TECHNICAL
PROGRAM

23rd International Conference on the
Computation of Electromagnetic Fields

COMPUMAG 2021

January 16 - 20, 2022, Cancún - México

IEEE
MAGNETICS

16-20, JANUARY 2022
CANCUN, MEX.

Sponsors and Exhibitors

Content

Welcome to the Conference COMPUMAG 2021

On behalf of the organizing committee, I would like to welcome you to the 23rd Conference on the Computation of Electromagnetic Fields COMPUMAG 2021 that initially was going to be held in the city of Cancun, Mexico, but due to the COVID-19 pandemic, it will be a pure virtual event held from the 16th-20th January 2022.

The COMPUMAG conferences began in 1976 in Oxford, United Kingdom. There have been 22 conferences held so far in different countries covering all the world continents: Europe, Asia, America and Oceania. This conference has been one of the most important events in the field of computational electromagnetics for researchers all over the world to present their latest research advances, share professional experiences, exchange new ideas and expand their professional networks. The aim of COMPUMAG 2021 is to discuss recent developments and practical applications in the numerical computation of electromagnetic fields for engineers and physicists engaged in the design and analysis of electromagnetic devices and systems. With your valuable contribution and active participation, we believe that you will benefit from the excellent quality of technical presentations and fruitful discussions, experience pleasant moments by virtual meeting friends/colleagues and establish new scientific relationships and networking.

For the 23rd instalment of the International Conference on the Computation of Electromagnetic Fields COMPUMAG 2021, an outstanding technical program has been achieved that includes two keynote speakers, oral and poster sessions. There were 403 digests submitted, 325 digests accepted and 286 technical presentations. In addition, the Conference will have the electromagnetics software companies ALTAIR and ESSS as exhibitors.

COMPUMAG 2021 will be run virtually using the SCOOCS platform. This is where presentations will be stored, live streams will be run, exhibitors and sponsors will be featured and all networking will occur. Much like at an in-person conference, attendees can set their agendas, participate in Q&A sessions and network with their peers

I look forward to meeting you on the online SCOOCS platform. We expect your attendance along with your colleagues and research students, to present your investigation results on the computation of electromagnetic fields. We have planned an event where the academic and networking will allow you to have a unique experience.

Sincerely,
Prof. Marco Arjona
General Chair

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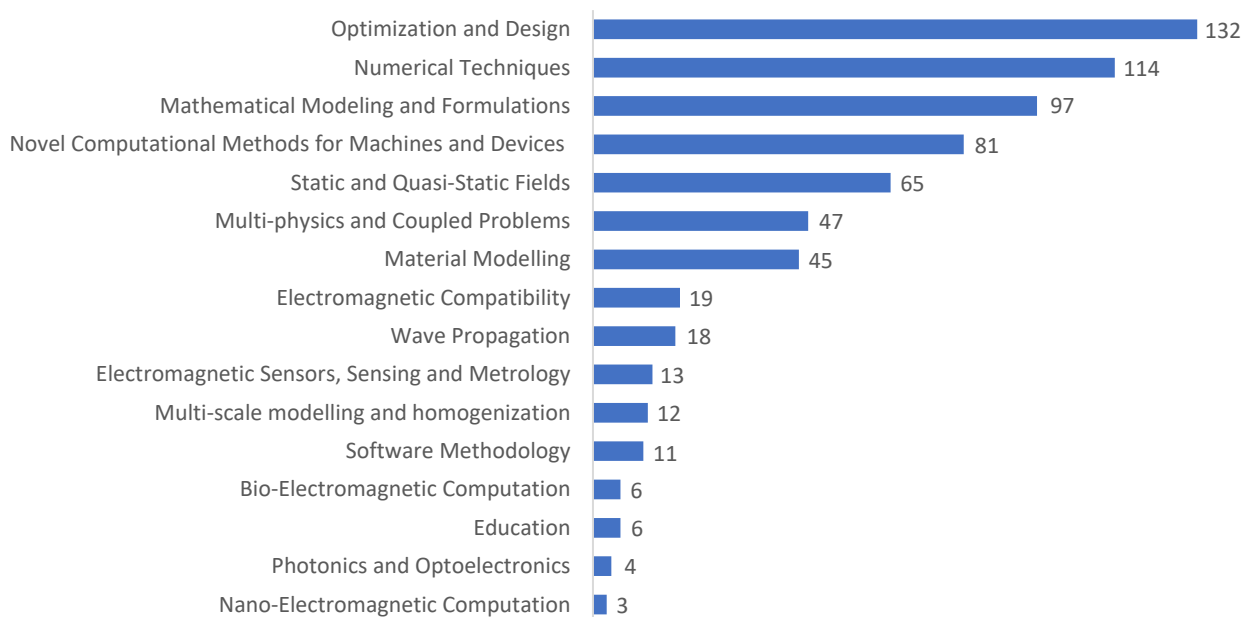|		
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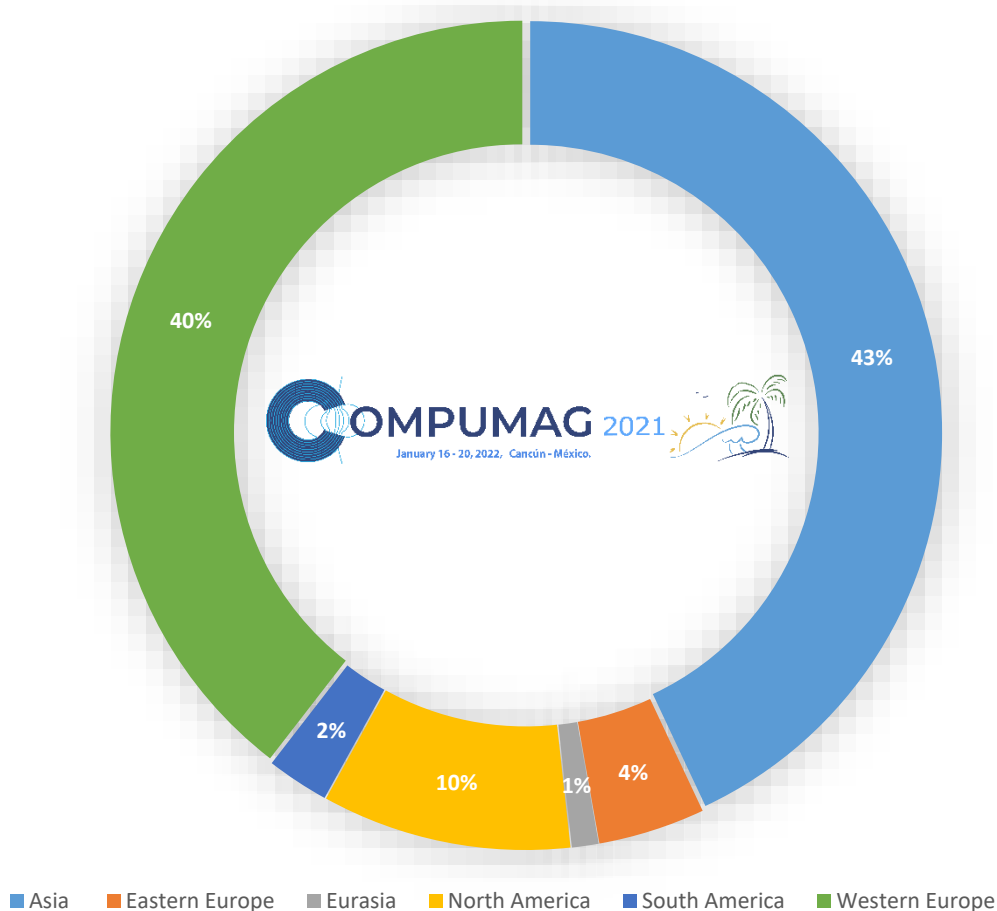Zhuang Chijie
Zygiridis Theodoros T.

