2021 JMAG & PSIM Users Conference

Virtual Edition

Sep. 27 to Oct. 1, 2021

Conference program

PSIM

powersys
Solutions for Electrification

JMAG
Simulation Technology for Electromechanical Design

September 27th, 2021

All session times are listed below in Central European Summer Time (CEST).

9.30 AM – 10.00 AM: Welcome Note/ Powersys Presentation **Dr Takashi Yamada**, JSOL & **Vincent Capron**, Powersys

General

10.00 AM- 11.00 AM: Development planning of JMAG
Dr Takashi Yamada, JSOL Corporation Session time has changed!

General

JMAG is constantly being worked on to achieve highly accurate and high-speed simulation. JSOL would like to share our progress from the past year including parallel solvers to accelerate speed as well as GUI improvements aiming for increased productivity of analysis workflow. Analysis technologies we are currently focusing on and our plans for incorporation will also be covered in this presentation. Design exploration is an important topic this year. This presentation will detail the present and future of JMAG.

11.00 AM- 12.00 PM: Traction Motor Design and Optimization for E-mobility Applications Session time has changed!
Shafigh Nategh and Bharadwaj Raghuraman, Volvo Cars

Keynote

This presentation demonstrates the study carried out on different permanent magnet motor topologies that can be used in e-mobility applications. Considering the environmental effects of rare earth elements used in permanent magnet materials, focus in this presentation is placed on the solutions with less rare earth element magnets. Additionally, challenges in using non rare earth magnets in the rotor structure of permanent magnet motors are reviewed and discussed. The risk of demagnetization under short-circuit condition is considered as one of the main challenges in using non rare earth magnets that needs attention when designing the electric propulsion system. As shown in presentation, proper rotor design can significantly improve the risk of demagnetization allowing short-circuit in larger operation range. In addition, obtaining an acceptable level of performance and efficiency as using rare earth elements is possible to achieve. This has been enabled using advanced JMAG Optimization functions incorporating different design aspects into the optimization process.

12.00 PM- 12.45 PM: Effect of the Interaction of Different Manufacturing Imperfections on the Unbalanced Radial Forces in a Sub-Fractional HP Single-Phase BLDC Motor
Nejat Saed, Technical University of Graz

NVH

The increasing electrification of vehicles not only applies to the main drive systems, i.e., either replacing the combustion engine with electric machines or the parallel operation of both, but also to the less visible auxiliary drives, e.g., water pumps or LED-headlight fans. Remarkable advantages of single-phase BLDC motors over their brushed counterparts, such as higher power density and low cost, make them a suitable choice for such auxiliary drive applications. The overall noise reduction of auxiliary drives has also attracted increased attention recently, since the noise of auxiliary systems is no longer masked by the main drive systems, as in the case of conventional, combustion engine driven, cars.

Manufacturing imperfections, inevitable in mass-produced sub-fractional HP motors, generate a distorted magnetic flux density waveform and additional magnetic forces, known as unbalanced magnetic forces (UMFs), and may eventually cause noise and vibration. Dynamic and static eccentricity as well as non-uniform magnetization are known as the dominant sources of the UMFs. This study analyzes the effect of the interaction of these different types of manufacturing imperfections on the unbalanced radial forces, focusing particularly on their phase difference. It shows the wide range of resulting distributions of the magnetic force that significantly exceeds those of the single-effect analyses. This explains the widespread structure-borne noise observed with sub-fractional HP machines, also reflected in extensive experimental investigations. The analyses also explore how dynamic eccentricity can counteract non-uniform magnetization and vice versa.

---------- BREAK ----------

2.15 PM- 3.30 PM: Advanced Electric Drive Modelling with Temperature and NVH Adaptive Control Session time has changed!

Keynote

Mohamed Essam Ahmed, AVL

The rate of vehicle electrification has risen recently, which leads to the realization that the development of each component separately is not sufficient. The reason for this is that each component (electric machine, inverter, even cables and busbars) has a significant impact on the performance of each other, as well as on the whole system level.

