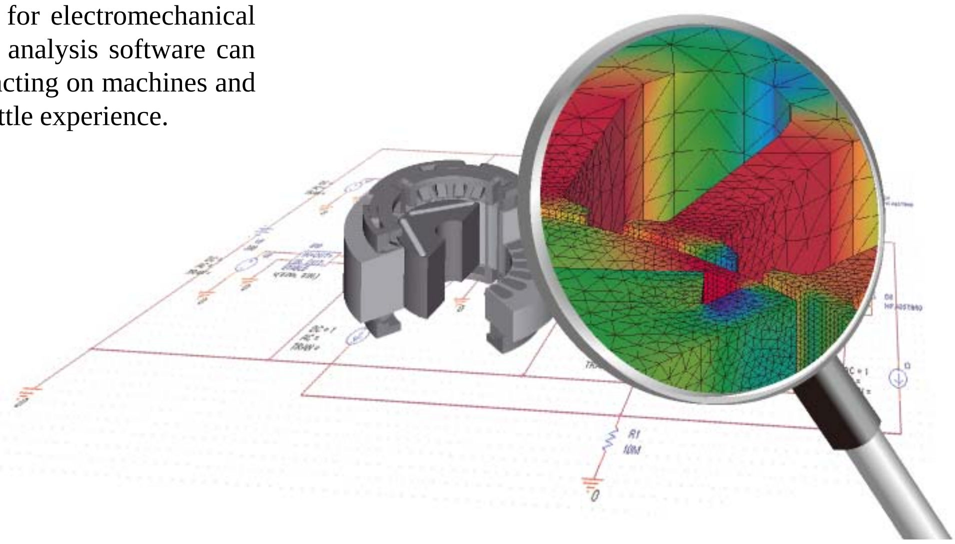
JMAG News Letter

July, 2010

JMAG is a comprehensive software suite for electromechanical design and development. This high speed analysis software can capture the complex physical phenomena acting on machines and obtain highly accurate results easily with little experience.



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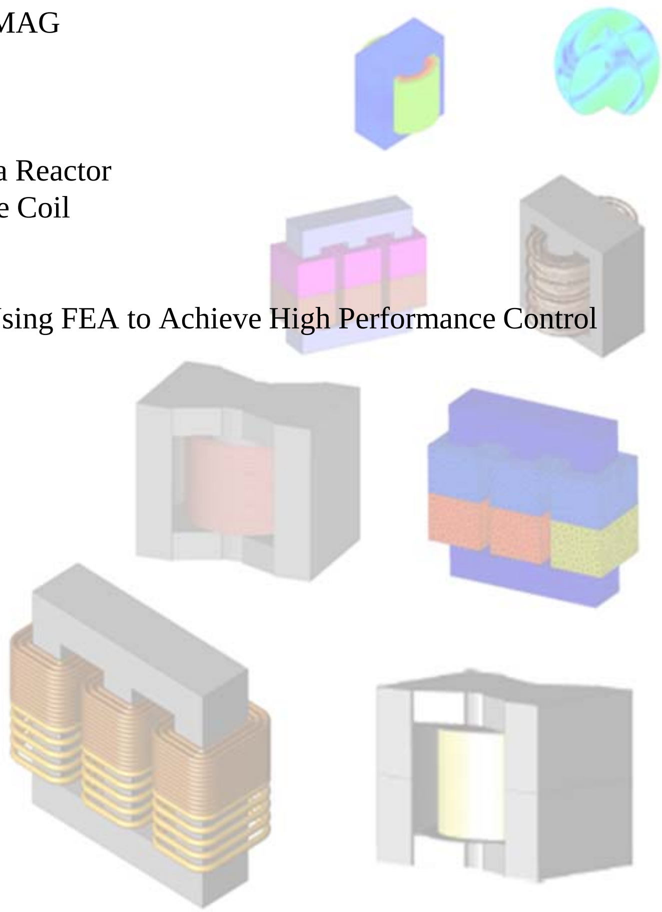

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JMAG News Letter　July Edition

This edition of the JMAG News Letter features transformer solutions. JMAG is well known for supporting motor design, but many of our users are also using JMAG for transformer design. Each year the functions are being further enhanced.

The first article is an interview with the Cosel Co., Ltd. who holds a leading market share in the industry. Cosel fully utilizes simulations to meet the demands for low noise switching power sources that have a high power density. This interview candidly discusses implementing JMAG as well as the process used to reduce the number of prototypes that are required.

The Technical Report introduces the design concept and effectiveness of the "transformer study" debuting in JMAG version 10. This "transformer study" utilizes an interface necessary for designing/analyzing transformers and makes creating geometry of complicated coil wires in addition to specifying the conditions easy. Transformer designers who are unfamiliar with CAE simulations can perform highly accurate analysis right after JMAG is implemented, which is described in more detail in the Technical Report.

The cost of the time required to perform settings and get the knowledge required to perform highly accurate analyses is said to be higher than the cost of the software itself. The “transformer study” is a product that confronts this issue with simulation software head on. You can experience the ease of operation in JMAG-Designer version 10.3 released this month.

This edition of the news letter is packed with information. We hope you enjoy it.

Transformer Design Achieving an Efficient Design Process

- **Cosel Co., Ltd. Interview**
- **Introductions to Analysis Examples**
- **Seminar Information**

What is Transformer Design?

- The JMAG solution for taking into account complex phenomena while providing an efficient design process.

- Reduce prototypes by examining the design requirements such as efficiency and leakage inductance in advance.

- Visualize complex physical phenomena such as current distribution of wires and magnetic flux leakage into the air

- Provides more efficient daily operations by performing designs and evaluations in a single system.

