users Conference 2011, which was held in December of last year. It will be a good read for both those who attended and those who were unable to come.

For a change of pace, this issue's Introducing JMAG article is an interview with members of the Institute for Electrical Energy Conversion, Technische Universität Darmstadt. There is also plenty of variety, with a new edition of JMAG A to Z and an example of using technical support.

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

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

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

JSOL Corporation
Electromagnetic Engineering Department, Engineering Technology Division

Implementing JMAG

Institute for Electrical Energy Conversion, Technische Universität Darmstadt

Taking on Research for New Motors and Generators

This edition of Implementing JMAG is brought by the Institute for Electrical Energy Conversion, Technische Universität Darmstadt in Germany.

Technische Universität Darmstadt has a long history, having been established in 1877, and is a central figure in German motor and generator research. The Institute for Electrical Energy Conversion uses JMAG to design cutting edge generators.

Mr. Bogdan Funieru reported about problems with motors and generators, his vision for the future, and the role that JMAG is playing in his research.

Laboratory/Introducing Business Activity

The now named Institute for Electrical Energy Conversion was founded in 1920. Then, the world wide first university electrical engineering chair, founded in 1882 by Prof. Dr.phil.Dr.-Ing.E.h. Erasmus Kittler, was split in the Institute of Electrical Machines and the High-Voltage Institute. The Institute is headed in the present by Prof. Dr.-Ing. habil. Dr.h.c. Andreas Binder who has now 15 scientific assistants: 14 ph.D. students and one post-doctoral assistant. A high proportion of the institute research projects are done in cooperation with Industry partners, parallel to some government founded projects. A big emphasis is put on the experimental testing of the designed motors and drive systems. For this purpose a lab with a total available power supply of 1 MVA is used. The available test rigs allow testing of machines up to 250 kW and it is as well possible to have sinus rotating convertors up to 40 kVA / 800 Hz and high voltage testing up to 250 kVA / 6 kV. For prototyping of electrical machines up to about 100 kW a workshop with four qualified electrical and mechanical workers is available.

The main goal of our research activity is the electrical machines design and optimization. Along with the standard induction and synchronous machines, also some special designs like motors with magnetically levitated rotor and linear drives are studied. Nowadays, the electrical machines cannot be optimized alone, being fully integrated with the power electronic current or voltage source and the mechanical system they drive. That means that for each application the whole drive system has to be optimized, and we cannot focus



just on the machine. For this reason also the control of motors by the power electronic inverter, the mechanical connection components with or without gearbox and also special motor designs with integrated machine components are of great interest. Furthermore, research on the interaction and possible adverse effects between the drive system components is done.

The fundamental points of your developmental research

Because we have a very broad research area I will split the main research directions according to the application field:

Drive systems for electric and hybrid vehicles

For hybrid vehicles and especially electric vehicles the autonomy is an important parameter due to the rather slow battery charging. It is therefore important to consider the whole vehicle including its mass and aerodynamic performance, which together with the efficiency of the drive system components and the battery capacity influences the autonomy. A full vehicle model, which uses simplified analytical models

for the different vehicle components and is able to apply different drive cycles to the vehicle, is used to investigate the autonomy and performance.

Furthermore, it is possible for automotive electrical drive systems to use distributed motors like in-wheel motors which free a lot of space in the vehicle interior and allow revolutionary interior configurations. For this kind of machine which has a disk like shape, permanent magnet motors in outer rotor and transversal flux configuration are investigated using finite element method.

Central drive synchronous motors with permanent magnet and electrical rotor excitation are also at the moment investigated with the goal of obtaining a higher power density.

Direct drive systems

If the mechanical gearbox is omitted, the force generated by the machine is transferred directly to the mechanical load of the motor or the actuator. This way the efficiency is increased and no maintenance is necessary for the gearbox. Some successfully closed projects in this area are: a spherical positioning system for an infrared telescope installed on an airplane, direct drive PM traction motor for high speed trains and linear actuators and motors used for tractive effort boosting for railway locomotives. An active project is concerning direct drive wind generators for power up to 5 MW. For this power range the removal of the gearbox is interesting because the gearbox is expensive and requires intensive maintenance. A low maintenance wind generator is especially for offshore wind turbines interesting, where the maintenance is difficult and expensive.



High-speed bearingless magnetically levitated motor (60000 rpm)

Electrical generators for renewable energies

Along with the direct drive wind generators mentioned earlier, the high speed wind generators represent at the moment the backbone of the wind energy production. Thus analytical and numerical models for the induction generators and doubly fed induction generators are investigated.

Of further interest are also small modular hydro generators in Straight-Flow technology. These modular generators can be used to harvest the energy potential of existing dams without important investment in infrastructure.

Hydro generators that use the tidal energy are another interesting research area. These generators can be installed in the shallow waters in the coast regions that have a significant tidal stream. The generator functions similar to wind generators, but is driven by the flowing water. In this case the construction needs to ensure safe functioning in a very hostile environment as the turbine is submerged in sea water.

High-speed motors

High-speed motors can be used to reduce the mass and volume of the drive system. Interesting applications are compressors, and high-speed cutting. In this area we have experience in the bearing less motors, integrated levitated motors for mechatronic pump systems and digital levitation control systems with and without position sensors.

Influence of the inverter switching on electrical machines

The fast switching of the IGBT inverters causes dangerous high voltage peaks and damaging capacitive bearing currents. After rigorous measuring of the bearing currents for different motor sizes, the bearing currents mechanism is now theoretically investigated, using numerical and analytical investigation. Measurements are performed on different mitigation techniques and the influence that the chemical composition of the bearing lubricant has on the bearing currents is investigated.

The inverter switching also induces additional harmonics in the stator current spectrum and for this reason the hysteresis losses and eddy current losses increase. In order to investigate these additional losses, analytical models and time intensive numerical transient FEM calculation are developed.

High performance industry drive systems and special machines

For the modern high performance industry motors the highest torque density combined with an excellent efficiency is expected. For servomotors a low torque ripple combined with a high dynamic response is expected. In these research directions investigations are done in designing of high density PM motors with water cooling and tooth coil concentrated winding, in calculation of the additional losses in induction machines for more exact efficiency calculation, increase of the efficiency of the induction machines and control methods for highly saturated PM tooth coil synchronous motors which compensate the motor non-linearity.

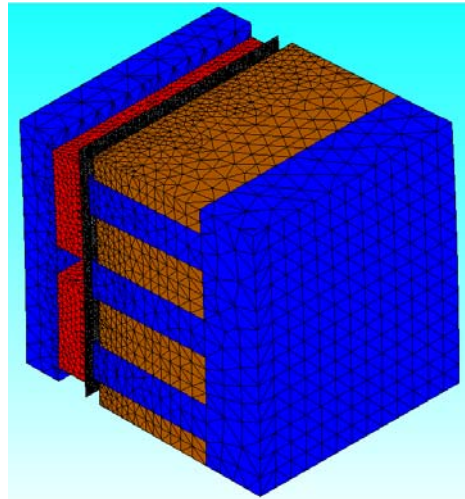
Special machines like self-starting line operated synchronous motors, variable impedance induction motors optimized for high starting torque and good efficiency at rated speed are also investigated.

How is JMAG useful for your study and business

For our institute the electromagnetic numerical FEM simulations are an essential part of the electrical machines designing process, which allow detailed investigation of the initial analytically obtained results. For this reason we use few different software codes. Among these codes, JMAG is the newest in our Institute and we are still in a learning phase of the software capabilities as until now we used mostly the electromagnetic solvers and less the rest of the modules. From the user interface point of view I can only commend the JMAG Designer development team for, in my experience, the most user friendly graphical user interface available in an electromagnetic FEM Program. Apart from the user interface, the program features all the necessary electromagnetic simulation types: static, transient and frequency domain solved with state of the art solvers that allow multi-core and multi-processor simulations, thus optimally using the last types of multi-core processors.

It was thus possible that we calculated with JMAG the losses induced in permanent magnets of a PM direct drive wind generator supplied by an inverter with a switching frequency of 2 kHz, which required a time step of about 8 μ s. Thus the simulation of 11 time periods required only about a week calculation time on a normal PC, which is acceptable for this rather complicated problem.

It was also possible due to the fast solvers to consider in detail the 3D effects which concern the eddy currents in permanent magnets. The effect of the magnet segmentation was considered with transient 3D models, and important reduction of the eddy current losses of up to 80% was revealed.



Half segment of 1/5 of the 3D model of direct drive 5MW wind generator, concentrated winding $q = 1/2$ with 5 bandage segments in axial direction

Future view of study and business

Along with the active projects that are still running for some years, other interesting research directions are planned for different domains from which I will mention only a few examples.

In automotive industry, along with the traction motors for electric and hybrid vehicles also the auxiliary electrical motors for classical combustion engines are optimized in order to reduce the fuel consumption. Furthermore, many components which are now mechanical driven, like power steering and brake systems, are replaced by electrical motors or actuators, which allow more efficient operation. Also the turbo compressors for small gasoline engines that can be replaced by high-speed electrical compressors which have the advantage that their output is not depending on the combustion engine speed and loading, and can therefore improve the fuel efficiency.

A second example is building of electrical motors which due to their special design have reduced bearing currents determined by inverter high-frequency switching. Thus instead of trying to limit the bearing currents with local measures, like special bearing lubricant or insulated bearings, which are in most of the cases increasing significantly the production costs, the

whole machine can be designed with the purpose of generating low bearing current.

Superconductor excited direct-drive wind generators are also of interest for output powers of about 10 MW and higher. For this power range the permanent magnet generators diameter and mass are increasing, and are not economical from construction and transportation point of view. Due to the higher power density of superconductor excited generators it is possible to achieve higher output powers with smaller volumes.

In all the new studies JMAG will play an important role, as a numerical simulation tool.

How do students view JMAG?

Jiansheng Huo,
Electric-Power Engineering Master Student.

During my master thesis I've used JMAG to simulate different configurations of 5MW PM wind generator, with distributed and concentrated winding. The main focus was obtaining the required power, with a small torque ripple lower than 1% rated torque and to investigate the losses in stator and especially in the rotor conductive parts. The distributed winding with the number of slots per pole and phase $q = 1$ has high torque ripple, which requires skewing of the rotor for ripple reduction, but also quite low rotor losses. For some concentrated winding configurations, the losses in the rotor are high and some configurations like $q = 2/7$ and $q = 1/7$ cannot be used, due to rotor overheating which may cause irreversible demagnetization of the PM. For other configurations like $q = 1/2$, $1/5$, $2/5$ the rotor losses are higher than for the distributed winding but have still an acceptable value.

The additional losses in the rotor due to inverter switching supply were also calculated and it was found out that due to the high switching frequency of 2 kHz which determines a current shape close to sinusoidal shape the loss increase is about 10–15%. Further calculations showed that the segmentation of the magnets reduced the eddy current losses in the magnets to only 20% of the losses in non-segmented magnets if axial (20 segments) and circumferential (4 segments) segmentation is used. Some of the models in JMAG were tested against different FEM software codes and showed a good concordance.



TECHNISCHE
UNIVERSITÄT
DARMSTADT



Institut für
Elektrische
Energiewandlung

An introduction to the Institute

Institute for Electrical Energy Conversion,
Technische Universität Darmstadt. Headed by Prof.
Dr.-Ing. habil. Dr. h.c. Andreas Binder.

At the Institute of Electrical Energy Conversion motor design and optimization is the main research direction. Classical and special machines are investigated together with the whole drive system, so that the application requirements are most efficiently fulfilled. Thus also the machine control and the mechanical components are studied.

Dr.-Ing. Bogdan Funieru graduated from "Politehnica" University of Bucharest in 2002, and has received his Ph.D. from the Technische Universität Darmstadt in 2007. Since 2007 is working as a post-doctoral assistant at the Institute of electric Energy Conversion in the same university. His main research interest is numerical simulation applied to electrical machines.

The release of JMAG-Designer Ver. 11

The newest version of JMAG-Designer was released January 2012. Ver. 11 improves many existing features while adding a variety of new functions. The overall goal of these features is to reduce analysis time while increasing analysis capabilities.