Compumag 2021 in Numbers

Submitted Papers' Distribution by Session

Session	Count
Optimization and Design	132
Numerical Techniques	114
Mathematical Modeling and Formulations	97
Novel Computational Methods for Machines and Devices	81
Static and Quasi-Static Fields	65
Multi-physics and Coupled Problems	47
Material Modelling	45
Electromagnetic Compatibility	19
Wave Propagation	18
Electromagnetic Sensors, Sensing and Metrology	13
Multi-scale modelling and homogenization	12
Software Methodology	11
Bio-Electromagnetic Computation	6
Education	6
Photonics and Optoelectronics	4
Nano-Electromagnetic Computation	3

Digests Accepted Papers' Distribution by Region

- Asia: 43%
- Western Europe: 40%
- North America: 10%
- Eastern Europe: 4%
- South America: 2%
- Eurasia: 1%

Digest Accepted Papers' Distribution by Country

Country	Papers
Austria	16
Belgium	8
Brazil	7
Bulgaria	1
Canada	8
China	54
Czech Republic	3
Estonia	2
Finland	7
France	24
Germany	19
Greece	5
Hong Kong	4

Country	Papers
Hungary	1
Italy	20
Japan	36
South Korea	28
Mexico	18
Netherlands	4
Portugal	1
Russian Federation	3
Switzerland	12
Taiwan	1
United Kingdom	2
United States	2
Total Papers	**286**
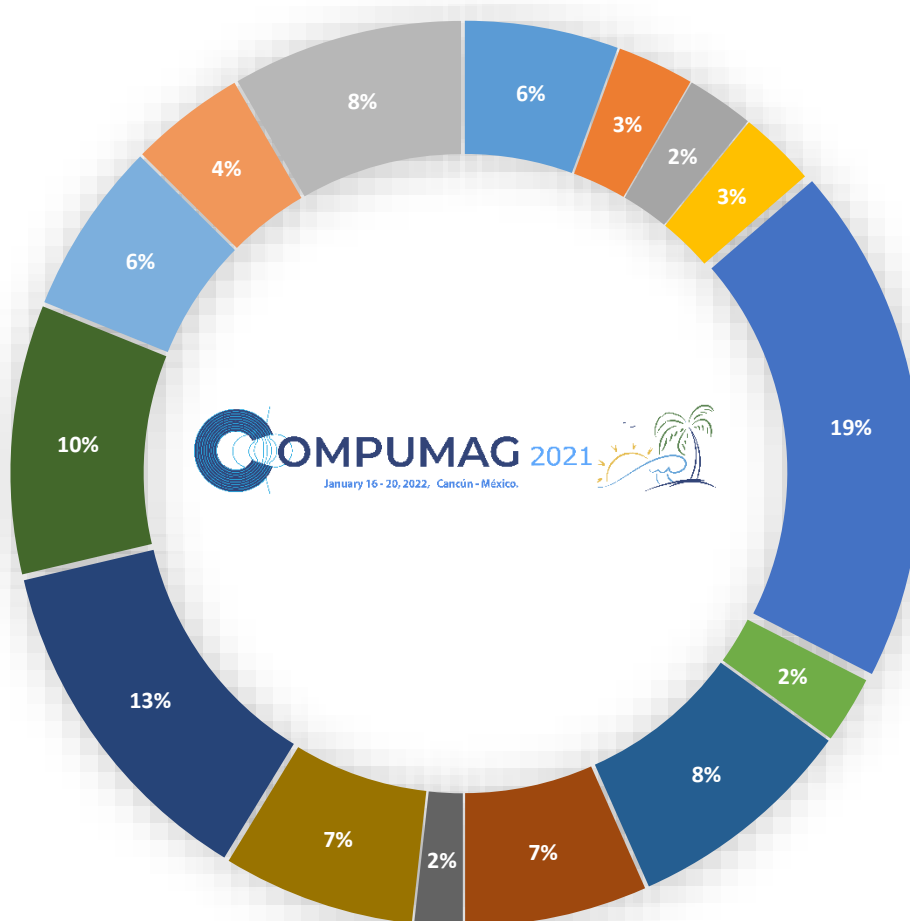
The Virtual Plataform SCOOCS

The original plan for the conference COMPUMAG 2021 was to organize it as a face-to-face event in Cancun, Mexico. However, the appearance of COVID-19 caused to rescheduling of this event half a year later with the hope of having an in-person conference. However, this did not happen, and instead of having the conference in the Cancun Convention Center, it was changed to hold a fully virtual conference. This represented a real challenge for the organizers because the nature of COMPUMAG conferences is that most digests are traditionally presented as posters. After a survey of possible platforms to use, SCOOCS was selected as the virtual platform for COMPUMAG 2021. The virtual platform SCOOCS is very intuitive in its use as a user. The platform SCOOCS has poster booths, virtual exhibitor booths, and networking tables where the attendees can easily navigate. The participants can make most of their activities with the platform itself.