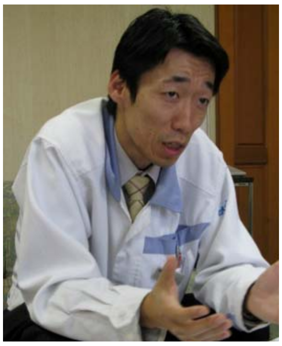
* For more information about transformer design in JMAG, see http://www.jmag-international.com/solutions/transformerdesign.html

* For more information about seminars, see http://www.jmag-international.com/event/index.html

Implementing JMAG

COSEL CO., LTD.

Comparing and Examining the Variability of Regulated DC Power Supplies via Simulation



Masahiro Shima
Group Leader
OS Design Dept.
Cosel Co., Ltd.

Cosel Co., Ltd. is one of the leading market shareholders of high quality/miniaturized switching power source devices (regulated DC power sources), DC-DC converters, and noise filters for EMC. Cosel often manufactures their own specialized transformers vital to power supply modules by optimizing the geometry of cores and the structure of windings.

Masahiro Shima, Group Leader of the OS Design Dept. in charge of comparing and examining the variability of design specifications for DC-DC converters using magnetic field analysis simulations discusses why he decided to implement JMAG and how they are using it.

Satisfying the Demands for Small DC-DC Converters with a Higher Power Density

What kind of products do you develop at Cosel?

Mr. Shima We handle regulated DC power supplies. The power produced by electric generation plants is distributed through utility poles to switchboards for residents and factories as an AC power source. A stabilized DC power supply is a device required to create voltage by converting the alternating power source to a direct current to use in electric circuits. Regulated DC power supplies can be separated into two large categories: unit type power supplies and on-board type power supplies. A unit type power supply is a type of power supply that can be added directly onto our customers products, such as industrial robots or vending machines. An on-board type power supply is a small power source that can be attached to our customers printed circuit boards, similar to other components. We also handle noise filters. Problems steaming from noise produced by devices or around devices is becoming more apparent as products get smaller and smaller. Noise filters are now an indispensable part of electric devices because of the malfunctions and reduction in communication speed cause by the noise.

What is important to meet the needs of your customers?

Mr. Shima Our customers require low-noise switching power sources with a high power density. However, heat becomes a problem as products are miniaturized. The losses inside of our products needs to be reduced to deal with the heat that is generated.

Increasing the reliability of our products with our technological strengths to reduce the heat generated internally as well as increasing the temperature range is vital to satisfying the needs of our customers.

What type of responsibilities do you have at Consel?

Mr. Shima In the OS Design Dept. were I work, we develop standard on-board type power supplies, examine new types of circuits, and create designs for smaller transformers. The on-board power supplies we are currently developing is a DC-DC converter. The Output power is 10 to 30 W. Designs are assigned to one of the engineers in each section. My responsibility as a group leader is to unify our engineers proceeding with the total development of the product while discussing the development with the design engineer in charge. The requirements for miniaturization and a high power density are requested by our customers. However, these products cannot be miniaturized without constantly worrying about costs unless the development is undertaken as a whole. My group is also responsible for developing transformers. We are especially focused on the miniaturization of transformers because transformers have the largest exterior dimensions of the products we handle. Transformers are one of the main sources of heat in DC-DC converters. The switching components also generate a large amount of heat requiring us to examine how to arrange the heat sources in a miniaturized product. Designs have to balance the power loss and heat dissipation because the losses will increase if the arrangement of the heat sources is too far apart to account for the dissipation of heat. Therefore, we optimize the arrangement of the heat sources by running a circuit and thermal simulation.

Comparing and Examining the Variations of Products Using JMAG

Why did you decide to implement JMAG?

Mr. Shima We started looking into implementing 3D simulations to resolve quality control problems we were having with transformers. The inductance characteristics of transformers differs largely causing problems with the performance of the entire product. We had been using a 2D analysis software before implementing JMAG, but we couldn't rely on the analysis because the depth of transformers is not uniform and 2D analysis software cannot analyze complex structures. We tried and benchmarked three types of 3D simulation analysis software. We chose JMAG because of the speed of the analysis and the results, such as the current distribution, could be visualized to make them easier to evaluate.

In what stage of design do you use JMAG?

Mr. Shima We use JMAG to evaluate the design specifications before building a prototype. We compare different designs before deciding on the geometry, but the characteristics often differed because of aspects or unexpected problems that cannot be fully judged using a sample prototype. Simulations can reproduce and visualize phenomena we hadn't been able to fully capture allowing us to focus on the desired phenomena. Simulations are advantageous because we can comparatively evaluate the product to improve their designs without building a prototype.

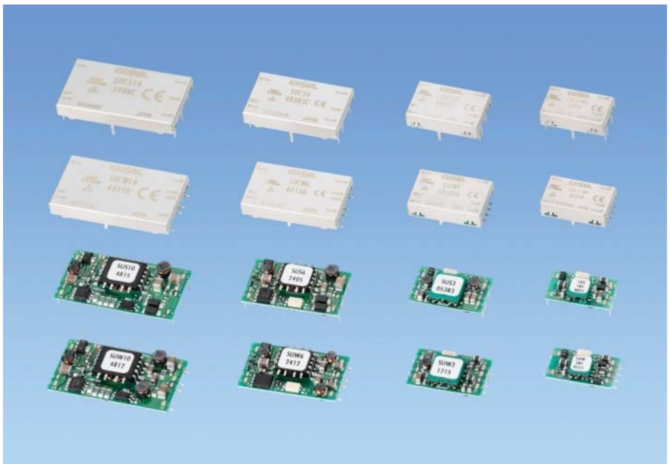
How are you utilizing JMAG?