Improvements in the solver can substantially reduce the calculation time, but this is only a part of the total time necessary to run an analysis. The total analysis time must consider the time spent generating the model and applying the conditions. That is why Ver. 11 improves many functions that help reduce the difficulty in setting up a model.

At JSOL, we are constantly working to improve all aspects of JMAG, and your feedback is appreciated. Your comments and requests will continue to shape JMAG's functionality and we look forward to hearing your opinion of the features described in the following paper.

1. Overview

Table 1 shows the new or improved features in JMAG-Designer Ver.11. Features which are described further in this paper are shown in blue italics. The reference section number for these features is also shown.

Function domain	Ver.11 new function parameter	Section number
High speed solver	<i>Time period explicit error correction method</i>	2-1-1
	<i>GPU support</i>	2-1-2
Improvement in the geometry editor	<i>Improvement in the constraint functions</i>	2-2-1
	<i>Skew extrusion</i>	2-2-2
Mesh generation functions	<i>Extruded mesh</i>	2-3-1
	Improvement in the mesh editor	
Improvement in JMAG-Designer's performance	<i>Faster multi-model, multi-case processing</i>	2-4-1
Multiphysics	<i>Coupled magnetic field and structural analysis involved with structural displacement</i>	2-5-1
	Structural anisotropic material	
Coupling	<i>Coupled analysis using MpCCI</i>	2-6-1
Result processing	<i>Efficiency maps</i>	2-7-1
	Result extraction tool	
New solutions	<i>JMAG-VTB</i>	2-8-1
	<i>JMAG-SuperExpress</i>	2-8-2
	JMAG for CATIA V5	
Documentation	Improvement in the Application Notes	
	Improvement in the Self Learning System and additional cases	

Table 1: A list of the primary new functions in Ver.11.

2. Introducing the new functions

2-1. High speed solver

This section introduces two functions which can lead to reduced analysis time either through faster processing or by reducing a transient period.

2-1-1 . Time period explicit error correction method

The time period explicit error correction method uses the temporal periodicity of the varying field in the magnetic field analysis. It shortens the transient period that occurs in a transient analysis, and forces the model into steady state operation in fewer time steps than if the model were allowed to achieve steady state operation on its own. This function is effective for models with an electric potential (voltage) source for circuits. It is also effective for models that require substantial analysis time (analysis steps) before reaching steady state. JMAG's unique technology has been built into this function, so it can be applied to almost all problems with time varying fields.

As an example, an induction motor analysis could require up to 10 time periods before transitioning to steady state operation. If the goal is to observe steady state operation, then these 10 periods are not necessary. In this case, adopting the time period control method would facilitate a reduction in analysis by reducing the transient period (fig. 1).

It is possible to reduce analysis time even further by combining the time period method with the traditional approximate steady state method.

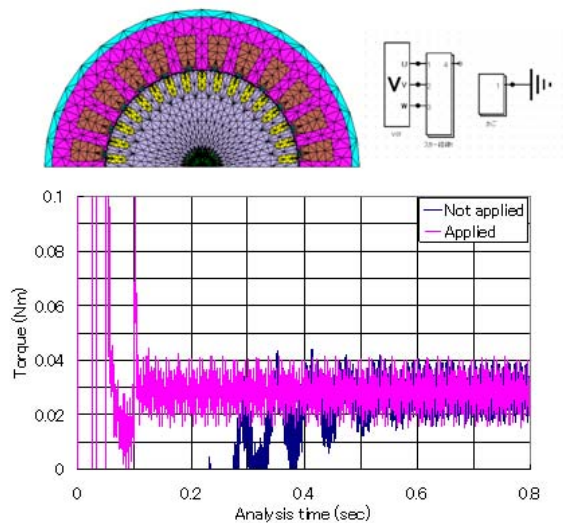


Fig. 1: A comparison of steady torque convergence when applying and not applying the time period explicit error correction method in induction motor analysis.

A second example of the time period method involves the analysis of a transformer for a switching power supply. In this case the capacitance of the secondary smoothing capacitor determines the system's time constant. This could lead to an extremely large time constant and thus a long analysis time before reaching steady state operation. By using the time period explicit error correction method, it is possible to considerably shorten the analysis time (fig. 2).

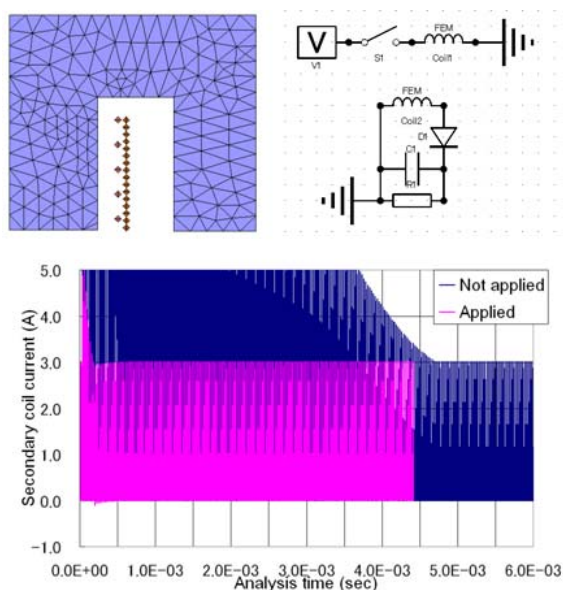


Fig. 2: Time period explicit error correction method in analysis of a transformer for switching power supply

A comparison of convergence for steady current when applying and not applying the method.

2-1-2. GPU support

Over the last few years there has been a great deal of improvements in the performance of a video card's GPU (Graphic Processing Unit). The GPU is now powerful enough that it can be incorporated into the solver.

JMAG is also working on faster calculations via parallel computing by using the computer's GPUs in the magnetic field analysis. This function can also be combined with the existing parallel processing licenses (SMP).

(Caution 1) This function is only provided to users that request it. Furthermore, there is a restriction on the GPUs that are compatible with this feature, so when using it refer to the operating environment at the bottom of the following link:

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

2-2. Improvement in the geometry editor

We have made improvements to many features in the Geometry Editor, including handling of basic shapes, creating skew geometry, and generating manual meshes. The following sections will introduce some improvements in constraint functions and skew extrusion. These functions are introduced with the goal of improving accuracy and productivity for designers.

2-2-1. Improvement in constraint functions

Correctly constraining a model is a necessary step when creating its geometry. This is especially true for parametric analyses where the geometry can be driven by a design table.

One big improvement is that the constraints in the geometry editor are compatible with JMag-Express (the motor template has been replaced by JMag-Express). This means that there is no need to reset constraints when transferring data from JMag-Express to JMag-Designer. It also means that turning a 2D model from JMag-Express into a 3D model in JMag-Designer is much easier. Constraint information from a JMag-Designer model is transferred to JMag-Express, which makes creating a template in JMag-Express much less rigorous.

Additionally, Ver. 11 now supports radius and diameter constraints as well as dependent constraints. Having dependent constraints means that constraints can be grouped together and

handled as a single parameter. This will make parametric condition settings substantially easier than in previous JMAG versions (fig. 3).

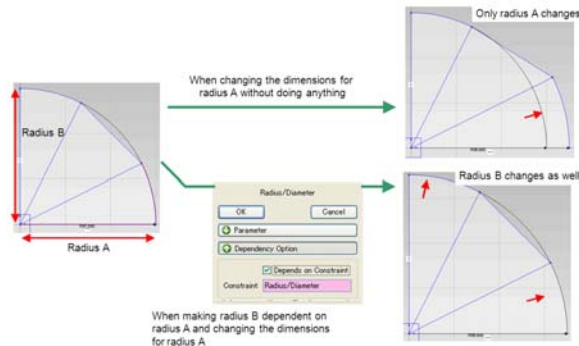


Fig. 3: Changes in geometry that use a group setting of several constraints

2-2-2. Skew extrusion

It is sometimes necessary to skew a rotor in order to reduce cogging torque. Unfortunately, accurately evaluating the skew effects requires a 3D analysis. The skew extrusion feature allows users to easily create a skewed 3D geometry.

The skew is applied in the geometry editor, which performs a skewed extrusion on the 2D sketch (fig. 4). Creating a skewed geometry is also possible for regions where a mesh has been generated.

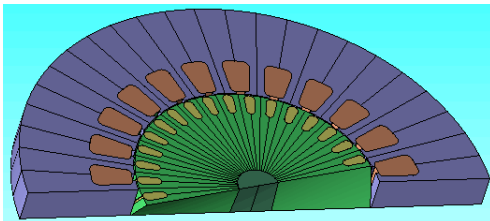


Fig. 4: An example of creating geometry with the skew extrusion function

It considers the skew in the rotor of the induction motor

2-3. Mesh generation functions

We have improved the efficiency of mesh generation with the introduction of a new algorithm in the mesh generator.

2-3-1. Extruded mesh

When using the automatic mesh function to generate a mesh in a rotating machine, there are times when the divisions in the axial direction are finer than necessary.

This is not a problem with a manual mesh since the number of axial divisions is directly controlled, but this type of control was not possible with the automatic mesh until now. The extruded mesh uses a prism mesh to ensure a highly accurate analysis even though the number of elements has been reduced (fig. 5). This function can be applied to a motor with a skewed geometry, as well.

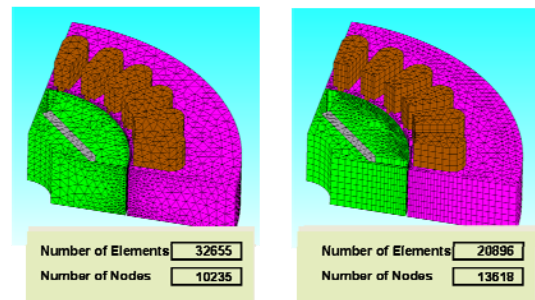


Fig. 5: A comparison of a traditional mesh model (left) and an extruded mesh model (right)

2-4. Improvement in JMAG-Designer's performance

JMAG-Designer's main characteristic is that it can handle several models or studies in a single project. By using the parametric analysis function, it is possible to calculate multiple cases with various design variables as parameters. These are useful functions, but we have heard many requests to reduce the time required to switch between studies and to increase the number of parametric studies available. These two issues have been addressed in Ver. 11.

2-4-1. Faster multi-model and multi-case processing

In JMAG-Designer Ver.11, we shortened the time necessary for switching between study displays and raised the upper limit for the number of cases that can be generated in a parametric analysis. It is also now possible to draw response graphs for multiple cases in parametric analysis.

A comparison of the time necessary to import multiple cases and switch between cases for Ver.10.5 and Ver.11 is shown (fig. 6).

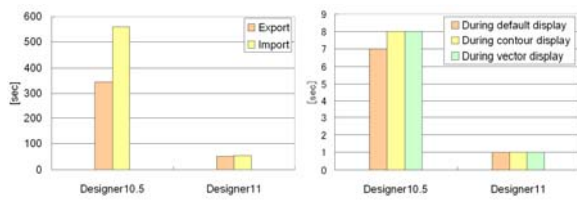


Fig. 6: A multi-case importing time comparison (left) and a switching display time comparison (right)

The comparative verification was a 7700 element 2D model, and there were 225 cases.

2-5. Multiphysics

Ver. 11 also has multiple improvements to its multiphysics capabilities. The following section introduces these new features.

2-5-1. Coupled magnetic field and structural analysis including a structural displacement

With JMAG's coupled magnetic field and structural analysis function, it is possible to simulate displacement and stress in a structural analysis based on the electromagnetic force from a magnetic field analysis. It is also possible for a magnetic analysis to simulate the magnetic flux density and iron losses, including the effects of stress based on a structural analysis. However, it is not possible to do a magnetic field analysis if a plastic deformation is involved in the structural analysis.

It is also now possible to do a magnetic field analysis that applies the displacement predicted in a structural analysis. This is possible with the use of a new coupled magnetic field and structural analysis tool. The targeted structural analysis solver becomes the structural analysis (DS) module of JMAG and Abaqus (developed by SIMULIA).