The poster booths allow displaying an embedded pdf and illustrating the research images and videos. Therefore, they are adequate to present the scientific work of the conference authors. All posters can be accessed directly from the technical program or by visiting the poster area.
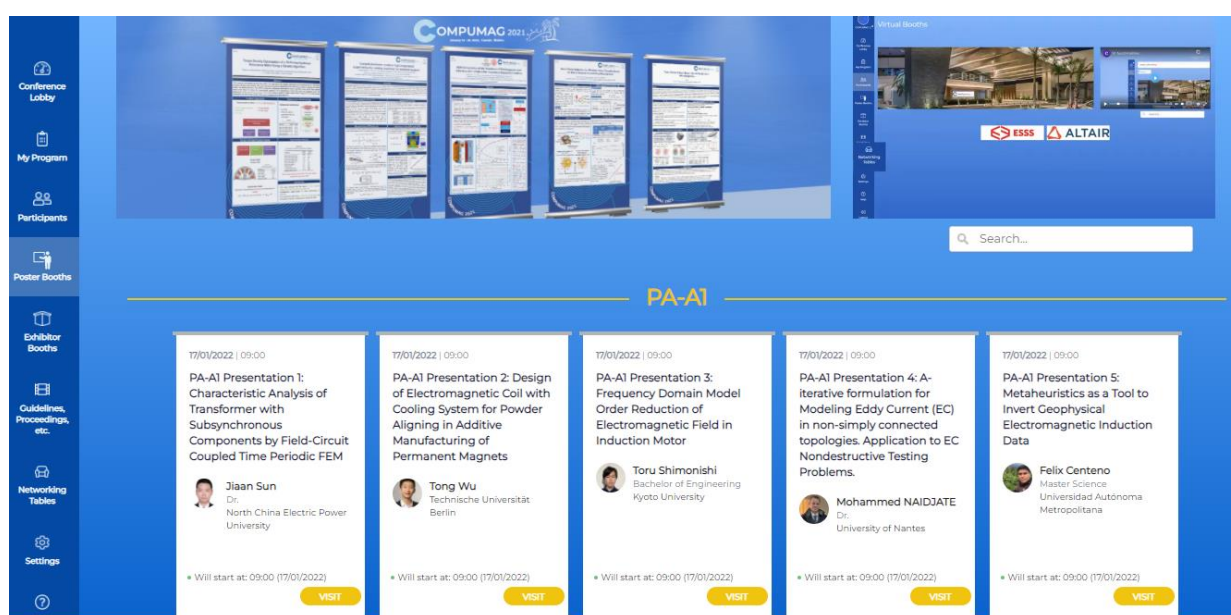

The virtual exhibitor booths are spaces where the sponsor or software companies can display the brand, products, services and more. Logos, videos and images can be added. Attendees can have the possibility to initiate a conversation with the exhibitors, as shown below.

The Networking tables are very versatile, and participants can create their discussion tables, as shown in the following figure.
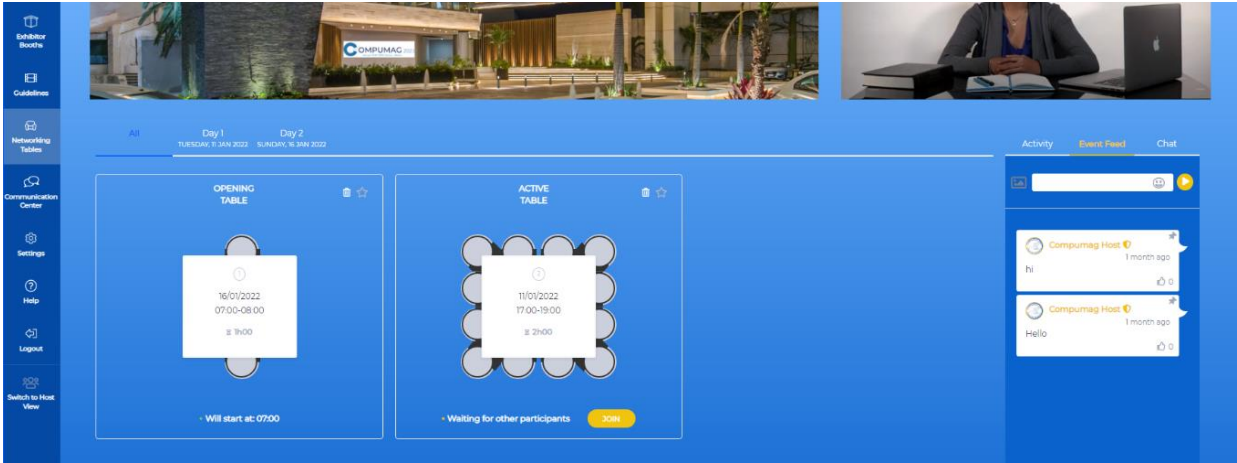
Rita Trowbridge Award

A prize to a young researcher in memory of Rita Trowbridge

Criteria and Conditions:
1. The prize will be presented to a young researcher, who is a participant of the conference and registered as a student.
2. The paper may be co-authored, but the young researcher must have contributed significantly, the evidence of this may be demonstrated for example by the fact that he/she is listed as the first author.
3. The paper must have been presented by the young researcher in either an oral or a poster session.

Procedure:
1. A small Awards Committee will be established before each COMPUMAG conference consisting of a chairman appointed by the ICS Board (must be a member of the ICS Board), the Chair (or one of the Co-chairs) of the COMPUMAG Editorial Board (or a person nominated by the Chair of the Editorial Board), a representative of the Local Organising Committee and two other members (could be, but do not have to be, ICS Board members) nominated by the ICS Board.
2. The Local Organising Committee of the COMPUMAG conference will prepare a list of eligible papers and will make this list available to the Awards Committee ahead of the conference. The scores of the referees will be shown on that list.
3. The chair of each conference session will be asked to nominate up to one (in exceptional circumstances two) authors for the award. A special form will be used for that purpose showing which papers are eligible. Such a form, showing all eligible papers in the session, will be prepared by the Conference Organisers. The session chair will be under no obligation to make a nomination.
4. The Awards Committee will meet briefly each day after the sessions to select the candidate papers from that particular day, taking account of the session chairs' nominations, reviewers' scores and their own observations during the day.
5. The Awards Committee will meet immediately after the final eligible paper has been presented on the last day and will make the decision. Up to 6 papers will be selected as to be 'commended' and authors will be issued certificates on behalf of the ICS Board. One of these authors (in exceptional circumstances two for a joint award) will be identified as the recipient(s) of the prize to a young researcher in memory of Rita Trowbridge.
6. The main prize(s) and the other commended papers will be announced at the closing session of COMPUMAG.

Conference Agenda Overview

Date: Sunday, 16/Jan/2022

Time	Session
8:00am - 9:00am	**Live help desk**

Date: Monday, 17/Jan/2022

Time	Session	Session
8:00am - 8:30am	**Opening**	
8:30am - 9:00am	**Keynote 1: The Past, Present and Future of Computational Electromagnetics**	
9:00am - 9:45am	**OA1: Mathematical modelling and formulations** Chair: **Prof. Jan Sykulski**, University of Southampton, United Kingdom	
9:45am - 10:00am	**Coffee break**	
10:00am - 11:45am	**PA-A1: Mathematical modelling and formulations** Chair: **Prof. Zhuoxiang Ren**, Sorbonne University, France	**PA-A2: Mathematical modelling and formulations** Chair: **Prof. Tetsuji Matsuo**, Kyoto University, Japan
11:45am - 12:00pm	**Coffee break**	
12:00pm - 1:45pm	**PA-P1: Static and quasi-static fields** Chair: **Prof. Piergiorgio Alotto**, Università di Padova, Italy	**PA-P2: Static and quasi-static fields** Chair: **Prof. Stephane Clenet**, Arts et Métiers Sciencs and Technology, France
1:45pm - 2:00pm	**Coffee break**	
2:00pm - 3:15pm	**OA2: Static and quasi-static fields** Chair: **Prof. Oszkar Biro**, Graz University of Technology, Austria	