Mr. Shima When we first implemented JMAG, we examined what would happen to the characteristics of existing products if we changed their geometry. Now we use JMAG to examine the inductance and leakage inductance of transformers as well as the magnetic saturation when developing new products. The extent of our analyses has also increased since we first implemented JMAG. Our designs have improved because we can determine the geometry of the transformers while calculating the Joule loss for the entire design of our DC-DC converters.

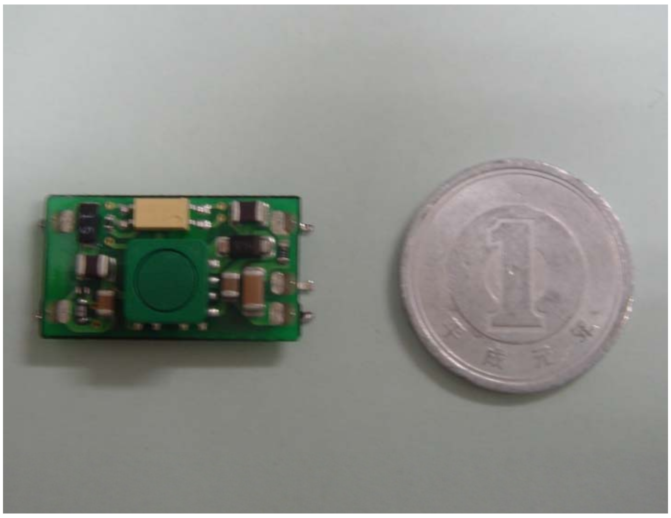
At what stage do you consider the variations and quality of products?

Mr. Shima We look at the variations after the design has been generally defined. There is a lot of trial and error used to determine the configuration of a product, but once the design is complete we put the product's variability to the test. The standard flow of our development is: 1) determine the design through trial and error of the geometry and materials to satisfy the requirements at the design development stage; 2) examine the variations and quality of the product by trying to increase the yield ratio before beginning production; 3) rework the design to achieve the most robust product by refining the geometry based on the results from 2.

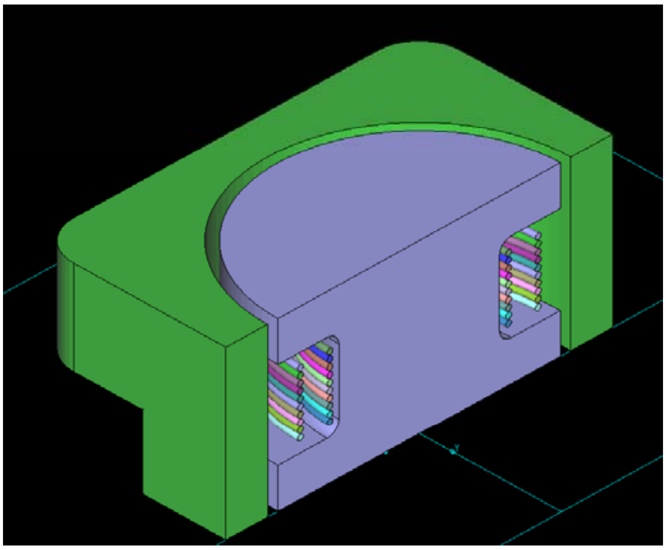
We have to stop at a certain stage and consider the variations, otherwise, the time required for analysis would be overwhelming.



On-board Type Power Supplies from Cosel Co., Ltd. (SU Series)



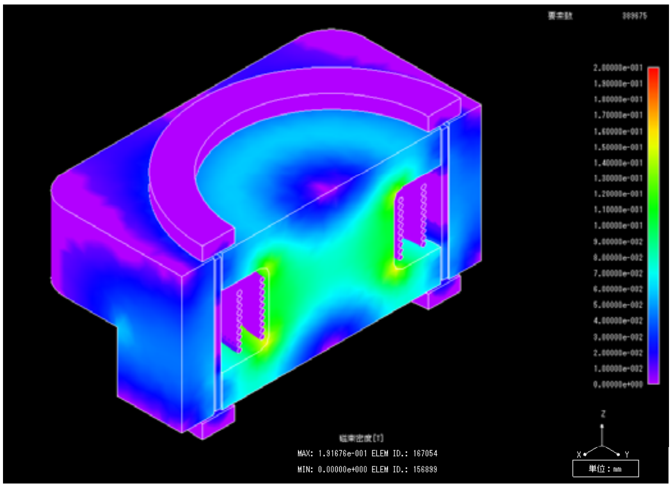
Product Developed by Masahiro Shima (SU1R5 model)



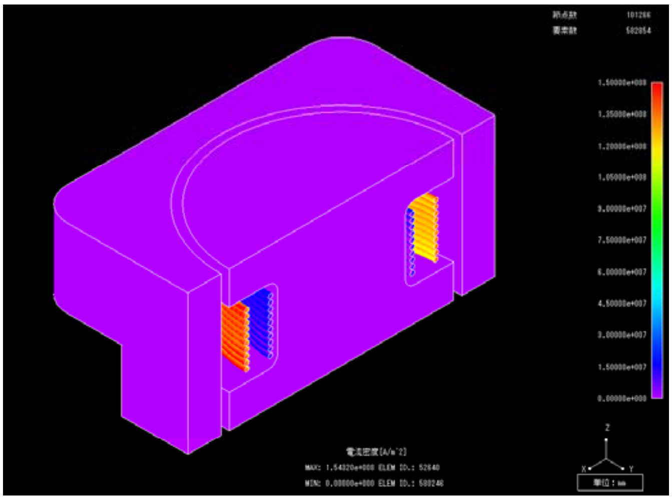
3D Half Model

Did you change the way you use prototypes?