One-way coupling with DS is can facilitate the magnetic analysis of a model with static plastic deformation where a change in a flux path affects the magnetic circuit. For example, variation in a stator's inner diameter caused by shrink fitting or press fitting the motor's case can influence the motor's characteristics. Changes in the circumferential air gap length due to variations in the stator's inner diameter can alter the motor's flux path, which then affects cogging torque. Coupling the magnetic analysis to the structural analysis makes it is possible to gain an understanding of this fluctuation.

Two-way coupling with Abaqus is useful for analyses of electromagnetic phenomena that include a plastic deformation which changes at each step. For example, evaluating the temperature distribution of a part that is undergoing induction heating will have losses and heat generation that are affected by changes in the flux path from plastic deformation. In a coupled analysis, it is possible to account for those kinds of phenomena and evaluate the results of the induction heating process (fig. 7).

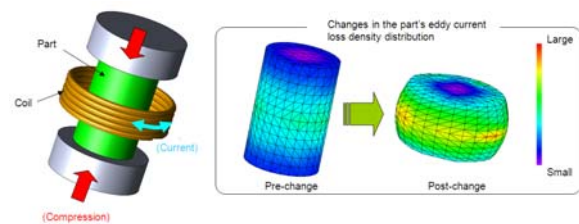


Fig. 7: Two-way coupled magnetic field and structural analysis that accounts for press fabrication of the part.

2-6. Coupled Analysis

Many customers have modeling programs that they are familiar with, and have requested to use these programs in conjunction with JMAG. JMAG already has links to many packages, but these do not cover all of the programs available.

JMAG now includes an open interface program called MpCCI (Multi-Physics Code Coupling Interface). This program can correctly map physical quantities between programs that do not have a direct link. This tool will extend modeling capabilities even further.

2-6-1. General interface support for coupled analysis

We have implemented an interface in JMAG-Designer Ver.11 that supports MpCCI. Fig. 8 shows the steps for an analysis using MpCCI, and another software program.

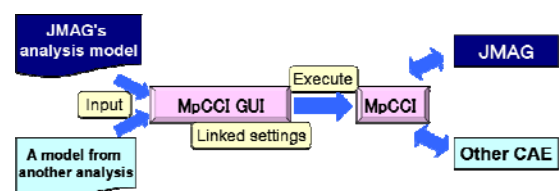


Fig. 8: The steps for a coupled analysis with JMAG, which uses MpCCI, and another CAE.

2-7. Result processing

Extracting results is necessary when examining specific parameters. JMAG-Designer Ver.11, has a results extraction tool that allows you to extract the objective result without starting JMAG-Designer or JMAG-RT Viewer.

2-7-1. Efficiency maps

An efficiency map is a vital characteristic diagram that allows you to understand a motor's characteristics at a glance. The efficiency map plots the interaction of the current amplitude and phase angle at various rotation speeds and torques across the controller range. The resulting motor efficiency is very useful, but it requires a great deal of time and effort.

JMAG-RT Viewer allows you to draw a speed versus torque curve and an efficiency map with one click after you have set the control method and drive type (fig. 9).

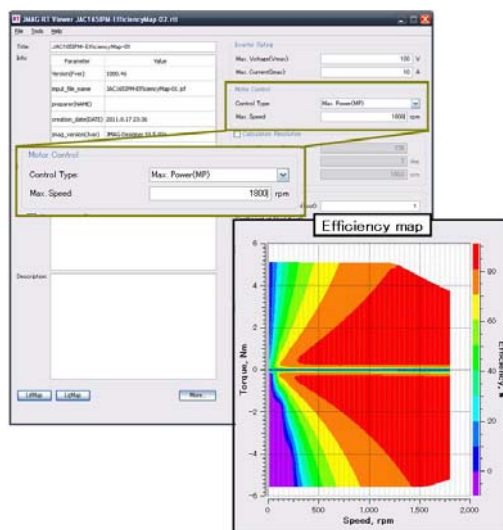


Fig. 9: An efficiency map using JMAG-RT Viewer

2-8. New solutions

JSOL is always working to extend and improve the capabilities of JMAG-Designer. Two new tools set for release later this year, JMAG-VTB and JMAG-SuperExpress, seek to dramatically reduce the time necessary to set up complex studies.

2-8-1. JMAG-VTB

The goal of JMAG is to act as a Virtual Test Bench and reproduce all of the measurements taken on a physical test bench. This sounds like a difficult task, but JMAG continues to reach for this ideal.

Many functions are being developed for future simulations, with the goal of further improving capabilities through coupling and linking. The downside of this development is that increasing capabilities results in a great deal of information to remember in order to master so many functions. The procedures will continue to grow more complex as simulations work to incorporate more diverse phenomena.

JMAG VTB seeks to reduce the amount of settings that a user must create for each model analysis. By selecting the object that you want to analyze and selecting the analysis objective, the necessary calculations run. This can be thought of as automating the analysis so that once you have set the work flow; you can apply it to all new models. With the initial version, we are planning on releasing it with approximately 20 workflows.

The workflows include built in settings, such as the necessary mesh division parameters, rotation angle, and graph displays. Our users can obtain results by simply importing the model data and setting the goal of the simulation. JMAG-VTB also has search functions for calculations and models that were carried out in the past, so the system allows you to reuse models easily. (fig. 10).

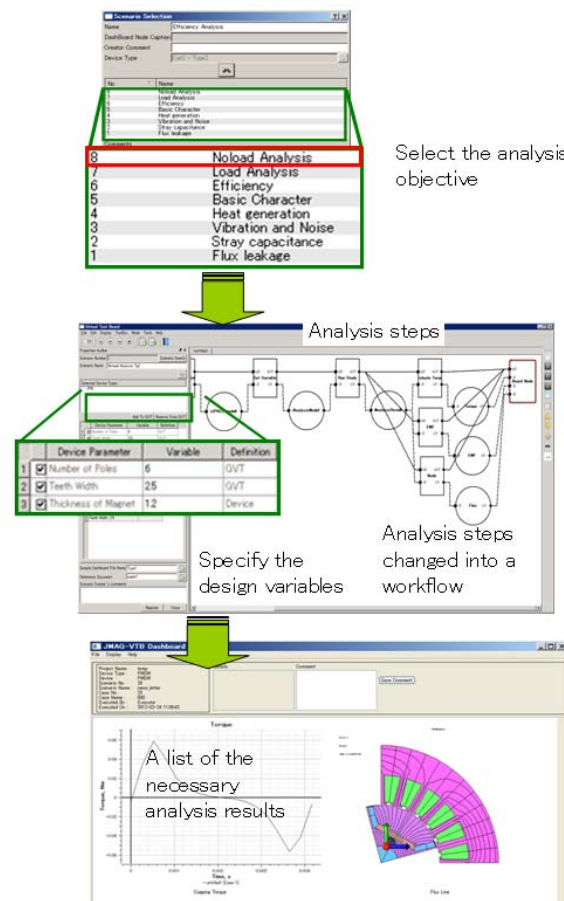


Fig. 10: Analysis automation via JMAG-VTB

2-8-2. JMAG-SuperExpress

We will release JMAG-SuperExpress, which is equipped with calculation functions for the motor templates.

SuperExpress provides detailed motor analyses of basic parameters through the use of FEA. Calculations for cogging torque, iron loss distribution, inductance maps, and efficiency maps are also possible (fig. 11).

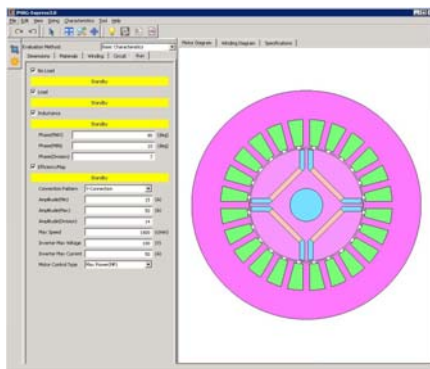



Fig 11 A screen image of JMAG-SuperExpress

We will introduce the details of the functions in April's JMAG Newsletter

3. In closing

JMAG-Designer is continuously improving to ensure that users can perform simulations accurately and quickly with a less difficulty.

Examples of the functions introduced here can be seen in the application notes section on the JMAG website. If you have any questions about how to use the new functions, please contact your support representative. 

(Takayuki Nishio)

Explanation: Model-based Development

Final Issue: Model-based Development Requires the Ability to Expand, Shrink, and Share the Model

This series discusses JMAG's contributions to model-based development. Issue 1 talks about the motivation behind developing "JMAG-RT" for control simulations, which have become a typical solution in model based development. In issue 2, I explained how we are approaching the model based development that we have in mind for JMAG by presenting the new functions involved with JMAG's model base, which was released last summer. Finally, in issue 3, I confirmed that multiphysics is also a solution for model based development and showed that improving the ability to share and distribute information is a necessary condition for CAE to participate in model based development.

This series has examined explanations of conventional model bases while also delving into what exactly model-based development is and what CAE technicians' tasks are. While at first I believed that I had a good understanding of MBD, over the course of this series I soon came to realize that I have much to learn. Though this means that I may have inconvenienced my readers, it provided me with a good chance to rethink model-based development. To finish this series, I would like to study model-based development by focusing on the keywords "zoom-in/zoom-out" and "circulation."

The model's role in a V-model development cycle

V-model development cycle

People often pattern their development process after the V-model, using it when explaining model based development, in particular. It conveniently links each step of the development process ("Specification and requirement", "System design", "Subsystem design", "Part design", "Prototype creation", "Unit evaluation", "Combined evaluation", "System evaluation", and "Comprehensive evaluation") in a workflow, expressing it in an easily understood manner by presenting the study and evaluation progress in a V shape.

The V-model starts with the part specifications and gets more and more detailed as the process moves along. First the prototype becomes more concrete as its trial parts and software become clearer, then it approaches completion thanks to evaluations and revisions, and finally the product comes to fruition when the scope of the evaluations broadens (fig.1).

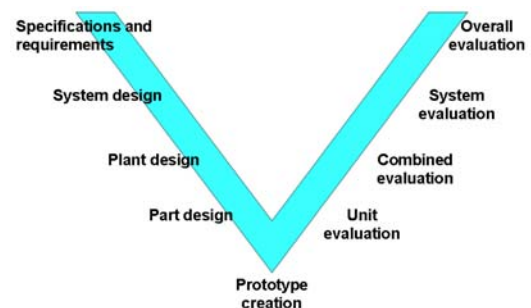


Fig. 1 V-model development workflow

Divergence and convergence

Recently, however, I have begun to feel uncomfortable about this V-model development cycle. After giving it much thought, I have finally reached a conclusion as to the cause of this discomfort, and therefore would like to give a brief explanation. To put it simply, this V-model development cycle is drawn as a single line, while an actual system is composed of multiple subsystems, and each subsystem is an assemblage of a number of components, sub-assemblies, software, and controllers. The

configuration starts from the system design and ends with the complete product, but it is not a single line. Instead, it begins to diverge from the first step, splitting into its greatest number of branches when creating a prototype, and beginning to converge up the ladder when evaluations start. I had thought that the old method was strange because no one had ever explained this to me (figures 2 and 3).