The current state of art in permanent magnet drives mostly adopts a motor control where the calibration is either independent of e-machine operation temperature or dependent only on the e-machine winding temperature, which can lead to the loss of optimal control and performance due to magnet temperatures away from the nominal one. In addition, NVH aspects such as torque ripple or stator forces are commonly addressed at the e-machine layout design stage only.

In this contribution, an advanced modelling of a full electric drive system is presented. Finite Element Analysis (JMAG) is jointly used with model-based and system analysis (PSIM) to develop temperature- and NVH-dependent dynamic control, where the electric machine can be quantitively characterized in detail, and, therefore, the control ensures optimal performance.

• Benefits of such analysis:
• Optimization and improvement of an existing electric drive (potentially via the over-the-air updates)
• Early-stage multi-objective and multi-domain electric drive optimization
• Faster front-loading and better calibration for testing
• Magnets (e-machine) health monitoring
• Optimal electric drive performance even in temperature ranges away from the nominal.

3.30 PM- 4.15 PM: PSIM - Present and Future Development

General

Hua Jin, Powersim

In this talk, we will present new functions and features currently being developed that will be included in the upcoming release. They include new features in the Power Supply Design Suite and EMI Design Suite, with new design templates and function blocks for CLLLC resonant converters and EMI analysis for different EMI filter types and for 3-phase systems. In addition, a set of tools are developed for product design validation and optimization. They include Monte Carlo analysis, sensitivity analysis, fault analysis, and parametric optimization.
Also, the roadmap for future development plans will be discussed.

4.15 PM- 5.00 PM: Partial Power Converter (PPC) as an interface between DC microgrid and battery energy storage system

Power Supplies

Naser Hassanpour, Tallinn University of Technology

Conventional full power converters process all the power transferred between input and output. Therefore, they have higher power loss and lower efficiency. One of the most promising solutions to boost the converter efficiency is to create a direct path between input/output to deliver a higher percentage of power without being processed by the DC-DC converter. These types of DC-DC converters are called Partial Power Converters (PPC). In these converters, only a small share of power is being processed, which in our case is 27%. The result is having low power elements, a high power density converter, and reaching higher efficiencies. A PPC-type DC-DC converter is simulated in PSIM to validate the theoretical analysis

September 28th, 2021

9.50 AM – 10.20 AM: New Express delivery: High-end motor design tools

Ahmed Shoeb, Powersys

Model Based Development

A new interface specialized in motor design is now available. Designers can investigate design proposal using JMAG-Express. Modelling and calculation are performed by JMAG-Designer in accordance with input design parameters, and calculation results are displayed in JMAG-Express.

10.20 AM- 11.05 AM: Suppression of Torque Ripple for Consequent Pole PM Machine by Pole Shaping Method

Ji Qi, Sheffield University

Optimization / Modelling

Consequent pole (CP) permanent magnet (PM) machines have attracted considerable interest as a means of reducing machine cost through a marked reduction in the volume of permanent magnet required to meet a particular torque specification. However, the presence of a large torque ripple that can result from the CPPM structure can hinder their adoption in some applications, especially for the dominant third order torque ripple. Several design-specific modifications have been proposed to ameliorate torque ripple, but it is common practice to adopt similar PM and iron pole shapes, an approach which does not fully account for the different features between PM and iron poles in CPPM machines. Additionally, the generalized principles underpinning this behavior have not been fully established. Consequently, the effect of the different pole shapes on torque ripple will be analyzed and an asymmetric pole shaping method will be proposed to reduce the torque ripple.

11.05 AM- 11.50 AM: Calculation of Electromagnetic Forces in Centric And Eccentric Permanent Magnet Synchronous Reluctance Machines

Tahar Hamiti, Nidec PSA eMotors

Mesh modelling

For rotor dynamics analysis the knowledge of average value and harmonic content of the unbalanced magnetic pull (UMP), caused by rotor eccentricity, are required to be calculated with high accuracy. In so doing, the machine is simulated without any symmetry. The mesh accuracy and regularity are of prime importance to ensure the result is exempt of numerical errors first on a model without eccentricity before tackling the eccentric case. This work presents a case study of force calculation considering three methods: 1- integration of Maxwell stress tensor using airgap flux density components; 2-summation of teeth forces calculated directly from the post-processing module and 3-the lumped force on the rotor, also extracted directly from the post-processing module. Sensitivity study to the airgap mesh number of layers and circumferential divisions is performed and some comparative results will be shown.