Mr. Shima Cosel usually has a year to a year and a half to develop a product series, depending on the model. Conventionally, we would build 3 or 4 prototypes to finalize the geometry. Often multiple prototypes need to be made for transformers because of problems with the core and bobbin, but we only had to build a single prototype for models we have been developing recently. Even from a cost perspective, simulations are contributing greatly because 4 or 5 prototypes had been required for one series of on-board power supplies. Building the core for a single prototype, depending on the dimensions, can costs several 100 thousand yen. We just have to assemble the prototype once the design is complete. Although this is not too laborious, it still takes three weeks to a month to build a single prototype which means that our only option for reducing the time required is to decrease the number of prototypes. These are the greatest benefits in my opinion.



Magnetic Flux Density Distribution



Joule Loss Density Distribution

Sharing Design Knowledge and Establishing New Technology

How do you share design knowledge and analysis results?

Mr. Shima We have a knowledge base that we use to register what we are developing at Cosel Co., Ltd and the methods used to resolve problems that occur with designs. Anyone requiring information at our company can browse design methods and problem countermeasures once the technological information is registered in the system. In addition, the engineers heading each division gather to present their findings. I have presented simulation analysis using JMAG several times. As far as I am aware, there are 5 or 6 other engineers that are currently using JMAG. Designers from other divisions often start using JMAG after seeing the contents and the analysis results I have used for my presentations registered in the knowledge base. Using JMAG is generally learned on the job, but many of our engineers start by coming to ask me about JMAG.

This is a little off the subject of computer aided engineering, but Cosel has a research technology department. They investigate new technologies that could be used in products developed in 5 or 10 years, such as new types of circuits, and then actively present their findings to academia.

Is there a link between educational institutions and public institutions?

Mr. Shima Several examples of institutions we have partnered with for research are the University of Toyama, Toyama Prefectural University, Toyama National College of Technology, and the Toyama Industrial Technology Center. Usually, we go to the an educational or public institution with a challenging problem we have, and then work with them to find a solution. These institutions have access to simulation software we don't currently have at our company to perform structural analysis that can evaluate vibrations and impacts.

Simulation Accuracy of the Design Tool JMAG

What are some of the benefits of using JMAG?

Mr. Shima One of the greatest benefits is that the results from the prototype and simulation match. One of the largest hurdles is achieving the accuracy required of simulations, and not just in the field of magnetic field analysis. I have never had a large margin of error between the actual results and analysis results using JMAG. The results that we are after usually have less than a 10% difference, sometimes less than a 5% difference, depending on the product we are investigating. We reviewed several different software packages that we could potentially use, but we decided to implement JMAG because the results we obtained were the closest to the actual measurements taken from the prototype.

You have acquired quite a bit of knowledge about modeling. How long did it take you to become accustomed to using JMAG?

Mr. Shima I started by trying to find the appropriate modeling for the physical aspects I wanted to obtain. The next thing I knew, I had gained enough modeling know-how to obtain highly accurate analysis results. It took between 3 and 6 months before we were actually using JMAG as a design tool. I am satisfied to a certain degree with the knowledge that I now have, although, that doesn't mean I still don't have a lot to learn. (Mr. Shima laughs)

What position does simulation technology hold in the design process at Cosel?

Mr. Shima As I said before, simulation technology is extremely vital to reducing the number of prototypes and improving the speed and efficiency of development under strict development schedules that demand a lot of trial and error to reach the final product. We are expanding the range we use JMAG, not just for electromagnetic field analysis, but also for other types of analysis. The chance for more and more companies that are not currently implementing simulation software to realize the benefits and impact simulations have from a prototype cost perspective will continue to grow.

What are your expectations for simulation analysis in the future?

Mr. Shima I want to know the results and effectiveness of a product without having to build prototypes. For example, simulations allow me to examine whether the characteristics are improved or worsened by changing the geometry of a design. Being able to examine the variability is also important. I can calculate how much the characteristics differ from the variability that we predicted. Examining the geometry to account for the variability by creating a model is very difficult. Parametric analysis allows me to change the geometry and see what happens. I would like to see simulation analysis tools that are easier to use to compare products and examine their variations in the future.

Compact DC-DC Converters (DHS Series)

COSEL

Corporate Name	Cosel Co., Ltd.
Established	July 26, 1969
Capital	2.055 million Yen (as of May, 2009)
Employees	418 (as of May, 2009)
Annual Sales	16,253 million Yen (as of May, 2009)
President	Toshimichi Machino

Business Overview

Cosel Co., Ltd. develops, manufactures, and sells regulated DC power supplies which are at the heart of electronic equipment such as computers. Cosel Co., Ltd.'s headquarters is located in Toyama Prefecture where they focus their manufacturing capabilities and continue to increase the standard of switching power supply products.

http://www.cosel.co.jp/

Analyzing Transformers Using JMAG

Leaps of Innovation in Transformer Design

- Contributing to Transformer Design using JMAG-Designer -

This edition of the Technical Report describes how the transformer analysis feature built into JMAG-Designer contributes to the design and development of transformers.