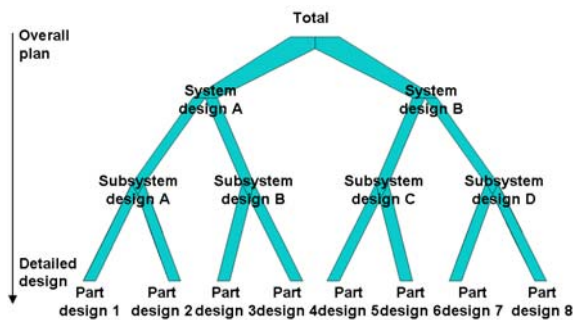


Fig. 2 Divergent development cycle

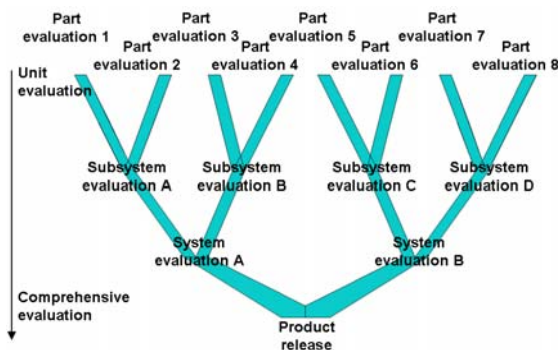


Fig. 3 Convergent development cycle

An image of the actual development cycle

A development cycle, therefore, is a V-model when seen from the front, but when viewed from the side it actually has a large number of branches, like a person's blood vessels. These branches join together again, becoming a completed product in the end. This clarifies the development cycle, and it seems like an obvious conclusion once a person realizes it. This concept is very common in understanding causes and structures of phenomena, and is similar to FTA (Fault Tree Analysis), which is used when analyzing malfunctions (fig.4).

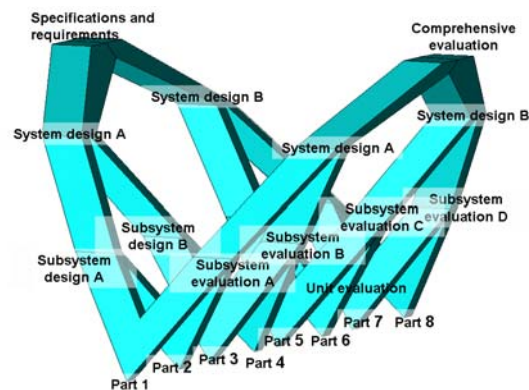


Fig.4 It is possible to image a development cycle in a three-dimensional view

The information necessary for judgment differs from one process to the next

Designers and engineers have to make correct judgments in each development process. In order to do so, however, they need to have the right amount of information. If they have too little information, they cannot make a judgment to begin with, but on the other hand, they may become confused with too much information and accidentally make a wrong decision. Therefore, it is necessary to filter the information at each step along the way: Designers and engineers need to have a broad point of view in the early stages, while in the later stages they have to take a perspective that is closer to the target because the study becomes more detailed.

In the end, the data in this development cycle becomes the model itself. For this reason, one has to be able to zoom in and zoom out on the model, accessing various groups of data freely. Think about it this way: Local data like the magnetic flux density distribution of each part is unnecessary when a person wants a rough estimate of a motor's thermal rating during operation, whereas the level of loss generation during operation becomes vital. In times like this, one does not need local losses, but when the evaluation target becomes the local demagnetization of the magnet, detailed part geometry and magnetic flux flow are indispensable. This is why people expect the ability to expand and contract the amount of data that they handle for their models freely, depending on the situation.

However, data also must be shared between divergent steps in the process, as mentioned above. For example, when two subsystems that are different, like those of an actuator and a controller,

have to coordinate and work together, they have to evaluate performance based on data that they have in common.

Fig. 5 gives a clearer perspective of the development process in 3D by adding axes to the image in fig. 4. By looking at it, one can get a better idea of the characteristics required of a model used in model based development: The vertical axis measures the model's level of detail, the horizontal axis measures the level of development, and the longitudinal axis measures the development progress situation (fig. 5). Increasing the speed of the v-model development cycle leads to increases in the speed and efficiency of development itself, so the model needs mobility along the vertical and horizontal axes in addition to a high level of data circulation.

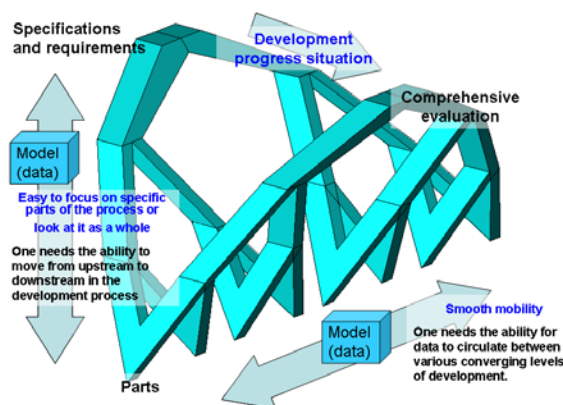


Fig. 5 Exchanging information freely is required for a model.

No single step can be skipped or shortcut during development

All of the steps in the process have to be fulfilled in order to get all of the way from start to finish. This fact becomes evident when looking at the v-model because it takes the divergent steps into consideration. Regardless of whether one is working with a prototype or a 3D analysis, the necessary judgments are unavoidable. When all of the risks in a process are not removed at an early stage, they remain in the following steps and lead to problems and setbacks later on. It is impossible to bring the project to fruition if one jumps from one step to the next without passing each detailed design phase (fig. 6).

3D analysis that uses the finite element method (FEM) does the best job of producing results in a detailed design process. If the model is also created following the concept of model based

design, one can easily use it in other branches or processes, and improve development speed by doing so.

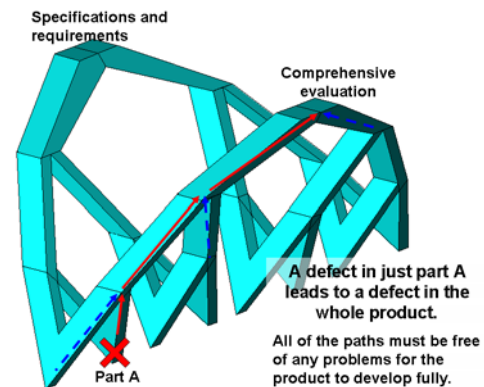


Fig. 6 All the path must be free from any problems.

An analysis tool that is conscious of magnification/demagnification and sharing data

Up to this point we have examined the model's role in V-model development. The data that flows through the development process is as universally important as ever, and the concept of model based development has come to be used as a means of raising its versatility and ability to circulate. I stated earlier that people want the ability to freely zoom in on and zoom out of the model itself, but the analysis tools that create and evaluate said model need to be used differently according to the development situation.

A 1D analysis tool

The system's suitability and requirements are studied in the initial stages of development. When preparing to study the exact geometry, one moves forward with logical judgments as to what the system should accomplish, what to get rid of, and what role the various members of construction (subsystems) will play. At this point in time it is best to ignore the physical completion and determine how the model should look. The tool that is typically used in this situation is called a 1D simulator. The model does not have part geometry or material properties, but the performance, functions, I/O relationships, and logic are all defined. MATLAB/Simulink, manufactured by MathWorks, Inc., and AMESim, manufactured by LMS International, are both typical analysis tools.

This is the point where the tasks and roles of the subsystems that make up the system are determined. Control and electric circuits attach importance to logical behavior instead of geometric entities, so they are handled in 1D. At this point in the model's development, it is important to decide what is going to be input and what is going to be output, so an evaluation environment for a model that behaves logically necessary.

A 3D analysis tool

Concrete design studies are carried out in the middle stages of development. Here, one evaluates whether various factors that have been determined upstream (physical validity, completion of the geometry, and how easy it will be to produce) have been fulfilled. The model at this point needs to account for actual geometry and physical properties. Physical simulations that use the finite element method are really unrivaled for these kinds of tasks. When using electromagnetic field analysis, JMAG is the best tool available. With JMAG, one can use a model to evaluate all of the physical systems required by an actual machine. For this reason, a coupled analysis function called multiphysics is necessary as well.

Easy interchange between 1D analysis and 3D analysis

As mentioned earlier, necessary information for judgment differs from one stage to the next. For this reason, one needs the ability to circulate data between the larger and more detailed structures of the development process when using a model in model based design. Instead of displaying everything at once, one has to be able to zoom in on specific parts and zoom out to see the entire picture. Of course, one also has to be able to zoom in and zoom out without much trouble.

JMAG's functions

JMAG provides models that give the ability to expand, contract, and share various amounts of data to meet the requirements of model-based development. I have listed some below.

Supporting 1D analysis

The typical solution for 1D analysis is JMAG-RT, which I introduced issue 1. One can use it to create a motor model with JMAG's highly accurate and high-speed magnetic field analysis. The model

uses a voltage signal as its input item, and the analysis obtains the linkage flux, inductance, torque, and phase current value. It provides useful motor data for power electric circuit designs and control designs. We are continuing to develop and improve the JMAG-RT model itself with the aim of raising its universality so that it can be used with C programs, in addition to general control simulators like Simulink.

One can also handle JMAG itself as a 1D model by using its direct link function. In this case it is possible to connect with phenomena for all electrical equipment, not just motors, so the ability to share increases greatly.

Supporting 3D analysis

In 3D analysis, which includes 2D analysis, a model is used that incorporates model geometry and material properties, in addition to following the laws of physics. This is JMAG's area of expertise, as it can run highly accurate electromagnetic field analyses. In addition to solving electromagnetic forces, induction losses, and nonlinear magnetization properties caused by electromagnetic phenomena, it shares all of the information with an analysis simulator. This improves multiphysics support and improves the ability to share data with Abaqus and LMS Virtual.Lab. We are preparing functions that make easy to use magnetic field analysis results with structural analysis and vibration/noise analysis.


In addition to functions that create its own geometry, JMAG-Designer also has a lot of functions that link with CAD. This is made possible with a function that allows CAD and JMAG-Designer to share geometry information files. Changes in CAD geometry are immediately applied in JMAG-Designer, so it is possible to proceed with electromagnetic evaluations of geometry and arrangement designs in parallel. This does not mean that one can share analysis results like multiphysics, but geometry and arrangement designs are extremely important in design development, so the ability to share geometry information will greatly contribute to model based development.

In closing

I originally began this series with the intention of introducing functions in JMAG-Designer that can support model based development. However, as I progressed with my explanation of how JMAG is contributing to model based development, I came

to the realization that I had not properly understood model based development itself. After this I began to deviate from introductions of JMAG-Designer's functions and put my efforts into reviewing the model based development process.

This series renewed my understanding of model based design, showing me that it changes the development procedures in a big way. It replaces development data that was previously distributed as documents, layouts, and prototypes into a model, and by doing so raises the ability to share and distribute data. To put another way, it gives designers and engineers the ability to see layouts and specification sheets as models.

I will leave JMAG-Designer's detailed functions to another article. When you read about them, think about how they can raise the level of development information being distributed in your own development cycles. By doing this, you will be able to contribute to streamlining your development process in ways that you had not noticed until now. 

(Yoshiyuki Sakashita)

Explaining FEA: Effectiveness of FEA in the Development Process

Final Issue – Failure Mode Simulation Using FEA

This report introduces FEA's characteristics, which include an excellent analytical ability, in order to examine both the advantages they bring to the development process and the utilization methods for applying them. In this, the final issue, I will introduce applications to failure modes, which is a new way of using FEA. Using FEA allows us to obtain information that is not available through an actual device test. It can give us substantially greater insight into the device's performance.

1. Overview

When a company releases a new electrical device, it must first confirm the conditions under which the device will operate correctly. The kind of safety demanded ensures that a product will operate without any accidents under loads that fall within, and even exceed, its guidelines. In order to secure safety, one needs to assume loads that surpass the guideline values ahead of time and have some leeway at the design stage. From there, it is necessary to put together a plan to predict and prevent accidents by using a failure mode simulation based on a prototype verification.

In reality, however, it is not rare for situations to occur in which products are recalled after release and undergo further verification because of unexpected accidents. Even if one uses a real machine test prior to release as a failure mode evaluation, when an accident happens it is often said that it occurred because the real machine test was insufficient. It is important to remember, however, that it is difficult from a cost perspective to prepare real machine tests that ensure completeness, and even if it were possible to prepare a complete testing environment, there is a great deal of danger involved with the machine test itself.

If it were possible to simulate a failure mode evaluation, all of the events would occur in the virtual space of a computing machine, meaning that there would be no danger involved. With a simulation, it is easy to test setting values that would be difficult to achieve in reality, so it is

possible to reduce the evaluation items from an actual machine test and restrict them to a minimum level. Failure mode evaluations that use simulations are as important as, if not more important than, advance evaluations during the design process.