11.50 AM- 12.35 PM: Using Cradle CFD and JMAG in emotors for better handling thermal challenges

Multiphysics

Elia Cipolato, Hexagon MSC Software

In recent years, the use of motors has been increasing in many industries due to environmental concerns. Especially in automotive industry, as the shift to electric vehicles (EVs) accelerates globally, the demands of developing motors has requested them to be smaller, more efficient, and safer.

One of the most important CAE efforts in motor development is to solve thermal challenges. This requires simulating temperature distribution using the 3D model with complex geometry and consider the most suitable cooling method for it. Cradle CFD, the thermal fluid analysis software in Hexagon solution, achieves it by collaborating with JMAG, the electromagnetic field analysis software.

Cradle CFD allows to import the Joule losses simulated by JMAG as heat condition, predicts heat transfer near the surfaces and simulates temperature distribution with the complex model of motor created by its powerful meshing. In this presentation, we introduce the workflow and the benefits of using Cradle CFD and JMAG.

---------- BREAK ----------

2.00 PM- 2.45 PM: PSIM - The Future of Power Electronics Control

Keynote

Dr. Antonio Lázaro, Carlos III University of Madrid

Power electronics is a key enabling technology in the process of electrification of means of transport and energy production systems.

Digital control platforms will play a key role in this process. At present, converter control enables functionality and communications to be fulfilled. In the near future, these capabilities should grow exponentially, endowing the converter with remarkable intelligence and adaptability to operating conditions.

Some of the advanced functions that will be available in the future are as follows:

- Multi-converter control
- Real-time optimization of inverter and DC-DC modulators
- Compensator Auto-tuning
- Real-time estimation of grid and generator parameters
- Cloud-computing
- Machine learning of energy-storage filters
- For high-availability safe systems
- Parallel processing
- HIL systems and State-estimators

This presentation will give examples of these advanced functions and show some of the future digital platforms. Finally, for the case of control algorithms, a methodology will be shown, based on the use of SmartCtrl, PSIM and Vivado HLS to develop and implement control functions very quickly.

2.45 PM- 3.30 PM: High-Efficiency and Low-THD HF 500W-1.5KW BTP PFC Using GaN Technology

Power Supplies

Siavash-Heydarzadeh, V-Research

Today's BTP (Bridgeless Totem Pole) boost PFC topology becomes more popular because of GaN MOSFET characteristics such as zero reverse-recovery, low output/gate capacitance/charge, etc. This presentation proposes the optimum 500W to 1.5-KW solutions, based on BTP boost PFC topology. The GaN technology and high switching-frequency are applied for achieving maximum efficiency and low THD while preserving high power density. The topology/magnetic designs and hard/soft(ZVS) switching control methods will be reviewed briefly. Finally, the practical challenges, considerations and solutions will discuss to reach maximum performance and functionality.

3.30 PM- 4.15 PM: Performance Investigation of Drone Propulsion Systems with High-performance Slotless PM Motors

Power Supplies

Zhaoqiang Zhang, Alva Industries AS

Inverter switching has a dramatic impact on the performance of drone propulsion system, especially when slotless PM motors are used. Specifically, the switching affects the choose of control methods, wire types, motor cables, magnet loss, stator core loss, etc. This talk will present how the inverter simulation software PSIM has been employed to address these issues in Alva product development, for achieving optimal system performance.