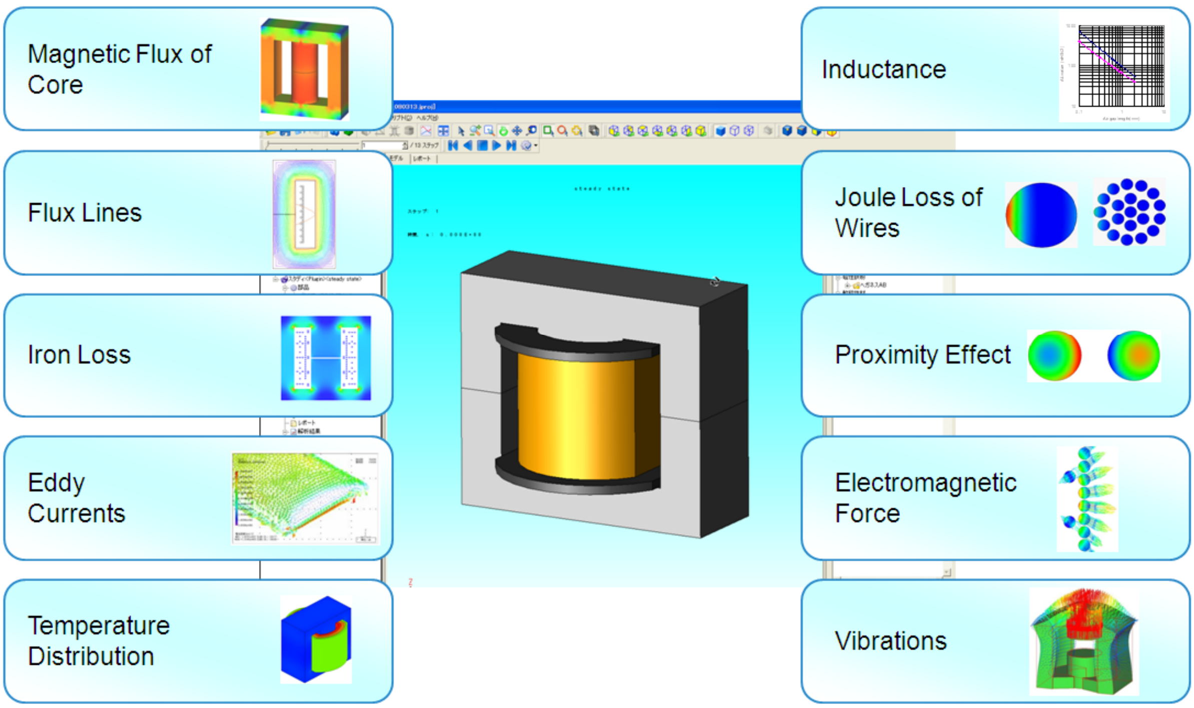
●Overview

Transformers are composed of only a few parts that have simple comparative operating principles. CAE simulation was deemed unnecessary for transformer design because transformers can continue to advance consistently using conventional design experience and their prototypes are seen as simple devices. However, the requirements for transformers in recent years are becoming stricter following the demands of other devices so that now a leap of innovation is required rather than conventional upgrades.

CAE simulations are starting to be sought out as a solution to the increasing demands of transformer design. The transformer analysis feature built into JMAG-Designer has been specifically developed to vastly assists transformer design. This edition of the Technical Report describes how the transformer analysis feature built into JMAG-Designer contributes to the design and development of transformers.

● Present Requirements of Transformers

Cellular phones today are full of features from the basic wireless calls and sending and receiving of text messages that are considered such basic features they don't provide any added value to still and motion cameras, televisions, and music players. A stable and steady power supply appropriate for these devices is necessary for them to function correctly causing the focus of transformers and inductors, which are key parts of the power supply, to increase dramatically. The stricter demands of transformers as well as other devices is peaking interest in applications of CAE simulation technology.



http://www.jmag-international.com/solutions/transformerdesign.html

Analyzing Transformers Using JMAG

(1) Small and Light

Using cellular phones as an example, transformers and inductors are required to handle a larger capacity to realize the improved performance and functionality while maintaining the size and weight allowed by new models. In other words, miniaturization is required while still demanding a higher capacity. There are also times when the potential geometry of each part is limited to optimize the entire product. The manufacturing must also be considered to realize lower costs. These types of restrictions cannot be overcome using conventional design methods. Design engineers need to be able to find the optimal solutions considering the various trade offs in a short period of time. CAE simulations can support engineers in accomplishing this goal.

(2) Higher Efficiency

Electric devices usually require higher efficiency. Losses increase temperature which causes the operation time of devices using batteries to shorten. The areas producing the loss need to be found and resolved. CAE simulations are advantageous in allowing engineers to accurately examine the losses that occur. Furthermore, CAE simulations are a necessary optimization tool when balancing the trade offs between requirements for higher efficiency and miniaturization.

(3) Higher Frequencies

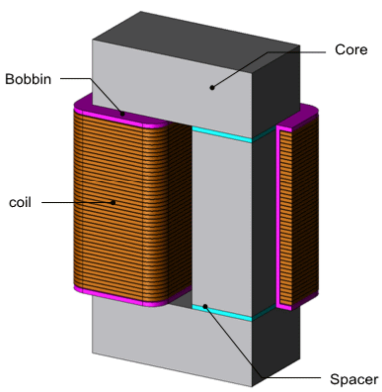
High frequency switching is evolving to provide smaller power supply systems. As the frequency of switching increases, the proximity and skin effects caused by electromagnetic induction have to be taken into account. The leakage inductance and losses are largely affected by these phenomena, but they are too difficult to calculate by hand. This means designs cannot be evaluated until a prototype is built. However, the proximity and skin effects caused by higher frequencies can be included in the evaluation of designs by performing an accurate CAE simulation.

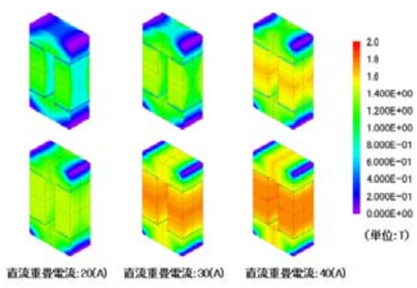
(4) Shorter Development Schedules

The stress of the development process itself is increasing. The amount of time to investigate designs is dramatically decreasing as development periods shrink. Designers have to support more manufacturing of various models in small quantities, which is not only limited to transformers. There is no longer enough time in the development schedule to implement phases to create and investigate prototypes, and then reevaluate the design when problems occur. In addition, creating prototypes composed of tiny parts is also difficult. Various problems of designs can be discovered before the actual prototype is built by using CAE simulations.