2. The technology required for simulating failure modes

What exactly are the necessary requirements for a simulation when performing a failure mode simulation? When examining actual failure modes, it becomes apparent that they are typically categorized as thermal or structural phenomena, such as heat generation and vibration/degradation. However, these only raise the issue of phenomena that can be seen visually, while the physics that occur in the interior is more complicated and varied because they have interactive relationships. Among electrical products, copper loss and iron loss tend to be the causes of heat generation phenomena. On the other hand, vibration and degradation phenomena occur when the electromagnetic force causes an excitation force. These phenomena, however, are not merely thermal or structural, but are instead composite phenomena related to the electromagnetic force. This is why one has to be able to model various and complicated physical phenomena in a failure mode evaluation and simulate the actual circumstances. Simulation technology with a high degree of detail is necessary to apply the information required for a phenomenon simulation in a model.

Failure mode simulation is also an important indicator for determining the advisability of a product release, so when a problem occurs during an evaluation, one needs to be able to diagnose the cause easily and implement any improvement strategies in the design right away. This is why it is necessary to possess simulation technology that has high analytical ability and can analyze outcomes instead of merely obtaining a highly accurate, detailed analysis result.

We highly recommend FEA as a simulation technology that fulfills these needs. I will examine the reasons that FEA is the simulation technology that is best suited for failure mode simulations in the following sections.

3. Why FEA is effective in failure mode simulations

With FEA, it is possible to match the material properties and conditions necessary for an analysis with actual conditions, and to apply the contents that have been set up in the analysis correctly. For example, you can input the points to define the BH curve of a material. Defining this curve means that the simulation will incorporate the nonlinear properties of the material, and this should increase the accuracy of the simulation. The higher the accuracy of the point sequence that has been entered, the closer the result is to the actual phenomenon. FEA also allows you to simulate complex interactions as described in the previous section. For instance, you can simulate the temperature of a device by first simulating the electromagnetic losses and then apply those losses to a thermal analysis model, because the device's temperature is a function of an electromagnetic simulation driving a thermal simulation. You can also couple these two simulations and run them together so that the changes in one directly affect the other. In other words, the losses drive a temperature change which then alters the material properties, and the new material properties are then reflected in the electromagnetic loss model.

By using FEA, you can gain insight into phenomena that are either difficult or impossible to measure directly. For example, you can use a FEA to determine the magnetic flux density of a device and confirm whether the magnetic design is correct, or if there is unintended saturation. Even complex

interactions such as electromagnetic force and vibration can be investigated by isolating the phenomena through a coupled FEA. In this case the excitation force distribution and stresses are driven by electromagnetic forces. These forces also change the material properties, which in turn effect the amount of electromagnetic force generated.

Through FEA you can examine the problem from multiple viewpoints and create output that will help visualize the phenomena under examination. You can also predict unintended problems and determine their solution. Though coupled analysis we can thoroughly examine how and why a device fails.

These are all reasons why FEA is a simulation technology that fulfills the requirements demanded for failure mode simulations.

4. FEA's advantages as seen through case examples

The following two examples examine how FEA can be used in specific failure mode analyses.

4.1 Demagnetization evaluation of the magnet inside of a motor during drive

A common fault in a motor during drive is a breakdown of the transformer insulation in the inverter, which produces a short circuit (fig. 1). This short circuit generates a massive current, which produces a reverse magnetic field and generates heat, creating demagnetization in the motor's permanent magnet (fig. 2). The resulting demagnetization causes the motor's characteristics to change, making it possible to assume that the entire system, including the motor, will be affected. A failure mode analysis needs to confirm the influence from demagnetization on the motor's characteristics and build countermeasures into the design (*1).

Using FEA to do the analysis makes it possible to perform a failure mode simulation that uses a coupled analysis with a control circuit that includes an inverter, like the one above. With this simulation, it is possible to predict the temporal changes of the demagnetization phenomena that occur after an accident. Excellent analytical ability, one of FEA's characteristics, allows you to get an understanding of the magnet's local demagnetization situation (fig.

3). By forecasting which part of the magnet is influenced by demagnetization the most, you can study alignments and materials that make it difficult for demagnetization to occur.

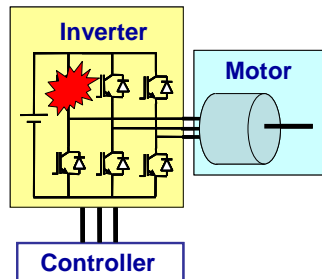


Fig. 1 Damage in the transformer that composes an inverter

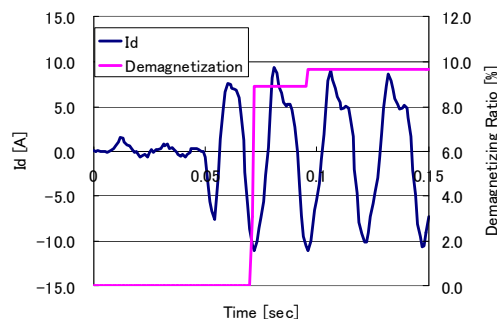


Fig. 2 Increase in D-axis current and development of demagnetization caused by a short circuit

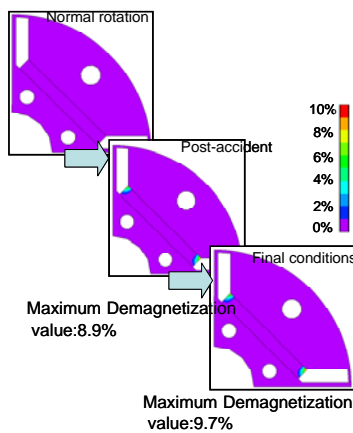


Fig. 3 Temporal changes in the demagnetization distribution of the magnet in a rotor

4.2 Stray losses and heat generation in a large transformer

The transformers used in power plants and substations generate a great deal of heat in the

surrounding chassis. This heating occurs because of flux leakage from the transformers themselves and because the high current flowing in the busbars results in stray loss. Even if the temperature level is below the upper limit of the transformer, it may still result in someone getting burned if they touch the chassis. This is why a thermal analysis of the transformer must also include temperature levels in the chassis, and not just the transformer itself. It is especially important to estimate the maximum achieving temperature that is generated locally, meaning that an accurate evaluation of the temperature distribution is necessary. Stray loss, which generates heat, also occurs in places not originally assumed to be magnetic circuits. For this reason, it is difficult to use just a magnetic circuit or empirical values when estimating loss distribution (fig. 4).

Estimating the temperature distribution of these heat sources becomes an even more difficult task if the stray losses do not have good distribution accuracy. It is possible to use actual machine tests to perform verification, but with a large-scale transformer, the facilities, which include the transformer itself, are extremely expensive to construct. For this reason, it is hard to think that advance verification using a prototype would be realistic from a cost perspective. This is why advance forecasts using FEA are indispensable (*2).

This analysis handles composite phenomena made up of an electromagnetic phenomenon and a thermal phenomenon, so a magnetic field-thermal coupled analysis is necessary. First, the magnetic field analysis is used to obtain three losses: Copper loss in the coil, iron loss in the core, and stray loss in the chassis. Next, these losses are used as heat sources to carry out a temperature distribution analysis and estimate both the final temperature distribution and maximum achievement temperature in each of the parts (fig. 5 and fig. 6). The loss distribution and temperature distribution obtained from this analysis are then used to study the arrangements of the coil, core, and chassis, which contain the local heat generation. Using FEA and doing a simulation in this way allows you to objectively investigate the physical phenomena that occur in the total facilities, which include the transformer, and use them in a design.

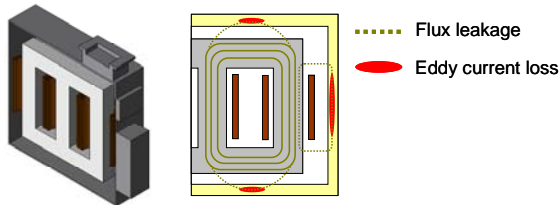


Fig. 4 Geometry of a large-scale transformer, including the chassis (left) and an image of stray loss generation caused by flux leakage (right)

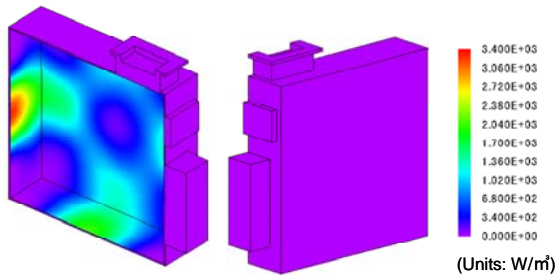


Fig. 5 Stray loss distribution in the chassis

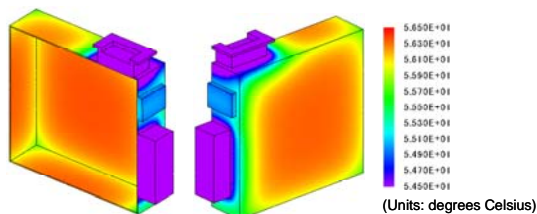


Fig. 6 Temperature distribution in the final state of the chassis

5. In closing

In this issue, I introduced FEA as a simulation technology that can be used to predict failure modes in a device.

In addition to having excellent capabilities when simulating physical phenomena, FEA makes it possible to carry out a wide range of failure mode evaluations and to analyze their causes in great detail. For this reason, one can think of FEA as a simulation technology that provides additional insight beyond actual machine testing.

I hope that everyone will use FEA to give a new added value to their development process.

(Takayuki Nishio)

(*1) This case example from a JMAG user comes from John Deere's presentation documents at the JMAG Users Conference 2011: "Electric Drives for Off-Road Mobile Equipment."

(*2) This case example from a JMAG user comes from Japan AE Power Systems Corporation's presentation documents at the JMAG Users Conference 2010: "Study of Local Heating on by IPB Connection Box and Around Metallic Parts of Large Power Transformer by 3-D Magnetic Field Analysis."

The two presentation documents mentioned above are listed on the Website for JMAG users. We will send a CD version of the Users Conference proceedings, so please contact the Users Conference Secretariat if you would like to receive a copy.

JMAG Users Conference Secretariat, Tomomi Igarashi
E-mail: event@jmag-international.com

Fully Mastering JMAG

Issue 3 Shortening Calculation Time 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 yet well known. Why don't we aim at making operations more efficient by becoming familiar with new functions that we haven't discovered yet?

In this series, we introduce "Things that we should know" in JMAG.

Overview

Designers are under constant pressure to meet tight timelines and deliver results as quickly as possible. At the same time, however, they cannot sacrifice accuracy in the pursuit of results. There are also those who worry that a huge amount of calculation time will be required to carry out a large volume of highly accurate calculations.

JMAG has continued to improve its high speed solver functionality and parallel solvers in order to help our customers solve these kinds of obstacles. In this issue, we look at how to shorten calculation time by examining JMAG's functions and introducing methods of creating analysis models. By all means, take this opportunity to try them out for yourself.

Using the solver's high-speed functions

JMAG has high speed solver functions that can substantially reduce calculation times. In this section we will cover five: The high speed solver for nonlinear iterations, the time period explicit error correction method, the steady-state approximate transient analysis option, the A-phi method, and the surface impedance method.

High speed solver for nonlinear iterations

This is a function that allows you to shorten calculation time when using a nonlinear material in a transient response analysis. When using this feature, we have seen approximately a threefold improvement in analysis speed compared to when it is not used (fig. 1). This function is not recommended for either an analysis involving motion where the displacement per step is large, or

for an analysis that does not use a current source in the circuit or the current condition. The procedure is as follows:

1. Display [Nonlinear Calculation] under [Study Properties].
2. Click the [Use High Speed Solver] check box.

Time period explicit error correction method

This is an effective feature for those who would like to calculate a steady state instead of a transient state. It uses the temporal periodicity of a time varying field in a magnetic field analysis, shortening the time required to calculate a steady state solution (fig. 2). It works well for synchronous machines, reactors, transformers, and induction machines that have a voltage power supply. The procedure is as follows:

1. Display [Solver Calculation Control] under [Study Properties].
2. Click the [Time Period Explicit Error Correction] check box.
3. Select the type of period and enter the frequency.