4.15 PM- 4.45 PM: Introduction to EMI Analysis and EMI Filter Design

Power Supplies

Amit Kumar, Powersim

Conducted EMI emissions can cause major issues if left to the end of a product development cycle. PSIM allows designers to reliably simulate and converge with non-ideal switches, parasitic inductance, and common mode capacitors. In this presentation, we will learn how to use the EMI design suite to design input filters for the power supply or motor drive system. With the ability to overlay an EMI standard onto the generated FFTs, we can use our automated filter design tools to simplify EMI compliance. We analyze some examples of converters and motor drives and how you can use the general template for your topologies. We will also demonstrate our new template in the design suite for three-phase systems. We will have the following learning through this presentation:

- Use our LISN element (line impedance stabilization network) to measure DM/CM EMI noise
- Place stray capacitance to the ground for common-mode noise with typical values
- Setup a level 2 switch device
- Overlay a conducted EMI standard (CISPR, MIL, FCC, custom, etc.)
- Identify problem frequencies to be targeted by the filter
- Implement the filter designed by the design suite and verify

While nothing can fully replace a full EMI chamber test, with our design suite, we are sure that your time in the chamber will be more productive, and your certification process will be less expensive and faster. Come and see the EMI design tools and workflow in action.

September 29th, 2021

9.50 AM – 10.20 AM: Efficiency Map improvements Session time has changed!

Ahmed Shoeb, Powersys

Modelling

In the V20.2 several improvements have been implemented concerning the efficiency maps analysis such as outputting an RT file from the efficiency map, including the magnets Eddy current loss calculation in the speed priority mode, reduce the modelling time in the conversion workflow from speed priority to accuracy priority mode.

10.20 AM- 11.05 AM: Using JMAG Script Editor to model electrical windings of any configuration

Vladimir Semin, Institute for Digitalization and Electrical Drives - Heilbronn University

Scripting

JMAG Designer allows several ways to create and simulate windings in electrical machines. The existing tools however have several limitations not allowing every possible existing winding configuration to be applied to the model.

In the presentation, a possible approach for easily assigning electrical winding configuration to an existing geometry is proposed: The method uses the JMAG's built-in script editor, as well as coupling with an external software tool for winding generating.

11.05 AM- 11.50 AM: E-motors and e-axles design by simulation

Michele Merelli, EnginSoft SpA

Modelling

Market requirements and the need for reduced emissions are pushing the demand for hybrid and electric traction both in the transportation and in the off-highway sectors. Over the next years e-drive units and e-axles will continue to evolve to meet industry specific requirements like increase in power density, efficiency improvement, weight and cost reduction, reliability.

One key-factor for the development of e-axles is the thermal management. The e-motor temperature strongly affects both the efficiency and life of the system and, with the increasing power density, external water-cooling is not effective. For this reason, internal oil jet cooling concepts are already used by several players in order to cool down the components more efficiently. Moreover, the growing integration of the e-motor and transmission units allows for the use of the transmission fluid as the coolant in the e-motor. The development of this type of integrated cooling and lubrication system is still very dynamic with multiple players exploring its potential and limits.

In this frame, with new concepts to be designed and compared, the adoption of simulation techniques since the early stages of the development process is crucial to drive the design of the e-motor cooling system and to optimize the lubrication of the e-axles.

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In this presentation the development process of virtual prototypes of oil cooled e-motors and axles is described with a particular focus on the oil flow analysis and optimization. The use of mesh-less CFD techniques, like the Moving Particle Simulation, can make the development of virtual prototypes much faster than Finite Volume CFD. The result is that the oil flow in a gearbox or e-motors can be virtually analyzed in a few days. In this way it's possible to predict the effect of different rpm, oil levels and temperatures and even the effect of dynamic operating conditions, like cornering, on the lubrication of gears and bearings, both in case of splash lubrication and in case of forced lubrication.

Based on these predictions the design of the gearbox and e-motor can be optimized before having a physical prototype and CFD simulation becomes a design tool.

Two case studies, one about a reduction gearbox and one about oil cooled e-motor will be presented with a comparison of numerical predictions against experimental data.

---------- BREAK ----------

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2.00 PM- 2.45 PM: Behavioural modalization of a residential microgrid using PSIM look-up tables

Jordi Clos Garrido, UPC

Microgrids & Grid connected

The aim of this technical presentation is to explain the application of PSIM look-up tables (among other PSIM blocks to implement energy flow criteria) to simulate a microgrid behaviour. Within the explanation, data sources to fill up look-up tables and each model of each microgrid component will be described, from photovoltaic field passing through batteries and reaching power grid and domestic loads.

This model is used to determine the viability of implementing a microgrid, so incomes and expected energy bill are also simulated using PSIM assuming Spain surplus energy policies.