Date: Tuesday, 18/Jan/2022

Time	Session	Session
8:00am - 9:15am	**OB1: Numerical techniques and modelling** Chair: **Prof. David Lowther**, McGill University, Canada	
9:15am - 9:30am	**Coffee break**	
9:30am - 11:15am	**PB-A1: Numerical techniques and modelling** Chair: **Prof. Maurizio Repetto**, Politecnico di Torino, Italy	**PB-A2: Numerical techniques and modelling** Chair: **Prof. Hajime Igarashi**, Hokkaido University, Japan
11:15am - 11:30am	**Coffee break**	
11:30am - 1:15pm	**PB-P1: Material modelling and multiphysics** Chair: **Prof. Anouar Belahcen**, Aalto University, Finland	**PB-P2: Material modelling and multiphysics** Chair: **Prof. Markus Clemens**, University of Wuppertal, Germany
1:15pm - 1:30pm	**Coffee break**	
1:30pm - 2:45pm	**OB2: Material modelling** Chair: **Prof. Ruth V. Sabariego**, KU Leuven, Belgium	

Date: Wednesday, 19/Jan/2022

Time		
8:00am - 9:15am	**OC1: Optimisation and design I** Chair: **Prof. Kay Hameyer**, RWTH Aachen University, Germany	
9:15am - 9:30am	Coffee break	
9:30am - 11:15am	**PC-A1: Optimisation and design I** Chair: **Prof. Shiyou Yang**, Zhejiang University, China, China, People's Republic of	**PC-A2: Optimisation and design I** Chair: **Prof. Chang-seop Koh**, Chungbuk National University, Korea, Republic of (South Korea)
11:15am - 11:30am	Coffee break	
11:30am - 1:15pm	**PC-P1: Optimisation and design II** Chair: **Prof. Sami Barmada**, University of Pisa, Italy	**PC-P2: Optimisation and design II** Chair: **Prof. Alessandro FORMISANO**, Università della Campania "Luigi Vanvitelli", Italy
1:15pm - 1:30pm	Coffee break	
1:30pm - 2:45pm	**OC2: Optimisation and design II** Chair: **Prof. Paolo Di Barba**, University of Pavia, Italy	

Date: Thursday, 20/Jan/2022

Time		
8:00am - 9:15am	**OD1: Wave propagation and electromagnetic compatibility** Chair: **Prof. Arnulf Kost**, Elektrische Antriebstechnik, TU Berlin, Germany	
9:15am - 9:30am	Coffee break	
9:30am - 11:15am	**PD-A1: Wave propagation and electromagnetic compatibility** Chair: **Prof. Yasushi Kanai**, Niigata Institute of Technology, Japan	**PD-A2: Wave propagation and electromagnetic compatibility** Chair: **Prof. Manfred Kaltenbacher**, TU Graz, Austria
11:15am - 11:30am	Coffee break	
11:30am - 1:15pm	**PD-P1: Novel computational methods for machines, biomagnetics, and education** Chair: **Prof. Antonios G. Kladas**, National Technical University of Athens, Greece	**PD-P2: Novel computational methods for machines, biomagnetics and education** Chair: **Prof. Sheppard Salon**, RPI, United States of America
1:15pm - 1:30pm	Coffee break	
1:30pm - 2:15pm	**OD2: Novel computational methods for machines and devices** Chair: **Prof. Herbert De Gersem**, Technische Universität Darmstadt, Germany	
2:15pm - 2:45pm	**Keynote 2: Future Trends in Optimal Design of Electromagnetic Devices**	
2:45pm - 3:15pm	**Closing**	

Monday, 17/Jan/2022

Keynote 1: The Past, Present and Future of Computational Electromagnetics

Time:
Monday, 17/Jan/2022:
8:30am - 9:00am

8:30 – 9:00 **The Past, Present and Future of Computational Electromagnetics**
Prof. David Lowther
McGill University, Canada

OA1: Mathematical modelling and formulations

Time:
Monday, 17/Jan/2022:
9:00am - 9:45am

Session Chair: **Prof. Jan Sykulski**
University of Southampton, United Kingdom

9:00am – 9:15am **Construction Principles of Electromagneto-Quasistatic Darwin Model Field Formulations**

OA1-1 **Markus Clemens[1], Marvin-Lucas Henkel[1], Fotios Kasolis[1], Michael Guenther[1], Sebastian Schoeps[2]**
[1]University of Wuppertal, Germany; [2]Technical University of Darmstadt

9:15am – 9:30am **Generating a Cauer Ladder Network Representation of Eddy Current Fields Using Scalar Potentials**

OA1-2 **Oszkar Biro[1], Niels Köster[2]**
[1]Graz University of Technology, Austria; [2]Virtual Vehicle Research GmbH, Austria

9:30am – 9:45am **RL-Ladder Circuit Models for Eddy-Current Problems with Translational Movement**

OA1-3 **Ruth V. Sabariego[1], Brent Vanbroekhoven[1], Johan Gyselinck[2], Patrick Kuo-Peng[3]**
[1]KU Leuven, Belgium; [2]Université Libre de Bruxelles, Belgium; [3]Universidade Federal de Santa Catarina, Brazil

PA-A1: Mathematical modelling and formulations

Time:
Monday, 17/Jan/2022:
10:00am - 11:45am

Session Chair: **Prof. Zhuoxiang Ren**
Sorbonne University, France

PA-A1-1 **Characteristic Analysis of Transformer with Subsynchronous Components by Field-Circuit Coupled Time Periodic FEM**
Jiaan Sun, Lin Li
State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources, North China Electric Power University, China, People's Republic of

PA-A1-2 **Design of Electromagnetic Coil with Cooling System for Powder Aligning in Additive Manufacturing of Permanent Magnets**
Tong Wu, Meng Li, Xiang Ding, Uwe Schäfer
Technische Universität Berlin, Germany

PA-A1-3 **Frequency Domain Model Order Reduction of Electromagnetic Field in Induction Motor**
Toru Shimonishi, Takeshi Mifune, Tetsuji Matsuo
Kyoto University, Japan

PA-A1-4 **A-iterative formulation for Modeling Eddy Current (EC) in non-simply connected topologies. Application to EC Nondestructive Testing Problems.**
Mohammed Naidjate[1], Nicolas Bracikowski[1], Bachir Helifa[2], Iben-Khaldoun Lefkaier[2], Mouloud Feliachi[1]
[1]University of Nantes, France; [2]University of Laghouat

PA-A1-5 **Metaheuristics as a Tool to Invert Geophysical Electromagnetic Induction Data**
Felix Centeno, Eduardo Rodríguez
Universidad Autónoma Metropolitana, Mexico