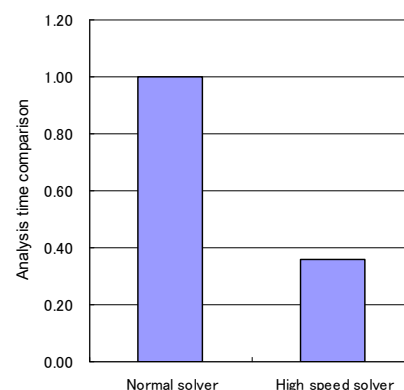


Fig. 1 A comparison of analysis times when using the high speed solver for nonlinear iterations

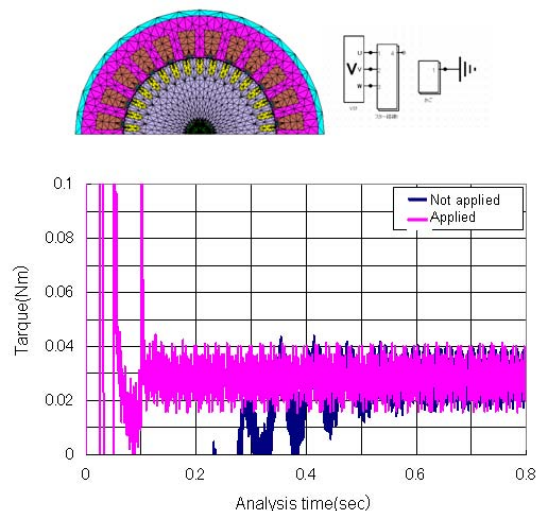


Fig. 2 A comparison of analysis times until a steady state is reached in an induction motor analysis, when applying and not applying the time period explicit error correction method

The steady-state approximate transient analysis option

Like the time period explicit error correction method mentioned above, this is a useful function for those who would like to calculate a steady state. First, use this function to calculate a trial steady state that assumes a single frequency, and then use the result to run a transient calculation. When you do this, the simulation will require less time to reach steady state operation (fig. 3).

This works best for simulations with a long transient period such as induction motors that use a voltage power supply, or with stationary devices like transformers and reactors. It is also possible to use this function with the time period explicit error correction method. The procedure is as follows:

1. Display [Solver Calculation Control] under [Study Properties].
2. Click the [Steady-State Approximate Transient Analysis] check box.
3. Select the analysis target.
4. Enter the slip when the analysis target is an induction machine.

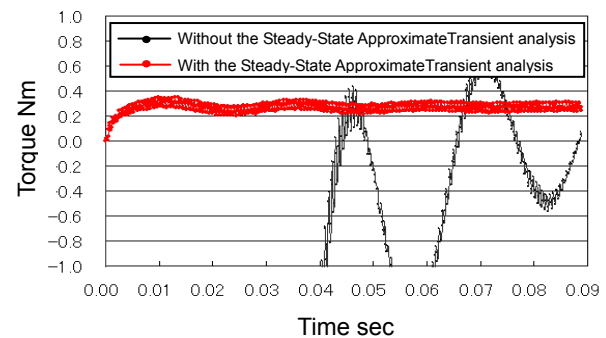


Fig. 3 A comparison of the time until a steady state is reached in an induction motor analysis, when applying and not applying a steady-state approximate transient analysis

A-phi method

The ICCG's convergence can deteriorate when it handles models with eddy currents. However, the A-phi method, which is one of ICCG's options, improves convergence by adding electric scalar potential to the conductor region as an unknown to be solved for. This works best in situations where a conductor region is a significant portion of the analysis target. That is why the A-phi method is recommended for use in 3D analysis with eddy current generation.

JMAG has two A-phi methods: A-phi method 1 and A-phi method 2. In most cases, A-phi method 2 does a better job of improving calculation efficiency. The procedure is as follows:

1. Display [ICCG] under [Study Properties].
2. Select [A-phi Method 2 (Recommended)] from [Calculation Method].

Surface impedance method (SIBC)

When performing a frequency response analysis with a high frequency and shallow skin depth in the conductor, reproducing eddy currents with the skin depth function can make the calculation scale too big. This is where SIBC helps. SIBC carries out calculations that account for current that flows only on the conductor's surface, making it possible to shorten calculation time by reducing the scale of the calculation. The procedure is as follows:

1. Click the [Use SIBC] check box in the [Electric Properties] group box.

Using your hardware's full calculating ability

This section introduces examples of using a parallel solver and GPUs (Graphic Processing Units) to enhance speed.

Parallel solvers

A parallel solver improves speed by dividing the processing load between several cores (CPUs) or machines. JMAG has two parallel solvers: a shared memory multiprocessor (SMP), and a distributed memory multiprocessor (DMP). Calculation speed differs greatly between CPUs when using the finite element method (FEM), so the hardware environment needs to be taken into account when deciding which parallel solver to choose (fig. 4). See the operating environments (*1) on our Website for more details. The degree of parallelism can be set as 2, 4, or 8. However, be careful because each degree of parallelism requires an additional SMP license. The procedure is as follows:

1. Display [Solver Calculation Control] under [Study Properties].
2. Select the type and degree of parallelism in [Parallel Computing].

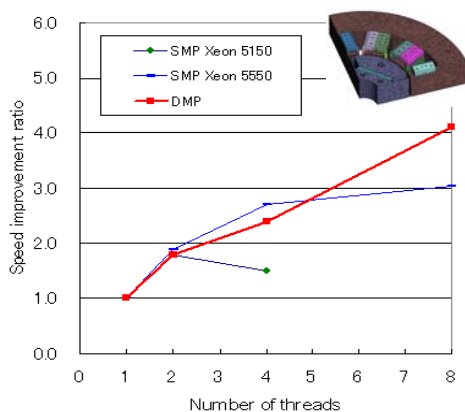


Fig. 4 A performance comparison of parallel solvers in an IPM motor analysis

GPU

JMAG is working toward improved calculation speeds by incorporating high performance GPUs in parallel computing (fig. 5). This function is provided to those users who wish to use it. There is a select number of GPUs that can use it, so be sure to review the operating environments (*1) on our website. The procedure is as follows:

1. Display [Solver Calculation Control] under [Study Properties].
2. Click the [Use GPU] check box.

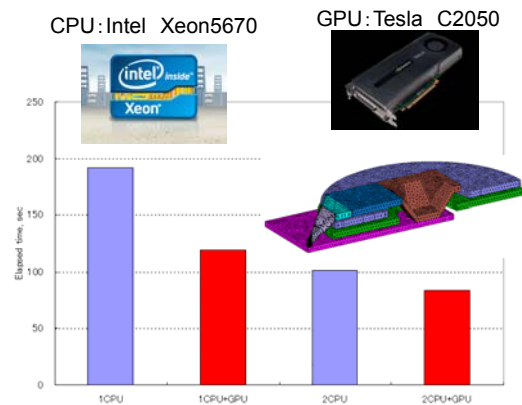


Fig. 5 The time shortening results of using GPUs in a magnetic head analysis

(*1) <http://www.jmag-international.com/products/specification.html>

Creating an analysis model for efficient calculation

Up to this point I have been introducing functions for JMAG solvers that reduce calculation time, but now I would like to switch to model creation methods that can improve the calculation speed. The methods that I would like to introduce are the S-characteristic correction method for section analyses and BH curves, and a mesh creation method.

Section Analysis

With JMAG, it is possible to use what is called the Section Analysis Function to extract a cross-section from a 3D geometry like CAD and analyze it in 2D. This 2D model analysis is achieved by actually creating a section analysis study. The conditions and materials that were set to the 3D model are also transferred to the section analysis study, so it is possible both to shorten the calculation time and to reduce the time and effort of creating a separate model. The method of creating a section analysis study is as follows:

1. Right-click [Study] under 3D Model and select [New Section Study].

Correcting the BH curve

A typical steel sheet has a nonlinear relationship between its magnetic flux density and magnetic field. JMAG uses the Newton-Raphson method for nonlinear iteration analyses, so when there is a point of inflection on the BH curve (from here on, the part of the curve near a point of inflection is called an S-shape), conversion can become difficult, thus increasing the calculation time. This

method corrects the S-shaped part of the BH curve to form a straight line, thereby improving convergence (fig. 6). However, be careful because the analysis results are affected if the model's operating point is in the adjusted part of the curve.

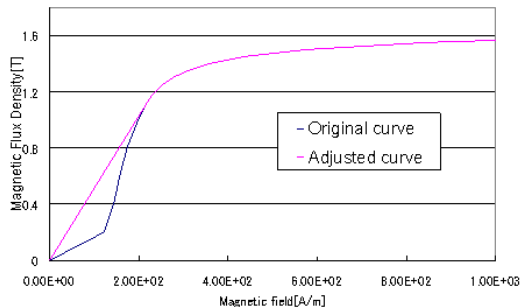


Fig. 6 An example of S-shape adjustment

Creating a mesh model that meets the analysis objective

Calculation time increases with the number of elements when using the finite element method, so one needs to create a mesh model that has the minimum number of elements necessary. The mesh required for an accurate analysis also changes depending on the physical quantities being evaluated, making it vital to take them into account and separate mesh usage accordingly.

Below is an example simulating a motor's induced voltage and cogging torque (fig. 7). As you can see, the resolution of the local magnetic flux density distribution improves when the mesh is more detailed. It does not really influence the induced voltage waveform that much, but the cogging torque is greatly affected.

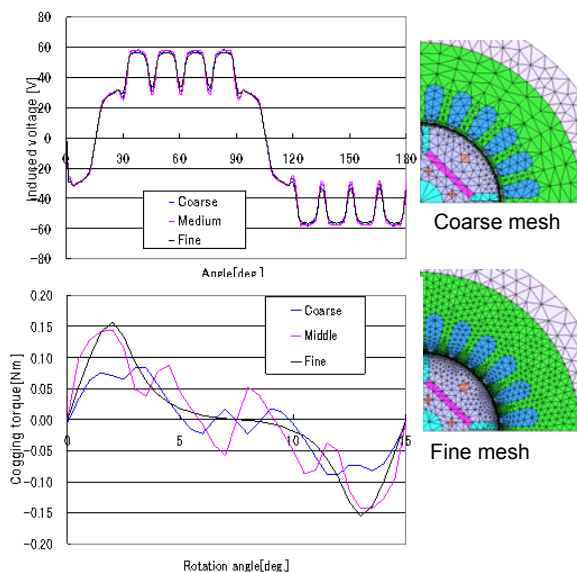


Fig. 7 Differences in outcomes depending on the mesh model (top: induced voltage, bottom: cogging torque)

Using a remote system

There is an increasing trend of running multi-case calculations, such as in a parametric analysis. To go with this trend, there has been a corresponding rise in demand for enhanced speed through the use of machine resources. One effective technique when processing a large number of calculations is to use remote systems, whose performance improves with the number of machines in operation. A remote system is a system that runs a job on a separate machine. However, be careful because licenses for the number of calculations to be run are required. The installation manual provides more details on this feature:

- The installation folder inside of the JMAG installation directory
- The JMAG Website > Support > Downloads

Reducing the number of calculation setbacks

It is best to avoid having to redo calculations because of a mistake in the analysis settings, particularly when carrying out large scale calculations. For this reason, I would like to introduce the restart function and monitoring function as options that can get a handle on setting mistakes early on.

The restart function

This function carries out an analysis by using the results from a completed analysis as the initial values. It is useful when you want to run a calculation, see how things progress after a certain amount of time, and confirm the results. You can carry out the subsequent calculations after confirming that there are no problems with the initial results. The procedure is as follows:

1. Display [Restart Control] under [Study Properties].
2. Specify the type of restart.


The monitoring function

The monitoring function is a function that displays a graph of the results mid-analysis, allowing you to confirm whether or not there is a mistake in settings before the analysis is finished. The procedure is as follows:

1. Right-click [Customize Monitor] in the [Run Analysis] dialog box.
2. Select the check boxes of the types of results that you want to display in the [Customize Monitor] dialog box and then click [OK].
3. Click the tab for the types of results displayed in the [Run Analysis] dialog box.