2.45 PM- 3.30 PM: AFE with a three-level inverter, how to control it and its model

Egor Kulik, LLC SMC Vector

Microgrids & Grid connected

AFE converters are widely used in electrical engineering - solar plants, wind turbines, frequency converters. The presentation describes how to use PSIM to simulate a hardware and a control system at the design stage of an AFE converter. A three-level T-type inverter is considered. The design of a power electronics part, PI regulators setup, PWM technique, power consumed analysis and thermal analysis are described.

3.30 PM- 4.15 PM: Design of High-Performance Motor Drives

Amit Kumar, Powersim

Motor Drives

There are three main parts to a motor drive: the motor, the inverter, & the control. The design of any part of the motor drive system usually requires a working motor drive control algorithm. PSIM will automatically calculate a working control algorithm based on user input specifications using Motor Control Design Suite (MCDS). The advanced control algorithms of field weakening (FW) and maximum torque per volt (MTPV) control are included in our design suite. We will leverage this ability to quickly design and compare switch types, capacitor values, or other power hardware elements. We will compare different motor models with the same power level hardware. The design tools in the MCDS leverage the automated current and speed/torque loop control algorithms of PSIM and allows designers to get on with their job instead of getting stuck with control issues.

We will learn how to import realistic machine model parameters from the FEA tools JMAG, and the free online tool JMAG express online. We can quickly import these motor parameters into our design suite producing closed-loop motor drive simulations.

We will also demonstrate our improved capabilities for the analysis of the DC bus, including the introduction of non-ideal switches, common-mode capacitances, long cable models, and parasitic bus inductance for EMI pre-compliance simulation.

Come and see how the design tools can be leveraged to speed up power stage design, motor design, control system design, and integrated motor drive in larger systems.

September 30th, 2021

9.50 AM – 10.20 AM: Integration study: new circuit control features to enable system simulation including multiple models

Model Based Development

Session time has changed!

Yves Thiolière, Powersys

It is now possible in JMAG-Designer to enable studies with system simulations that include multiple physical phenomena and models. Multiples FEA model and JMAG-RT models can be integrated for simulating whole complex physical system, such as electrical , thermal, and control.

10.20 AM- 11.05 AM: Modeling, analysis and design of large line-start permanent-magnet synchronous motors

Modelling

Amedeo Vannini, University of Pisa & Nottingham

Permanent magnet synchronous machines provide some benefits with respect to wound-field solutions, including lower losses, greater simplicity and higher reliability. This makes them potentially interesting also for large power applications involving continuous operation and large costs in case of sudden failure, such as pumps and compressors for pipelines, which are usually fed directly from the mains for the same reasons. The analysis and design of large synchronous machines featuring both magnets and squirrel cage using both analytical and simulation models is presented, investigating steady-state conditions as well as start-up transients under different assumptions about the grid.

11.05 AM- 11.50 AM: FEA Modelling of Eddy Current Losses on Permanent Magnets of PMSM motor for EV traction application

Modelling

Nirmalya Panigrahi & Vinayak Gupta, Jaguar Land Rover

The losses due to eddy currents in permanent magnets of a motor, have significant impact on the magnet temperature and its performance. While designing Battery electric vehicles (BEVs) this can influence the range and the cooling system for the motor assembly. The rare-earth magnets have higher conductivities which leads to significant magnet losses at maximum speed operations. In case of pulse width modulated current input to the 3-phase motor, the high-frequency harmonics can cause considerable rise in the magnet losses. This paper presents a detailed finite element analysis (FEA) modelling which takes into account the 3-D eddy current flow with a magnet to analyze and predict losses in a magnet with higher accuracy.