● Challenges of Applying CAE Simulations to Transformer Design

CAE simulations have many advantages and they are used in a wide variety of technological fields. However, many people worry about whether they will be able to adjust to the software feeling they require an analysis specialist or the knowledge and experience necessary to improve accuracy. Companies who want to use CEA simulations but have no prior experience are especially hesitant to take the first step because they feel there is no way to receive support from simulation specialists in another fields of design. Every user also wants the return on their investment of software to start the moment it is implemented. The transformer analysis feature of JMAG described in this Technical Report is capable of accurate simulations that have been designed to reassure those who decide to implement JMAG.





Magnetic Flux Density Distribution

Analyzing Transformers Using JMAG

● Transformer Analysis Feature of JMAG

(1) Design Concept

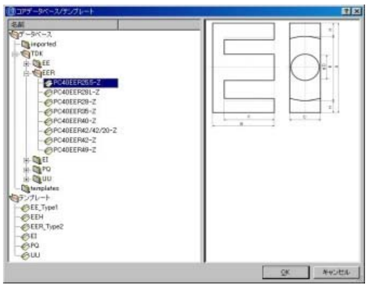
JMAG's transformer analysis is a specialized magnetic field analysis for evaluating transformers and inductors. The procedures necessary to perform an analysis from creating the model to evaluating the analysis results have been dramatically simplified by limiting the analysis target to transformers based on the reputable features of JMAG's magnetic field analysis. The geometry and conditions that can quickly become complicated can now be created and specified with ease. Transformer designers who are unfamiliar with CAE simulations can perform highly accurate analysis right after JMAG is implemented by using JMAG's transformer analysis.

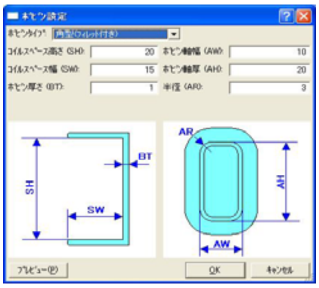
(2) Creating Geometry

JMAG's transformer analysis has geometry templates of transformers and inductors that are often used. The model geometry can be created by simply specifying the dimensions. Geometry from the TDK core catalog is built into the database so that our users can model core geometry simply by selecting what they need. The bobbin geometry and the coil arrangement are also specified easily using templates. Users that want to investigate core geometries with characteristics that cannot be expressed by the existing templates can use features for importing CAD models.

(3) Specifying Conditions

The condition settings have also been dramatically simplified by limiting the analysis target to transformers which differs from standard magnetic field analyses. The settings fundamental to a transformer analysis such as the boundary conditions for partial models and the full model conversion are specified automatically by the solver when the geometry is created. This allows users to execute an analysis using a bare minimum of settings.





Core Template Database and Bobbin Settings

(4) Material Database

The key to analysis accuracy depends on whether an analysis is run using the right material properties. An analysis performed with the most detailed model will not obtain accurate results if the wrong material properties are used. Catalog data from TDK, JFE, and Hitachi Metals are included in the material database built into JMAG offering ferrite that is often used for high frequency transformers. Catalog data from Sumitomo Metals, Nippon Steel, JFE, and China Steel are also included for the material properties of magnetic steel so that analysis accounting for nonlinear characteristics of the material properties can be performed. In addition, material properties for iron loss characteristics and stress dependency for each manufacturer are included in addition to the BH curves to increase the analysis accuracy. The material properties can be set just like conditions by simply selecting a material from the material database and dragging and dropping the material on the model in the graphics window.

(5) Analysis Solver

The flux lines for losses caused by the proximity and skin effects of the coil are a vital aspect of the transformer analysis. Therefore, a specialized analysis function for the coil has been developed and implemented. This innovation allows an analysis to account for effects of litz wire swiftly, which was very difficult to include up until now.

(6) Post-processing

The fundamental characteristics of transformers such as inductance, Joule loss, amount of flux linkage of the coil, and direct current resistance of the coil can be displayed using both graphs and tables. The amount of distribution, such as the magnetic flux density distribution and Joule loss density distribution can be displayed using contour and vector plots. Transformer designs can be evaluated to see whether the design is working as intended by examining the analysis results using JMAG's rich post-processing functions.

Analyzing Transformers Using JMAG

(7) Other JMAG Features and Coupled Analysis

The results obtained from a transformer analysis can be easily used to implemented coupled analysis with the thermal analysis solver and structural analysis solver available in JMAG. Loss distributions caused by copper loss accounting for the high frequency current distribution of the coil as well as iron loss that has varying degrees of magnetic flux distribution in the core can be captured accurately. A thermal analysis that accounts for the effects of heat dissipation can be performed in addition to obtaining vibration and noise using a structural analysis that accounts for the electromagnetic force produced in each part. JMAG is simple when performing multiphysics analyses encompassing the complicated physical phenomena that makes CAE simulations superior.

(8) CAE Benefits the Design Process

Implementing CAE simulation into the design process benefits the design process itself. The modeling process for CAE means the designer once again considers and makes decisions about design specifications for the simulation. The same process is accomplished when creating the plans and specifications, but creating the simulation model requires that designers make decisions based on more information. When designs are performed by creating plans and specifications, a vastly experienced engineer has to review the plans and specifications for designs, or they need to be examined using the actual prototype to determine if there are any inconsistencies. Therefore, the pros and cons of designs cannot be determine when the plans and specifications are created.