In Closing

This issue focused on shortening calculation time, and I took this opportunity to introduce high speed functions for JMAG's solver, parallel solvers, tips for creating a model, and methods for checking results before finalizing a simulation. From the standpoint of enhancing speed, however, it is always important to use a computer with good performance. There is still potential for shortening calculation time even further, whether it is by using improved computers or JMAG's features. Everyone's experience will be different, though, so please try the features that we discussed today and see how they affect your simulation.

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

(Mayumi Warita)

Mini Corner

How Do I Fix Problems With JMAG?

Has anyone here ever experienced a problem when using JMAG? What do you do in those situations? You may be using independent methods such as asking a JMAG user nearby, asking customer support, just thinking about it, or maybe even giving up.

We here at JMAG provide various types of support services to help solve any problems that you may be experiencing. I would like to introduce support services that you should know for every situation that you encounter when using JMAG.

■Problems when you are taking on a new analysis target

You understand JMAG's basic operations. Now you actually have to grapple with your own challenges. Where do you go from here?

We have prepared "Application Notes" for those who are taking on new analysis targets in JMAG. They are technical documents that explain things like analysis target specifications, analysis steps, condition settings, and mesh generation. The procedure for setting up the application notes is as follows:

- Start Menu > JMAG-Designer > Documents > Application Notes
- JMAG-Designer's Menu bar > Help > Application Notes
- JMAG Website > Support > Application Notes

We are also conducting intermediate seminars for those who would like to learn from an instructor instead of doing it on their own. See the JMAG Website for more information on the contents and schedule.

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

Fully Mastering JMAG

An Introduction to JMAG Technical Support

JMAG Technical Support works hard every day to bring quick solutions to problems brought by our customers, so that they can proceed with their analysis work smoothly. In this series, we introduce the kinds of situations where JMAG Technical Support can be of service to our customers by using example conversations between clients and support members.

In this issue, we introduce a customer who had not experienced any inconveniences with JMAG, even though he had never used Technical Support before. When he contacted Technical Support, however, he gained some new information and was able to expand the range of his analysis. This article is mainly intended for those who have never contacted Technical Support because they are not sure if their questions would be appropriate.

Mr. A has been using JMAG for about a year. He mainly does analysis on PM motors.
He is contacting a JMAG Technical Support supervisor.

Mr. A's current situation

He is a PM motor development supervisor. He uses JMAG-Designer to study no-load induced voltage and steady torque while changing the geometry. The person before him established the analysis methods, so he just carries out the analysis tasks that he was taught to perform. That is why he has not had any particular problems and did not think about contacting JMAG Technical Support.

Recently, however, the operating temperatures inside of his motors have started to be a problem, so he wants to confirm the influence of demagnetization, which is caused by changes in temperature, on the magnets, but he cannot find a way to approach the issue (see Column at the end).

Ask us first

One day Mr. A receives the JMAG Newsletter, where he finds an article introducing Technical Support. Mr. A had thought that he could only contact Technical Support if he had a question about JMAG's functions, but when he looked in the Newsletter and saw an article containing a conversation about general technical questions, he thought about contacting them about the issues that he was having.

Mr. A	When I read the JMAG Newsletter I saw an article called, "Ask Technical Support When Doing a New Analysis," so I decided to contact you and ask a few questions. I haven't accounted for magnet demagnetization, so I was wondering if I could do that in a JMAG analysis.
Support	Yes, you certainly can. What is the objective of your analysis? Would you like to confirm whether the motor's output is able to meet its requirements when the magnet has demagnetized? (*1)
Mr. A	Yes. The temperature in the motor rises, meaning that there is the possibility of thermal demagnetization, so I wanted to verify the influence from it. But I have no idea what that kind of analysis would entail, so I was wondering if I had to prepare anything in advance. I don't have a thermal analysis model, so I was wondering if it was an analysis that I could do with the license that I already have.
Support	You can confirm the effects from thermal demagnetization in a magnetic field analysis with JMAG, so there should not be any problems if you only have a license for transient response magnetic field analysis. (*2)

Ask us first, like Mr. A. We get a good understanding of the customer's current situation and provide appropriate answers.

Get answers to your questions with Technical Support

Support	JMAG has prepared magnetic properties for magnets at every temperature, so you can run the analysis by just inputting the temperature variation information. (See Column at the end for details)
Mr. A	Oh, I see. The analysis procedures seem pretty straightforward, so I'll study the magnet's demagnetization from now on, too. Are the mesh divisions the same as the analysis that I've been doing up to now?
Support	To account for demagnetization, a fine mesh is generally required to express the distribution of the coercive force that is produced in the magnet.
Mr. A	How do I confirm whether demagnetization has occurred?
Support	There is a display item called "Demagnetizing Ratio," so click it to confirm. We have done an introduction of this analysis in the Application Catalog. Do you know about the Application Catalog?
Mr. A	Yes. I referred to it a little when I first started analyzing, but I haven't looked at it since then.
Support	Ok, I see. I think that things will be easier to understand if you look at the Application Catalog while doing your analysis. Please don't hesitate to contact us if you have any other questions.

The support member continues to resolve each of the customer's questions.


Try asking about things that have been concerning you

Mr. A	It's kind of off the topic, but I'd like to ask about something else. Is there a simple way to change the materials or conditions? I've gotten used to the changing procedures so it's not a big problem, but they take a long time to confirm. Could you tell me if there's a simple way to change or confirm?
Support	In that case, try using Case Control in the parametric analysis function. You should be able to do it easily by using Case Control (*3).
Mr. A	I've heard of Case Control, but I had never thought about using it before. I'll be sure to ask Support if there is anything that I'm concerned about in the future.

If you have any problems or questions, by all means be like Mr. A and contact Customer Support. We will propose the best methods.

- Since this exchange, Mr. A has continued to undertake magnet demagnetization analysis and parametric analysis. He has started asking Technical Support about other analyses, and not just questions about procedures related to what he is currently doing.

In Closing

JMAG has a lot of features, and they are enhanced with each upgrade. This is why it can be difficult for a customer to even confirm whether the analysis that he wants to run can be done with JMAG. The members of JMAG Technical Support have a thorough knowledge of JMAG's features and how to use them. Contact Technical Support if you are interested in trying something but think that it might be too difficult or even impossible. We will support you so that you can use JMAG to its fullest potential in your work. 

(Tetsuya Hattori)

Commentary from a JMAG Technical Support member

- *1. Technical Support asks about analysis objectives at the beginning in order to provide the best response.
- *2. A coupled analysis between a magnetic field analysis and a thermal analysis is necessary to obtain temperature variations.
- *3. With the parametric analysis function, you can change geometry dimensions in addition to the materials and conditions by linking with the Geometry Editor or CAD.

[Column]: Accounting for demagnetization in the magnet due to temperature variations

Drive conditions have gotten severe recently, and the operating temperatures inside of motors have started to become a problem. Variations in temperature cause demagnetization in the magnets, so more customers want their analyses to account for influence from demagnetization.

Magnets demagnetize when the temperature at which they are used rises. There are two types of demagnetization in a magnet: Reversible demagnetization, where the magnetic properties return to their original condition when the temperature drops back down to normal, and irreversible demagnetization, where the magnetic properties do not return to their original condition. The operating points determine which kind of demagnetization occurs, so it is necessary to examine the operating points in each part of the magnet correctly.

JMAG has prepared magnetic properties, which have been provided by magnet manufacturers, for magnets at each temperature. Therefore, the magnetic properties change with temperature variations, making it possible to examine demagnetization phenomena.

By running a coupled analysis between a magnetic field analysis and a thermal analysis, it is possible to account for demagnetization in the magnets caused by temperature variations. However, by entering the temperature variation information and setting an irreversible magnet, you can account for a magnet's demagnetization from temperature variations by using a magnetic field analysis alone. In this case, you only need a license for a transient response magnetic field analysis to run it.

Event Information

2012 Event Introduction

JMAG is taking part in events, both in Japan and overseas. Take a look at JMAG's activity.

In this issue, we will present the dates and times for User Conferences that are being held all over the world.

JMAG Users Conference 2012 in Taiwan Conference Outline

Host : FLOTREND CORPORATION, JSOL Corporation

Dates : Thursday May 31, 2012

Venue: TBA

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



JMAG Users Conference 2012 in Germany Conference Outline

Host : Powersys Solutions, JSOL Corporation

Date : Tuesday July 3, 2012

Venue: STEIGENBERGER AIRPORT HOTEL: Frankfurt, Germany

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



The 2011 Users Conference in Germany

JMAG Users Conference 2012 in America Conference Outline

Host : Powersys Solutions, JSOL Corporation

Date : Monday August 13, 2012

Venue: TBA

JMAG Users Conference 2012 in Tokyo Conference Outline

Host : JSOL Corporation

Dates : Wednesday December 12 - Thursday December 13, 2012

Venue: Tokyo Conference Center - Shinagawa

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

The details regarding each Users Conference will be released starting with the next issue. We will also post additional event information on the website regularly, so please give it a look as well.

URL: <http://www.jmag-international.com/event/index.html#event>

*Dates listed are subject to change without notice. We appreciate your understanding.

Event Information

Event Report 1

At the JMAG Users Conference 2011, we planned a simulation park and held displays from exhibitors. We also had seminars to introduce JMAG's latest solutions, in addition to presentations in which users could announce examples of how they use JMAG.

In this issue, let's reflect on the JMAG Users Conference 2011 and look at feedback from those who attended the presentations, section meetings, and simulation park.

JMAG Users Conference 2011 Conference Outline

Host : JSOL Corporation

Dates : Wednesday December 7 - Thursday December 8, 2011

Venue: Tokyo Conference Center – Shinagawa

Number of attendees: 430

URL <http://www.jmag-international.com/event/conference2011/index.html>



Presentations (Day 1)

We invited presenters who are active in the front lines of various fields, and they took the opportunity to talk about their successes in development and the results of their analyses.

Keynote presentations

We invited Dr. Noboru Kikuchi from the University of Michigan for our keynote presentation. He talked about several topics, including which simulation technology must be used so that electromagnetic field analysis can play a more active role in product development in the future, challenges in usage technology, and the latest research progress for the direction of CAE as a whole. Dr. Yamada also presented JMAG's roadmap and plans for future development. Those who attended the presentations gained confidence regarding the difficulty of CAE analysis and their own future research, saying things like, "I was able to reconfirm that my research is not headed in the wrong direction," "The presentations covered old ground, which was very interesting," and "I came to realize once again how difficult multiphysics is."

Development planning of JMAG

Dr. Takashi Yamada
JSOL Corporation



Let Us Promote Analysis of Electromagnetism

Dr. Noboru Kikuchi
Executive Vice President
Member of the Board
TOYOTA Central Research
and Development Laboratories, Inc.
University of Michigan



Global Cases and Coupling Analysis Session

We received presentations from members of corporations that are active on a global scale in which they talked about themes such as coupled analysis. Did everyone feel that the simulation world is growing beyond simple electromagnetic fields and is starting to require more and more evaluations that link and couple multidisciplinary regions such as controls, thermals, vibration, and sound?

Electric Drives for Offroad Mobile Equipment

Mr. Jim Shoemaker
Advanced Product Technology
Mgr Vehicle Electrification
Technologies
John Deere



Multiscale Noise and Vibration models for a Switched Reluctance-based drivetrain for EV and HEV

Dr. De Langhe Koen
Simulation Division
LMS International



Research on the Behavior of Vibration and Noise of an IPM Motor on HEV

Dr. Zeng Jinling
Science Research Department
CHINA FAW GROUP
CORPERATION R&D CENTER



Vibration and Noise Analysis of The Motor for Electric Vehicle

Mr. Takayuki Miyakawa
Vehicle Performance Engineering
Department
Nissan Motor Co.,LTD



Analysis System Construction Session

These presenters based their talks on keywords such as optimization, model based design, HILS, distributed processing, and JMAG-Bus. Was everyone able to see examples of how JMAG's added value increases by applying it in an analysis system instead of using it as an individual analysis software?