PA-A1-6 **Comparison of iterative and direct solvers in the solving of different consideration of Darwin formulations**

Houssein Taha[1], Zuqi Tang[1], Thomas Henneron[1], Yvonnick Le-Menach[1], Jean-Pierre Ducreux[2]

[1]Univ. Lille, Arts et Metiers Institute of Technology, Centrale Lille, Junia ULR2697-L2EP, F-59000 Lille, France; [2]EDF R&D, ERMES, 7 Boulevard Gaspard Monge, 91120 Palaiseau, France

PA-A1-7 **A Novel Method to Solve Total Electric Field of DC Voltage Divider Based on Upwind FEM**

Liancheng Xiu

Wuhan university, China, People's Republic of

PA-A1-8 **MPPT control characteristic of the micro-converter for solar power for driving loss reduction compared**

SeungTaek Oh[1], Hyunwoo Kim[1], Yeji Park[1], Junho Kang[1], Chang-Sung Jin[2], Chang Hyun Kim[3], Jae jun Lee[4], Ju Lee[1]

[1]Department of Electrical Engineering, Hanyang University, Seoul 04763, Republic of Korea; [2]Department of Electrical Engineering, Wonkwang University, Iksan 54538, Republic of Korea; [3]Department of IoT Electronics Engineering, Kangnam University, Yongin 16979, Republic of Korea; [4]Department of IoT Electronics Engineering, Yuhan University, Bucheon 14780, Republic of Korea

PA-A1-9 **A Novel Method for Improving the Air Gap Flux Density in PM Motor by Splicing PMs**

Xuze Yu, Yanpu Zhao

Wuhan university, China, People's Republic of

PA-A1-10 **Numerical Modeling and Experimental Study of HTS Coils Inductances**

Sara Fawaz, Hocine Menana, Yazid Statra, Bruno Douine

Lorraine University, France

PA-A1-11 **Permanent Magnet Maxwell Tensors: Comparison of Local Forces and Stress Distributions**

Laurent Bernard[1], Luiz Guilherme da Silva[2], Pedro Henrique Cardoso Costa[1], Nelson Sadowski[1], Laurent Daniel[2]

[1]GRUCAD-UFSC, Brazil; [2]UMR CNRS 8507, CentraleSupélec

PA-A1-12 **Lumped-Parameter Model of High Temperature Superconductor Rotating Machines for Transient Analysis**

Alejandro Baez-Muñoz[1], Frederic Trillaud[2], Juan Ramon Rodriguez-Rodriguez[3], Luis M. Castro[3], Rafael Escarela-Perez[4]

[1]Posgrado en Ingeniería Eléctrica, Universidad Nacional Autónoma de México, CDMX 04350, México; [2]Instituto de Ingeniería, Universidad Nacional Autónoma de México, CDMX 04350, México; [3]Departamento de Energía Eléctrica, Universidad Nacional Autónoma de México, CDMX 04350, México; [4]Departamento de Energía, Universidad Autónoma Metropolitana, Azcapotzalco, CDMX 022000, México

PA-A1-13 **Finite Element Model of a Superconducting Generator for Aircraft Application Coupled to an External Electrical Circuit**

Wilder Durante[1], Frederic Trillaud[2], Kévin Berger[3], Ghazi Hajiri[3], Rémi Dorget[3,4], Javier De la Cruz[5]

[1]Posgrado en Ingeniería Eléctrica, Universidad Nacional Autónoma de México, CDMX 04510, México; [2]Instituto de Ingeniería, Universidad Nacional Autónoma de México, CDMX 04510, México; [3]Université de Lorraine, GREEN, F-54000 Nancy, France; [4]Safran Tech, Electrical & Electronic Systems Research Group, Rue des Jeunes Bois, Châteaufort, 78114 Magny-Les-Hameaux, France; [5]Instituto Nacional de Electricidad y Energías Limpias, Cuernavaca 62490, México

PA-A1-14 **What Formulation Should One Choose for Modeling a 3D HTS Magnet Motor Pole with a Ferromagnetic Material?**

Julien Dular[1], Kévin Berger[2], Christophe Geuzaine[1], Benoît Vanderheyden[1]

[1]Université de Liège, Belgium; [2]GREEN, Université de Lorraine, France

PA-A1-15 **Fast Model for Computing Iron Losses in Nonlinear Thick Steel Laminations**

Ismet Tuna Gürbüz[1], Paavo Rasilo[2], Floran Martin[1], Ugur Aydin[3], Anouar Belahcen[1]

[1]Aalto University, Finland; [2]Tampere University, Finland; [3]ABB Oy, Marine and Ports, Finland

PA-A1-16 **Electric Field Computation using Axial Green Function Method for Neumann Boundary Condition on Curved Boundaries**

Junhong Jo[1], Do Wan Kim[2]

[1]National Institute for Mathematical Sciences, Korea, Republic of (South Korea); [2]Inha University, Korea, Republic of (South Korea)

PA-A2: Mathematical modelling and formulations

Session Chair: **Prof. Tetsuji Matsuo**
Kyoto University, Japan

PA-A2-1 **An Admittance Transfer Function Model Based on Improved SIABC for 3D Electromagnetic Field Problems**
Jiajia Chen[1], Xiao Yu[1], Qingshui Guo[1], Shiyou Yang[2], Zhiwei Xu[1]
[1]Intelligent Chip Research Center, Zhejiang Lab, Hangzhou, 311121 China; [2]College of Electrical Engineering, Zhejiang University, Hangzhou, 310027 China

PA-A2-2 **Variational Coupling of the Finite Element Method with a Lumped Circuit Using Side Constraints**
Karl Hollaus, Michael Leumüller, Markus Schöbinger
TU Wien, Austria

PA-A2-3 **Higher-Order ReLUs for Computational Deep Neural Networks**
Jinhee Yoon[1], Junhong Jo[2], Hyunwoo Kim[1], Do Wan Kim[1]
[1]Inha University, Korea, Republic of (South Korea); [2]National Institute for Mathematical Sciences, Republic of (South Korea)

PA-A2-4 **Order Reduction Methodologies and Applications for Fast Solution of Three-dimensional Electromagnetic Fields**
Jiajia Chen[1], Xiao Yu[1], Qingshui Guo[1], Shiyou Yang[2], Zhiwei Xu[1]
[1]Intelligent Chip Research Center, Zhejiang Lab, Hangzhou, 311121 China; [2]College of Electrical Engineering, Zhejiang University, Hangzhou, 310027 China

PA-A2-5 **One Stroke Complementarity for Eddy Current Problems**
Silvano Pitassi, Ruben Specogna
University of Udine, Italy

PA-A2-6 **Optimal polynomial bases for the High--Order Cell Method in the time domain**
Bernard Kapidani[1], Lorenzo Codecasa[2]
[1]Ecole Polytechnique Federale Lausanne, Switzerland; [2]Politecnico di Milano