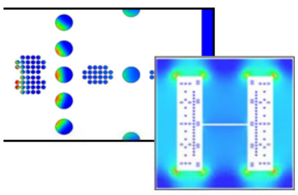
However, designers can have a opportunity to more thoroughly investigate their designs by implementing CAE simulations into the design process. This results in a higher quality output that greatly benefits designers.

Designers Accumulate Experience

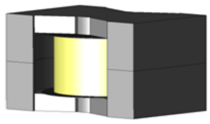
The trail and errors undertaken by veterans can be experienced first hand at a low cost because the evaluation process can be performed quickly and high risk ideas can be attempted without the fear of failure.

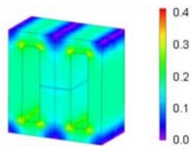
Flush Out the Pros and Cons of a Design

Designs can be intuitively understood from their strengths to the causes of problems and areas requiring reevaluated because phenomena that can't be evaluated using a prototype, such as magnetic flux density and the flow of magnetic flux, can be obtained in CAE simulations.

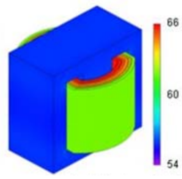


Iron Loss Distribution





Magnetic Flux Density



Heat Generation Distribution

A license for the transformer analysis and solver is required with the basic JMAG set to start using the JMAG transformer analysis function. The frequency response magnetic field analysis solver or the transient response magnetic field analysis solver, or both of these solvers can be implemented as necessary.

If you are interested in knowing more about the transformer analysis, please contact your local sales representative.

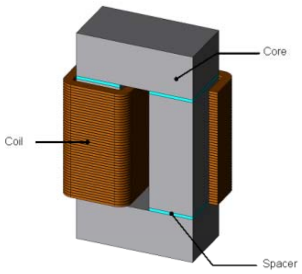
JMAG Application Catalog

The Application Notes guide users inexperienced in analysis software or experienced users that want to explore new fields of simulations through a smooth simulation process.

In this issue of the JMAG News Letter, two of our newest examples are highlighted; "Sound Pressure Analysis of a Transformer," and "Thermal Analysis of a Choke Coil."

Sound Pressure Analysis of a Reactor

Reactors are used in a variety of electric power system. An important concern for reactors is the noise caused by resonance phenomena of the electromagnetic force and eigenfrequency.
The sound pressure can be evaluated with a structural analysis using the electromagnetic forces obtained from magnetic field analysis as the excitation force.
This note presents how sound pressure from a vibrating reactor can be obtained when a structural spacer is removed.



Electromagnetic Force Distribution

Figure 1 shows the distribution of the electromagnetic forces. Since the material of the spacer is a non-magnetic material, the magnetic circuit does not change regardless of spacer removal, so electromagnetic force distributions will be the same whether the spacer is removed or not.
Figure 1 shows that the electromagnetic force is concentrated in the gap. This is due to the difference in the permeability of the core material and the spacer.

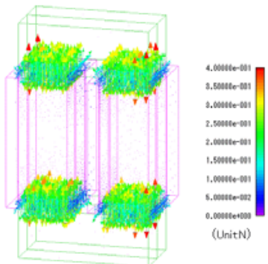


Figure 1 Electromagnetic Force Distribution

Eigenmode

Figure 2 shows the eigenmode at the frequency approximately 20 kHz. When the spacer is removed, the structural symmetry of the sides is corrupted, and this leadds to deformation at the top of the reactor. Since the electromagnetic force is concentrated in the gap, sound pressure and vibration are expected to increase by a removal of the spacer.

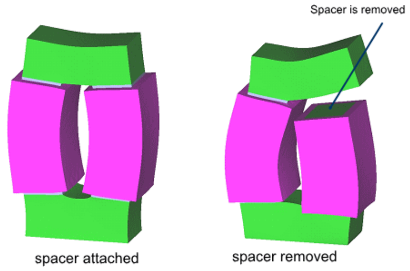


Figure 2 Eigenmode around 20 kHz

Acceleration Distribution

Figure 3 shows the distribution of the acceleration. Since the electromagnetic force distribution does not change by the removal of the spacer, the difference in the eigenmode must be the cause of the difference in the acceleration distribution. The removal of the spacer increases the acceleration, and particularly the vibration increases near the gap.

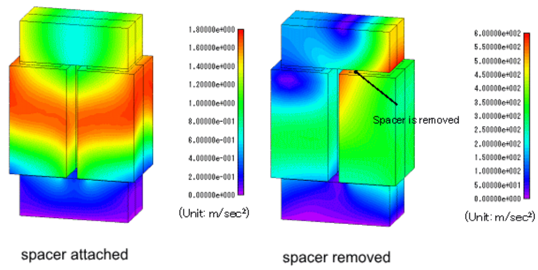


Figure 3 Acceleration Distribution

Sound Pressure Distribution

The distribution of sound pressure is shown in the Figure 4. Removal of the spacer has a large effect on the sound pressure distribution. If all of the spacers are in place, the core material vibrates up and down. If one spacer is removed, vibration takes place in the gap in the direction longitudinal to the core, and hence the distribution is dispersed. The sound pressure level is high without the spacer due to the larger vibration.