11.50 AM- 12.35 PM: Export of Unprocessed JMAG Field Solution Data for Custom Post-Processing and Visualization

Robin Köster & Dr.-Ing. Björn Deusinger, Technical University of Darmstadt

Scripting

The availability of unprocessed field solution data obtained by JMAG allows for custom post-processing steps, which may for example be implemented in MATLAB. In this sense, the export functionality of the JMAG GeneralInterface allows for another option to integrate JMAG into the automated processing chain for the motor design by providing inter alia the vector potential and the magnetic flux density along with the corresponding mesh (node positions, relation to edges). Custom post-processing functions may for example be required in case of complicated material behaviour, whereof the analytical estimation of AC loss in superconducting windings is discussed as an example. Besides, the accessibility of raw data may also be desired, if custom visualization schemes should be applied to the field solutions, e.g. in order to align to preceding schemes from different software. This talk is therefore on the automated export of JMAG field solutions with a short outlook on how to work with the obtained data.

---------- BREAK ----------

1.30 PM- 2.00 PM: "Optimization" process of a 3-phase PWM Rectifier

Adrien Michel, Powersys

Power Supplies

A new feature based on " optimization" capability has been added into the new PSIM version. By using the optimization process, engineers will have the possibility to optimize their design, run sensitivity + Monte Carlo Analysis and finally add some faults into the circuit. This goal of this presentation is to show how to use those new tools in order to optimize a 3-phase PWM rectifier and get a robust design model.

2.00 PM- 2.45 PM: Power Converters for EV Battery Charging Systems

Vitor Monteiro, Universidade do Minho

Storage & Generation

Power Converters for EV Battery Charging Systems: Aiming to contribute to diminishing the negative effects caused by the transportation sector, the full adoption of electric mobility is increasingly a reality. In this context, power electronics technologies play a crucial part to support the full adoption of electric mobility, including on-board and off-board battery charging systems, as well as new topologies with innovative operation modes for supporting the power grid. Embracing these features, it will be presented power electronics technologies for electric mobility where some of the main technologies and power electronics topologies are presented and explained.

2.45 PM- 3.30 PM: Wireless dynamic charging systems for electric vehicles

Zariff Gomes, Vedecom

Storage & Generation

The dynamic wireless inductive charging technology can mitigate the cost of the charging infrastructure and electric vehicles, moreover increasing its efficiency and acceptability. At this presentation, a 30kW dynamic wireless charging system will be presented and the introduction to the VERA project (VEDECOM) and INCIT-EV project (European Project) where the technology is adapted to the real case conditions and demonstration.

3.30 PM- 4.15 PM: Regenerative Breaking Basis using PSIM & SmartCtrl

Dr. Antonio Lázaro, Carlos III University of Madrid

Storage & Generation

Regenerative braking considered as a general concept, in which the load is eventually able to return energy to the generator or a storage system, is one of the bases for increasing the energy efficiency of an electric vehicle or a broader electrical system.

In this paper are presented the basics of how to handle the energy returned by a motor drive to be stored in a supercapacitor battery, through a bidirectional DC-DC converter, keeping the voltage of the intermediate DC BUS and the supercapacitors stable.

Since the simulations focus on power transfer, averaged models in PSIM are proposed to reduce simulation time and it will be shown how to use SmartCtrl to design the control loops of the bidirectional converter: current control, voltage control on the DC BUS and voltage control on the supercapacitors.

Finally, a simulation of the complete system will be shown: motor drive, bidirectional DC-DC converter, super capacitors and source converter.

October 1st, 2021

9.50 AM – 10.20 AM: Multiphysics: Compatible with 3 coupled analyses of magnetic field, heat and structure

Didier Zefack, Powersys

Multiphysics

The effect of temperature, stress and deformation can be accounted for through a coupled analysis using a 2D model for magnetic field analysis and structural analysis, and a 3D model for thermal analysis

10.20 AM- 11.05 AM: Using JMAG in a multidisciplinary/multi-platform development environment

Zoltan Nadudvari, Rolls Royce

Multiphysics

The electrification of aircraft is playing a significant role on the path to reduce the aviation industry's environmental footprint. The industry poses specific challenges for the development engineers due to the strict requirements and design boundary conditions. Developing an electrical drive train which meets the high safety standards, the desired efficiency and power to weight ratio requires a multidisciplinary design approach to cover all the requirements and design aspects. In an agile environment different engineering teams often use different platforms / ecosystems (e.g. Matlab, Simcenter, Ansys) to deliver the results in time and face the challenge of real-time data exchange between the disciplines. JMAG offers a wide range of flexibility to share simulation results with 3rd party ecosystems. In this presentation a workflow will be presented where the effect of mechanical stress due to thermal expansion on the iron core of an electric machine can be taken into account to get a more precise loss and performance result.