PA-A2-7 **Calculation of the Terbium Domain Wall: An Atomistic Micromagnetic Problem**
Marcos Flavio de Campos, Jose Adilson de Castro
Federal Fluminense University - UFF, Brazil

PA-A2-8 **Estimating Multidomain Wall Motion in Polycrystalline Materials**
Celso S. Kurashima, Julio Carlos Teixeira
UFABC - Universidade Federal do ABC, Brazil

PA-A2-9 **Numerical and Experimental Analysis of Mechanical Deformation of Hydrogen Block under the Influence of Electric Field**
Byungsu Park[1], Ilhan Park[2], Eunchae Jung[2]
[1]Chung-ang University, Korea, Republic of (South Korea); [2]Sungkyunkwan University, Korea, Republic of (South Korea)

PA-A2-10 **Indirect induction baking of thin layers controlled by digital twin technique based on RNN**
Iveta Petrasova, Pavel Karban, Vaclav Kotlan
Faculty of Electrical Engineering University of West Bohemia, Czech Republic

PA-A2-11 **An Equilibrated Error Estimator for the MSFEM for the Eddy Current Problem in 2D Using the A-Formulation**
Markus Schöbinger, Karl Hollaus
TU Wien, Austria

PA-A2-12 **2-D Relaxed Darwin Formulation for the Modeling of Inductive and Capacitive Effects in Semi-homogenized Windings**
Carlos A. Valdivieso[1], Gerard Meunier[2], Brahim Ramdane[2], Johan Gyselinck[3], Christophe Guerin[1], Ruth V. Sabariego[4]
[1]Altair Engineering France, 38240 Meylan, France; [2]Univ. Grenoble Alpes, CNRS, Grenoble INP, G2Elab, F-38000 Grenoble, France; [3]Universite libre de Bruxelles, BEAMS department, 1050 Brussels, Belgium; [4]KU Leuven, Dept. Electrical Engineering, Campus EnergyVille, 3600 Genk, Belgium

PA-A2-13   **Statistical Model to Predict Static Magnetic Forces Due to Rotor Eccentricity in a Hemocompatibility Assessment Platform**

Shweta Karnik[1], P. Alex Smith[1], Nobuyuki Kurita[2], O. H. Frazier[1], Yaxin Wang[1]
[1]Texas Heart Institute, Houston, TX 77030 USA; [2]Division of Electronics and Informatics, Gunma University, Kiryu, Gunma, JAPAN

PA-A2-14   **Numerical Analysis of an Incomplete Balancing Domain Decomposition Method based on Polynomial Finite Element Spaces**

Daisuke Tagami
Kyushu University, Japan

PA-A2-15   **A Machine Learning Perspective on Spectral Estimation Techniques for Time Signals from EM Field Simulations**

Rodrigo Silva Rezende, Rolf Schuhmann
Technische Universität Berlin, Germany

PA-P1: Static and quasi-static fields

Time:
**Monday, 17/Jan/2022:
12:00pm - 1:45pm**

Session Chair: **Prof. Piergiorgio Alotto**
Università di Padova, Italy

PA-P1-1   **Boundary Integral Equation Method for Compensating Magnetostatic Fields of Thin Shells**

Andrew Lapovok, Roman Nyzkiy
Krylov State Research Centre, Russian Federation

PA-P1-2   **An Electric Field Feature Set for Insulation Prediction of Rod-plane Air Gaps Using Least Squares Support Vector Machine**

Zhibin Qiu[1], Huasheng Hou[1], Caibo Liao[1], Xiongjian Zhu[1], Jianben Liu[2], Louxing Zhang[1]
[1]Department of Energy and Electrical Engineering, Nanchang University, China, People's Republic of; [2]State Key Laboratory of Power Grid Environmental Protection (China Electric Power Research Institute), China, People's Republic of

PA-P1-3   **Geometric Multi-Grid Method for Accurate and Fast Electrostatic Analysis with Unstructured Numerical Human Body Model**

Masamune Nomura, Amane Takei
University of Miyazaki, Japan

PA-P1-4   **Investigating voltage excitation of the Darwin model via the prescription of terminal scalar potentials**

Klaus Roppert[1,2], Samuel Kvasnicka[1,2], Christian Riener[1,2], Thomas Bauernfeind[1,2], Manfred Kaltenbacher[1,2]
[1]Institute of Fundamentals and Theory in Electrical Engineering, Technical Graz, Graz, Austria; [2]Silicon Austria Labs, TU-Graz, SAL GEMC Lab, Austria

PA-P1-5   **2D FEM Calculation of AC Losses in Twisted Superconductors with a Helicoidal Transformation**

Julien Dular[1], Mariusz Wozniak[2], André Nicolet[3], Benoît Vanderheyden[1], Christophe Geuzaine[1]
[1]Université de Liège, Belgium; [2]CERN, Geneva, Switzerland; [3]Aix-Marseille Université, France

PA-P1-6   **A Magnetostatic Analysis of a Flux-Switching Permanent-Magnet Machine for Linear Bearingless Applications under Rotational Motion**

Floran Martin[1], Reza Hosseinzadeh[1], Alexandre Halbach[2], Marko Hinkkanen[1], Anouar Belahcen[1]
[1]Aalto University, Finland; [2]Tampere University, Finland

PA-P1-7   **Unbounded Axisymmetric FEM Formulation for Static Fields**

Rooney Coelho, José Roberto Cardoso
University of São Paulo, Brazil

PA-P1-8   **Sensitivity Matrix of an ECT System by Using FEA**

Vitor Malo Machado
Instituto de Telecomunicações, Portugal

PA-P1-9 **An Effective Thin Shell Approach in the Magnetic Field Formulation for Modeling Edges and Corners of Thin Regions**

Bruno de Sousa Alves, Marc Laforest, Frédéric Sirois
École Polytechnique Montréal

PA-P1-10 **Numerical Modeling for Induced Eddy Current Calculation According to Second Order Centered Finite-Difference Stencil**

Jaeho Ryu, Ingo Hahn
Institute of Electrical Drives and Machines, University of Erlangen-Nuremberg, Germany

PA-P1-11 **A novel family of geometrically-defined sparse inverse mass matrices**

Silvano Pitassi, Francesco Trevisan, Ruben Specogna
University of Udine, Italy

PA-P1-12 **Consideration of Rotational Motion in the Proper Generalized Decomposition by a Sliding Interface Technique**

Fabian Mueller, Kay Hameyer
Institute of Electrical Machines, RWTH Aachen University, Germany

PA-P1-13 **High-order Frequency Derivatives in Voltage Source Problems of Variational Eddy-Current System**

Seung-Eun Rho, Il han Park
Department of Electrical and Computer Engineering, Sungkyunkwan University, Korea, Suwon, 16419, Republic of (South Korea)