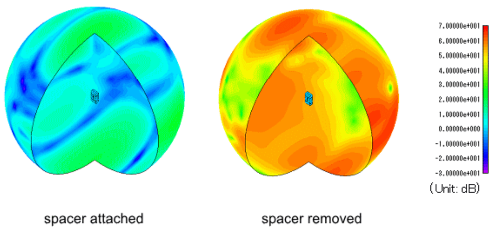


Figure 4 Sound Pressure

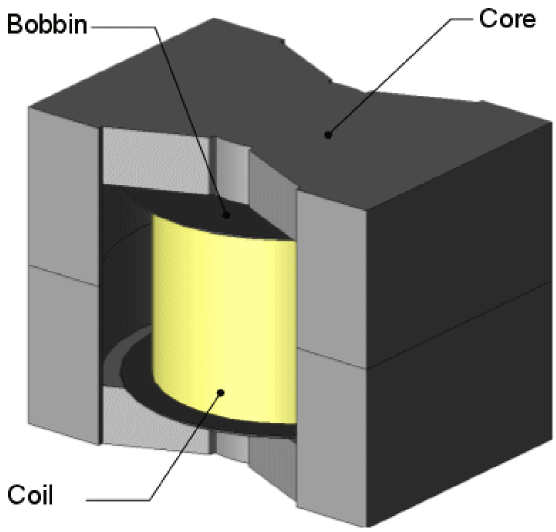
JMAG Application Catalog

Thermal Analysis of a Choke Coil

A choke coil is an electronic component use to prevent currents that exceed the predetermined frequency. The heat generated by the iron losses of the core and the copper losses of the coil inside the choke coil need to be evaluated because of problems that can occur in the choke coil.

The loss distribution obtained with a magnetic field analysis can be used as the heat source for a thermal analysis in JMAG-Designer.

This example presents the use of a thermal and magnetic field analysis to obtain the temperature distribution using the iron losses and copper losses in the choke coil as the heat source.



Inductance of One-phase and d/q-axis Inductance

The heat generation density distribution of the core is indicated in Fig. 1, and the temperature distribution and maximum temperature of the core and coil are indicated in Fig. 2.

The heat generation density is higher on the inside corners of the core as indicated in Fig. 1. The iron losses that generate the heat are caused by the flow of magnet flux concentrating on the shortest path through the magnetic circuit. Furthermore, the temperature inside the coils is hotter than the temperature of the core as indicated in Fig. 2 (b). The heat from the coil transferred to the core cause the core around the coil to be hotter than the rest of the core as indicated in Fig. 2 (a).

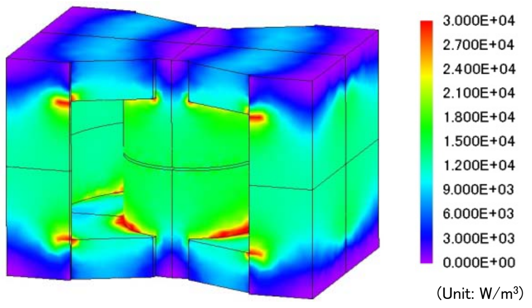
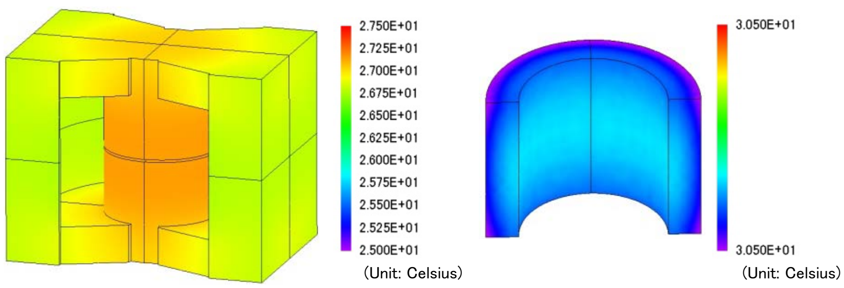


Fig. 1. Heat generation density distribution



(a) Core

(b) Coil

Fig. 2. Temperature distribution

Advanced AC Drive Designs Using FEA to Achieve High Performance Control

http://www.jmag-international.com/event/2010/AC/

Free

Learn how to overcome challenges in improving the accuracy of AC machine drive designs, including sensor-less drives. This course will show you how to use finite element analysis to gain deeper insight into the induced voltage and inductance required to obtain the rotation position. You will discover how to achieve the most efficient motor drive systems, with a better understanding of the physical aspects that range from current and voltage to rotation angle.

"Advanced AC Drive Designs Using FEA to Achieve High Performance Control"is a free seminar that will provide you with a foundation in finite element analysis for the control of AC drives

■Course Schedule

1st session: August 16

13:00 Session Begins

- **13:00-14:00 Challenges of Drive Designs for AC Machines**
  Comprehensive analysis of the control designs for AC drive critical to achieve high performance
- **14:00-14:30 Combining SILS/HILS with FEA;**
  Leading-edge development methods capable of combining Software in the Loop (SILS) that utilizes motor models for inverter and control design/Hardware in the Loop (HILS) that evaluates the control utilizing motor models and inverters with the powerful insight of finite element analysis (FEA).
- **14:30-15:00 Understanding Complex Phenomena**
  Optimize and investigate motor drive systems based on real motor characteristics obtained with JMAG-RT.
- **15:00-16:00 Examples by Application**
  Create equivalent circuits for induction machines, PM motors, and more to incorporate complex phenomena from inductance (saliency) to iron losses, heat generation, and noise.

16:00 Session Ends

2nd session: August 16

16:30 Session Begins

- **16:30-17:30(Workshop) Hands-on Training Using the Motor Design Tool JMAG-Express**
  Create a motor model capable of linking to SILS and HILS that accounts for complex motor characteristics. This session allows each participant to install JMAG-Express on their own PC and perform simulations to encompass the LdLq characteristics of motors into motor models.
- **17:30-19:00 Reception for Participants**
  A reception will be hosted providing a venue for what we hope will be an invaluable technical exchange of information.

19:00 Session Ends

* The contents of the program are subject to change without notice.

■ Event Overview and Introduction

Dates: August 16, 2010
Venue: Madison Concourse Hotel - Wisconsin
1 West Dayton Street · Madison, Wisconsin

Contact Yusaku Suzuki JSOL Corporation
E:mail : event@sci.jsol.co.jp