11.05 AM- 11.50 AM: Multiphysics Simulations for Electrical Components Design with MpCCI

Pascal Bayrasy, Fraunhofer

Multiphysics

Many of the technological advances over the past decades have occurred by miniaturization. In miniaturization, the shape, size, and characteristic features of the devices must be ensured to allow them to be appropriately integrated and packaged in a successful industrial product. Reductions in weight and space provide new aspects to consider during the design of electrical components. The prediction of heating and cooling processes is of eminent importance in the development of electrical devices. The thermal potential of the materials involved in the product need to be exploit in order to achieve the performance at the customer's specified operational temperatures. By using a multiphysics approach designers and engineers are able to take in account in earlier stage the temperature dependency of the magnets which affect the final torque for an electrical motor for instance. The MpCCI CouplingEnvironment is a multiphysics enabler to extend the JMAG solution range with other advanced CFD and FEA simulations codes. Different methods will be presented to address different aspect of the design of electrical components.

11.50 AM- 12.35 PM: A Multidisciplinary Approach to Integrated Motor Modeling using GT-SUITE and JMAG

Peter Stopp, Gamma Technologies

Multiphysics

As electric vehicles become increasingly more mainstream, an increasing level of refinement is required for a modern driving experience. As efficiency and NVH targets become increasingly more stringent, an integrated CAE modeling approach is required to predict system behavior early in the development cycle. This integrated CAE approach requires multi-disciplinary modeling, of electromagnetics, mechanics, and thermal systems together. While these analyses may typically be managed by different engineers, or even different departments, there is a growing need for increased collaboration. This presentation will detail several avenues for increased collaboration of motor integration to improve NVH behavior.

---------- BREAK ----------

2.00 PM- 2.20 PM: Flying capacitor Boost in SEMITOP E2 in PV applications

Fabio Brucchi, Semikron

Storage & Generation

This presentation will focus more on the dimensioning of a three-level MPPT Flying capacitor application for 1500VDC Solar and ESS converters. Showing both part of the presentation may let appreciate the flexibility of PSIM both in semiconductor analysis and application dimensioning.

2.20 PM- 2.40 PM: 1200V Diode Technologies comparison

Fabio Brucchi, Semikron

Power Supplies

This presentation will be related to the Tandem diode application (650V IFx's Rapid diode in series) and will cover the simulation of the Tandem diode more at semiconductor level. It will mainly focus on how PSIM helped in findings critical aspects of this semiconductor solution.

2.40 PM- 3.10 PM: Resonant Converter Design and Optimization

Amit Kumar, Powersim

Power Supplies

This webinar will cover how to design, optimize, and close the loop on resonant converters using our new resonant Power Supply Design Suite in PSIM.

We will demonstrate our new and exciting time-domain-based Steady-State Solver tool, Design Curve tool, and Parameter Optimization tool to find optimum values of the resonant parameters, operating frequency range to maintain ZVS, quality factor, magnetics ratio, and other design parameters.

We will study and optimize resonant LLC tank and resonant CLLLC tank for popular resonant applications for design examples.

As the design tools are instantaneous in generating design curves, output calculations, and output waveforms, we will demonstrate how it takes only a few minutes to optimize the resonant converters.

Some important topics we work through:

- Generate accurate design curves for DC gain, RMS values, peak values, and average values in time-domain
- Find the narrowest range of operating frequency for your wide-load and line-range applications
- ZVS-ZCS boundary, leading-lagging boundary point for input current, calculation of peak/max DC gain within the soft-switching region
- Feedback and feedforward control of the output voltage. We will be using SmartCtrl for the feedback control
- Practical aspects like active and passive device selections based on output calculation of the RMS, peak, and average values
- Dead-time relation with MOS cap and magnetic ratio
- Comparative analysis between time-domain method and FHA method

3.10 PM – 3.20 PM: End of Conference - Closing Remarks

Scan me to register to the conference

Contact us: marketing@powersys.fr