PA-P1-14 **Proper General Decomposition Method Applied to Periodic Nonlinear Eddy Current Problems**

Niels Koester[1,2], Oszkar Biro[2]
[1]Virtual Vehicle Research GmbH, Infeldgasse 21a, Graz, Austria; [2]Institute of Fundamentals and Theory in Electrical Engineering, Inffeldgasse 18, Graz

PA-P1-15 **BEM Computation of the Impedance of Ferromagnetic-core Inductors with a High-Order Impedance Boundary Condition**

Shuli Yin, Luca Di Rienzo, Youpeng Huangfu
Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Italy

PA-P1-16 **Effectiveness of the Chebyshev Approximation in Magnetic Field Line Tracking**

Raffaele Albanese[1,2,3], Andrea Gaetano Chiariello[2,4], Raffaele Fresa[2,5], Antonio Iaiunese[1], Raffaele Martone[2,3], Pasquale Zumbolo[1]
[1]Università degli studi di Napoli Federico II, via Claudio 21, I-80124 Napoli, Italy; [2]Consorzio CREATE c/o Università degli studi di Napoli Federico II, via Claudio 21, I-80124 Napoli, Italy; [3]DTT S.C. a r.l. via E. Fermi 45 I-00044, Frascati (Roma), Italy; [4]Università degli studi della Campania, via Roma, 29, I-81031 Aversa (CE) Italy; [5]Università degli studi della Basilicata, Via Nazario Sauro 85, I-85100 Potenza, Italy

PA-P1-17 **Circulating Currents in Parallel Foil Windings of Medium Frequency Transformers**

Siamak Pourkeivannour, Mitrofan Curti, Elena Lomonova
Eindhoven University of Technology, The Netherlands

PA-P2: Static and quasi-static fields

Session Chair: **Prof. Stephane Clenet**
Arts et Métiers Sciencs and Technology, France

PA-P2-1

Cancellation-Errorless Double-Layer Approach in Static Electromagnetic Analysis

Zoran Andjelic[1], Kazuhisa Ishibashi[1], Christian Lage[2], Paolo Di Barba[3]
[1]POLOPT TECHNOLOGIES GMBH, Switzerland; [2]Berlin Scientific, Berlin, Germany; [3]Pavia University, Pavia, Italy

PA-P2-2

The equivalent currents approach for both plasma and external sources modeling in Tokamak devices

Andrea Gaetano Chiariello[1,2], Antonio Iaiunese[3], Raffaele Martone[2,4], Fabio Villone[2,3], Pasquale Zumbolo[3]
[1]Università degli studi della Campania, via Roma, 29, I-81031 Aversa (CE) Italy; [2]Consorzio CREATE c/o Università degli studi di Napoli Federico II, via Claudio 21, I-80125 Napoli, Italy; [3]Università degli studi di Napoli Federico II, via Claudio 21, I-80125 Napoli, Italy; [4]DTT S.C. a r.l. via E. Fermi 45 I-00044, Frascati (Roma), Italy

PA-P2-3

Fast computation of eddy currents for moving conductors

Aldi Hoxha, Mauro Passarotto, Ruben Specogna
Polytechnic Department of Engineering and Architecture (DPIA), EMCLab, Università di Udine, 33100 Udine, Italy

PA-P2-4

Magnetic Microwire Materials Route Magnetic Flux in Screens and Cores of Electrical Machines

Markus Schöbinger[1], Md Tawhid Bin Tarek[2], Yilmaz Sozer[2], Igor Tsukerman[2], Karl Hollaus[1]
[1]TU Wien, Austria; [2]University of Akron, USA

PA-P2-5

Homogenization Method Based on FFT: Dual Formulation for Magnetostatic Problems

Romain Corcolle, Pingping Ding
NYU Shanghai, People's Republic of China

PA-P2-6

Efficient PEEC Computation of Losses and Currents in Screens of Round Wires in Submarine Tripolar Cables

Luca Giussani[1], Luca Di Rienzo[1], Massimo Bechis[2], Pasquale Cambareri[1], Carlo de Falco[3]
[1]Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Milano, Italy; [2]Prysmian S.p.a., Milano, Italy; [3]MOX, Dipartimento di Matematica, Politecnico di Milano, Milano, Italy

PA-P2-7

Deep learning Using Domain Decomposition Method Applied to Anisotropy Magnetostatics problem

Ruohan Gong, Zuqi Tang
L2EP, University of Lille, France

PA-P2-8

Improvement of Calculation Accuracy of Electromagnetic Force Based on Nodal Force Method Using Error Correction in Magnetostatic Field

Yoshifumi Okamoto[1], Tomoya Iino[1], Yuki Yamashita[1], Akira Ahagon[2], Yoshitaka Kida[2], Kazuki Semba[2], Takashi Yamada[2]
[1]Hosei University, Japan; [2]JSOL Corporation

PA-P2-9

Multi-Slice Meshed Reluctance Network Modeling of an Axial-Field Switched Reluctance Motor

Mostafa Hatoum, Salim Asfirane, Georges Barakat, Yacine Amara
1Groupe de Recherche en Electrotechnique et Automatique du Havre (GREAH), 76600 Le Havre, FRANCE

PA-P2-10

Accurate Resonances Prediction through Lumped-Parameter Modeling of Transformers for High Frequency Applications

Nicolas Davister, Fabrice Frebel, Christophe Geuzaine
University of Liège, Belgium

PA-P2-11

3-D Analytical Modeling of Asymmetric Axial-flux Hybrid Excited Electrodynamic Wheels

WEI QIN[1], Ma yuhua[2], gang lv[1]
[1]Beijing jiaotong university, China, People's Republic of; [2]Taiyuan Institute of China Coal Technology and Engineering Group

PA-P2-12

Fast Sensitivity Analysis of Electric Potential Distribution Around the Transmission Lines Using Adjoint Method

André Luiz Paganotti[1], Rodney Rezende Saldanha[1], Márcio Matias Afonso[2], Adriano Chaves Lisboa[1]
[1]UFMG, Brazil; [2]CEFET-MG, Brazil

PA-P2-13   **Novel Magnetic Circuit Design and Acceleration Calculation of Horizontal Linear Vibration Motor**

Zhi-Xiong Jiang, Ki-Hong Park, Sang-Moon Hwang
Pusan National University, Korea, Republic of (South Korea)

PA-P2-14   **Equivalent Image Magnetic Dipole Method Considering the Magnetic Effect of Ferromagnetic Material Applied in Gradient Coil Design**

Xiaohan Kong[1,2], Zheng Xu[2], Sheng Shen[2], Liang Xuan[2], Hajime Igarashi[1]
[1]Graduate School of Information Science and Technology, Hokkaido University, Japan; [2]School of electrical engineering,Chongqing University, China, People's Republic of

PA-P2-15   **Magnetization Estimation Method for Permanent Magnet Based on Mathematical Programming Combined with Sigmoid Function**