A Case Example of JMAG-RT Application in an Electrical Automotive MBD

Mr. Kei Yonemori
Senior Specialist
Technical Research Center
MAZDA Motor Corporation



JMAG-RT apply to the design quality verification of motor control ECU

Mr. Yoshinori Takeuchi
Project Assistant Manager
Corporate ePF Division
DENSO CORPORATION



Leveraging JMAG-RT and FEA-based Models for High Fidelity Real-Time Tests in FPGA

Dr. Ben Black
System Engineer
System Engineering
National Instruments



Optimizing Designs with High Throughput Computing

Dr. Brooklin J. Gore
Senior Researcher
Core Computational Technology
MORGRIDGE Institute for
Research at the University of
Wisconsin-Madison



Expanding and Utilizing JMAG-Bus for Developing Motor Systems

Honda R&D Co., Ltd.
Automobile R&D Center
Technology Research Division 9
Mr. Takehiro Miyoshi



Induction Heating Session

In this session, we received presentations about methods of incorporating evaluation systems into analysis operations and comparisons between experiments and analysis.

A System of Coordination With Analysis Engineers and the Successes That Follow

Mr. Norihide Fujiyama
Senior Manager
Analysis Team Product
Development Dept
KOYO THERMO SYSTEM CO.,LTD



Development of the self fluxing alloy fusing process with the control system using the simulation

Mr. Tomoji Osada
Manager
Research & Development Group
NIPPON THERMONICS.Co.,Ltd.



Effect of magnetic property on the accuracy of induction heating analysis

Mr. Hiroshi Yuki
Advanced Technology R&D Center
NTN Corporation



Presentations (Day 2)

We started the morning session on the second day with an introduction of new products from Mr. Ogawa.

Introducing JMAG-VTB and JMAG-Super Express, Which Make Complex and Detailed Simulations Accessible

Mr. Tetsuo Ogawa
JSOL Corporation



Motor Session

In the morning, JMAG users gave presentations centered around the theme of how electromagnetic field analysis is being utilized in motor R&D and design. In the afternoon, professors from universities that are engaged in motor research gave attendees a glimpse of things from an academic perspective, talking about the progress in their research of making the motors of the future. It was a thought-provoking session, as everyone got a glimpse of the agony of these professors, who are taking on challenging themes every day.

Demagnetization Analysis Method Using Dy Diffused Magnets and the Most Suitable Dy Diffusion Methods and Their Effects for Motor Applications

Mr. Mitsutoshi Natsumeda
Kumagaya Works Design Section
Hitachi metals, Ltd.



A Vibration Analysis Using Numerical Results of Electromagnetic Analysis of the IPM Motor (D-model of IEEJ), Using Package Softwares, JMAG & CAEFEM

Mr. Takushi Fujioka
Manager
Motor Division
FUJITSU GENERAL LIMITED



A Case of Coupled Analysis of JMAG-RT and Circuit Simulator

Dr. Hideki Ohguchi
Core Technology Development Gr.
Rotating Machinery Technology
Development Dept.
Product Technology Laboratory
Corporate R&D Headquarters
Fuji Electric Co.,Ltd.



Eddy-Current Rotor Position Sensor

Mr. Seiji Shimizu
Leader
Business Unit Module & Energy
SUMIDA Electric Co.,Ltd



Variable Characteristics Motors (Matrix motor and CMMF motor)

Prof. Kan Akatsu
Associate Professor
Electric Engineering
Shibaura Institute of Technology



Voltage Boost Type Drive Circuit without Additional Reactor for Switched Reluctance Motor

Dr. Nobukazu Hoshi
Associate Professor
Department of Electrical Engineering
Faculty of Science and Technology
Tokyo University of Science



Development of a Ferrite Permanent Magnet Axial Gap Motor with Segmented Rotor Structure

Dr. Masatsugu Takemoto
Associate Professor
Graduate School of Information
Science and Technology
Hokkaido University



Transformer Session

This session included a wide array of topics, from fundamental characteristic evaluations of transformers and inductors to loss evaluations and product quality evaluations. Was everyone who attended able to raise their awareness of the results of using JMAG to apply FEA to each process?

The Magnetic Simulation Using JMAG and Simpleware

Dr. Yosuke Iijima
R&D LABORATORY
MATERIALS R&D DEPARTMENT
TAIYO YUDEN CO., LTD.



DC Superposition Characteristic Measurement of Reactors and Comparison with the measured values

Mr. Kouhei Ueda
Magnetics Development Engineer
Transformer Development Dept
TABUCHI ELECTRIC CO.,LTD.



Core Loss Analysis of the Transformers for Vehicle Power Supplies

Mr. Masato Kabetani
Electronics Division Engineering
Department
Toyota Industries Corporation



Approach of a transformer analysis using JMAG

Mr. Kazuki Semba
JSOL Corporation



Operation Streamlining Session

The presentations in this section were about examples of streamlining analysis operations by utilizing link functions and scripts with a 3D CAD. Streamlining is a topic that is common and does not rely on an analysis target, so these presentations covered ground that everyone can use in their own analyses in the future.

Magnetic Shield Design Optimization in HDD Writer

Mr. Kenkichi Anagawa
Writer design section
wafer design team
product development group
HDD head business division
data storage & thin film
technology components business group
TDK corporation



Making JMAG analysis handy by CATIA models

Dr. Hisashi Yajima
Chief
Product development division 3
SMC Corporation



JMAG-Designer Script Course (Hands-on Version)

Mr. Motohito Hirose
JSOL Corporation



Designers and In-house Distribution Session

These presentations were based on the theme of design streamlining and talked about examples of creating design tools centered around JMAG and shortening the design period. They also took the theme of in-house distribution and talked about innovations that they carried out to base their speaker design operations on JMAG.

Development and design of a loudspeaker using JMAG-Designer

Mr. Yoshihide Toyoshima
Senior Engineer
R&D Center
Onkyo Corporation



Development of Bicycle Generator Hub Dynamo Using JMAG

Mr. Takeshi Fujiwara
System Engineering
Bicycle Components Division
SHIMANO INC.



Partner Seminars

JMAG's technical partner companies also gave presentations about cases of coupling with JMAG and the latest available technologies.

The State-of-the-Art in Hardware-in-the-Loop Simulation of Motor Drives

Mr. Simon Abourida
Opal-RT Technologies, Inc.



Model Based Development and HILS for motor control development

Mr. Takashi Miyano
Director
Engineering Department
dSPACE JAPAN K.K.



The Introduction of JMAG-Designer Optimization Problem, Using modeFRONTIER Direct Interface

Mr. Seiji Nishita
Engineering Supervisor
Integrated Technology Dept.
Integrated Simulation Div.,
CD-adapco JAPAN Co., LTD.



Those who attended each session commented that they were glad they attended such a productive users conference, saying, "It was great because I was able to hear how people approach analysis technology abroad," "I found out what companies are looking for, so I'd like to keep this in mind in the future," and, "I felt relieved because we were concerned about the same things."

Presenter Interviews

We asked the presenters about their impressions of the Users Conference, how difficult their preparation was, the main points of their presentations, and what things they will be looking for in JMAG in the future.

Those who were attending the Users Conference for the first time said, "I was surprised at how many people attended," "The presentation topics were so broad, it turned into a chance to learn a lot and communicate," and, "It was really active." The presenters themselves also said that they learned a lot because they were able to hear talks given by people from other companies.

When asked how difficult their preparation was, they responded, "It was tough to do results verification between a real machine and JMAG," "There was a lot that I wanted to get across in a short presentation, so I had to come up with ways to say everything," and, "It was hard to get permission from my company." They also worried about how to relate their message to people who were not in their field of specialty. The engineers from our company had the same concerns as well, so they joked that the situation was the same wherever you looked.

It seems like everyone made the main points of their presentations about how to do a collaboration with JMAG and expressing potential for the future.

When asked about their future expectations for JMAG, in addition to saying that they would love some additional functions, they also said that they would like more coupling with other solutions and improvements in accuracy.

JMAG will continue to press forward in order to add to its unique charm by bringing a new value to everyone's design and development.

Section meetings

We wanted everyone to spend time productively during the conference, so we improved activities other than presentations and changed the poster exhibitions, which had been carried out until last year, into opportunities for technical exchange and information sharing.

Those who attended the section meetings said that they were rewarding, as they gave the chance to see behind the scenes of JMAG and share information while talking about the current situation of CAE. We would like to implement the topics discussed in the section meetings in our future development plans.

If you did not get a chance to attend the section meetings this year, by all means take the chance next year!

Your comments determine the direction of JMAG's development.



Exhibitions

This year 22 companies exhibited, including material manufacturers who have technical exchanges with JMAG.

The exhibition hall doubled as the lunch hall, so attendees would often talk with exhibitors while eating lunch with one hand. Companies who held exhibitions also gave presentations during the technical exchange sessions.

At the JMAG booth we had a pre-release introduction of JMAG-Designer Ver. 11, as well as meetings to give those who wanted to transition to JMAG-Designer an opportunity to consult with us.

Those who attended the presentations and stopped by the booth commented that they were glad to have been able to get such productive information, saying, "It was great to hear examples of coupled analysis with JMAG," and, "I got to consult with them about test production."

We would like to take this opportunity to thank all of those who presented.



Simulation Park and technical support meetings

Continuing from last year, we planned a hands-on program aimed at those who were either not very familiar with or who had just started handling simulation.

Hokkaido University was kind enough to prepare a 3D display for us, making it possible to view magnetic flux lines in three dimensions without using a special tool.

Niihama National College of Technology also prepared a real-time electromagnetic field visualization system and did an exposition on how to understand it intuitively. Additionally, attendees were able to come into contact with electromagnetic field simulations while experiencing things like J-introductions to FEM's principles.

We held technical support meetings in front of the Simulation Park to give attendees a chance to talk directly with JMAG engineers about their daily problems and how to resolve technical challenges, and it turned out to be so popular that for a time people had to line up.

Attendees said that they wanted more time and that they wanted to consult with our engineers even if it meant missing a presentation, so next year we plan to make it a chance to resolve the concerns of even more of our customers.

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

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

We are looking forward to seeing everyone at next year's Users Conference!



Event Information

Event Report 2

JMAG is taking part in events, both in Japan and overseas. Have a look at JMAG's activity.

SMMA Fall Technical Conference

Conference Outline

Host : SMMA - The Motor & Motion Association

Dates : Tuesday November 8 - Thursday November 10, 2011

Venue: Renaissance Charlotte Suites Hotel (America)

Powersys Solutions, JMAG's overseas distributor, put on an exhibition at the SMMA Fall Technical Conference.

At the exhibition booth, we introduced JMAG's functions and presented case examples and demonstrations.

NIDays 2011

Conference Outline

Host : National Instruments Japan Corporation

Dates : Thursday December 1, 2011

Venue: Tokyo Conference Center – Shinagawa

URL : <http://www.ni.com/nidays/>

At NIDays 2011 (at Shinagawa), JMAG's own Hiroyuki Sano gave a presentation titled, "Using JMAG Models to Realize Highly Accurate Motor HIL Systems." We also carried out demonstrations while introducing functions and case examples at the JMAG exhibition booth in front of the meeting hall.

CDAJ CAE Solution Conference2011

Conference Outline

Host : CD-adapco JAPAN Co., LTD

Dates : Monday December 12, 2011

Venue: Pan Pacific Yokohama Bay Hotel Tokyu

URL : <http://www.cdaj.co.jp/ccsc2011/index.html> (This URL is provided only in Japanese)

At the CDAJ CAE Solution Conference 2011 (in Yokohama), we gave a presentation titled, "Magnetic Circuit Design Using JMAG, an Electromagnetic Field Analysis Software." We also carried out demonstrations of coupling JMAG and modeFRONTIER while introducing functions and case examples at the JMAG exhibition booth.

(Tomomi Igarashi)