Narichika Nakamura[1], Yoshifumi Okamoto[1], Kenta Osanai[2], Satoshi Doi[2], Tetsuya Aoki[2], Keichi Okazaki[2]
[1]Hosei University, Japan; [2]Denso Corporation, Japan

OA2: Static and quasi-static fields

Time:
**Monday, 17/Jan/2022:
2:00pm - 3:15pm**

Session Chair: **Prof. Oszkar Biro**
Graz University of Technology, Austria

2:00pm – 2:15pm

OA2-1

Fast Time-domain Analysis of Darwin Model of Maxwell's Equations using Arnoldi-based Model Order Reduction

Shingo Hiruma[1], Hajime Igarashi[2]
[1]Kyoto University, Japan; [2]Hokkaido University, Japan

2:15pm – 2:30pm

OA2-2

Limitations of the Two-Step Darwin Model in Frequency Domain

Joerg Ostrowski, Christoph Winkelmann
ABB Switzerland Corporate Research, Switzerland

2:30pm – 2:45pm

OA2-3

Performance Evaluation of Parallel-in-Space-and-Time Finite-Element Analysis of Electric Machines based on Domain Decomposition and Parallel TP-EEC Method in Massively Parallel Computing Environment

Yasuhito Takahashi[1], Koji Fujiwara[1], Takeshi Iwashita[2]
[1]Doshisha University, Japan; [2]Hokkaido University, Japan

2:45pm – 3:00pm

OA2-4

Efficient FEM-BEM Coupling Based on Argyris Element for Axi-Symmetric Open Boundary Magnetostatic Problems

Matteo Bonotto[1,2], Abate Domenico[2], Paolo Bettini[3]
[1]INFN-LNL, Viale dell'Universit`a, 2 - 35020 Legnaro (Padova) Italy; [2]Consorzio RFX, Corso Stati Uniti 4, 35127 Padova, Italy; [3]Dipartimento di Ingegneria Industriale (DII), Universit`a di Padova, Italy

3:00pm – 3:15pm

OA2-5

Error Estimator for Cauer Ladder Network Representation

Shingo Hiruma[1], Stéphane Clénet[2], Hajime Igarashi[3], Thomas Henneron[2]
[1]Kyoto University, Japan; [2]Université de Lille; [3]Hokkaido University

Tuesday, 18/Jan/2022

OB1: Numerical techniques and modelling

Time:
Tuesday, 18/Jan/2022:
8:00am - 9:15am

Session Chair: **Prof. David Lowther**
McGill University, Canada

8:00am - 8:15am **OB1-1**	**Nonlinear Model Order Reduction of Induction Motors Using Parameterized CLN Method** Miwa Tobita, Tetsuji Matsuo Kyoto University, Graduate School of Engineering, Japan
8:15am - 8:30am **OB1-2**	**Hierarchical Multilevel Surrogate Model based on POD combined with RBF Interpolation of Nonlinear Magnetostatic FE model** Thomas Henneron[1], Stephane Clenet[2] [1]University of Lille, L2EP, France; [2]Arts et Metiers Institute of Technology, L2EP, France
8:30am - 8:45am **OB1-3**	**A high-order Spline Geometric Method for electromagnetic simulation** Bernard Kapidani, Rafael Vàzquez Hernandez Ecole Polytechnique Federale Lausanne, Switzerland
8:45am - 9:00am **OB1-4**	**Comparison of 3-D Nonlinear Multiharmonic Eddy Current Formulations for High-Temperature Superconductors Using Sparselizard C++ Library** Janne Ruuskanen, Alexande Halbach, Timo Tarhasaari, Paavo Rasilo, Tiina Salmi Tampere University, Finland
9:00am - 9:15am **OB1-5**	**Non-parametric Belief Propagation Solver for Stochastic Systems of Linear Equations** Amir Akbari, Dennis Giannacopoulos McGill University, Canada

PB-A1: Numerical techniques and modelling

Time:
Tuesday, 18/Jan/2022:
9:30am - 11:15am

Session Chair: **Prof. Maurizio Repetto**
Politecnico di Torino, Italy

PB-A1-1	**Adaptive mesh procedure for the unstructured inductive PEEC formulation** Kouceila Alkama[1,2], Gérard Meunier[2], Olivier Chadebec[2], Jean-Michel Guichon[2], Bertrand Bannwarth[2], Enrico Vialardi[1], Jonathan Siau[1], Rémy Perrin-Bit[1] [1]Altair Engineering, France; [2]Univ. Grenoble Alpes, CNRS, Grenoble INP, G2Elab, 38000 Grenoble, France
PB-A1-2	**Finite Element Mesh Based Hybrid Monte Carlo Micromagnetics** Lei Xu College of Engineering, Peking University
PB-A1-3	**Nonlinear Magnetic Field Analysis Using 3-D Parallelization Time-Periodic Finite-Element Method with Parareal Algorithm** Jiaan Sun, Lin Li State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources, North China Electric Power University, China, People's Republic of China
PB-A1-4	**Improved Sinc Method Based on POD Technique for Time Domain Electromagnetic Field Problems** Ze Guo[1], Zuqi Tang[2], Shuai Yan[1], Zhuoxiang Ren[1,3] [1]Institute of Electrical Engineering, Chinese Academy of Sciences, China, People's Republic of; [2]L2EP, University of Lille, France; [3]GeePs, Sorbonne Universite, France
PB-A1-5	**Combined Euler-Lagrange Approach for the Stability Analysis of Moving Structure in Electromagnetic Field** Ze Guo[1], Shuai Yan[1], Xiaoyu Xu[1], Zhifu Chen[1], Zhuoxiang Ren[1,2] [1]Institute of Electrical Engineering, Chinese Academy of Sciences, China, People's Republic of; [2]Group of Electrical and Electronic Engineering of Paris, Sorbonne Universite

PB-A1-6

Solving Magnetodynamic Problems via Normal Form Method

Nnaemaka ugwuanyi, <u>Stephane Clenet</u>, Xavier Kestelyn, Olivier Thomas
Arts et Métiers Institute of Technology, France

PB-A1-7

Parametric Geometric Metamodel of Magnetostatic Problem Based on PGD and RBF Approaches

<u>Allaa Eddine Boumesbah</u>, Jérôme Tomezyk, Thomas Henneron
University of Lille

PB-A1-8

Analysis of Numerical Computation Error of Grounding Grid Positioning Based on Magnetic Field Differential Method

<u>Songlin Liu</u>, Yijun Lai, Fan Yang
State Key Laboratory of Power Transmission Equipment & System Security and New Technology

PB-A1-9

Parallelization Efficiency of k-skip Mister R for Large Scale Linear System obtained from Electromagnetic Analysis

Takayasu Morishita[1], Ran Dong[1], Kuniyoshi Abe[2], Yoshihisa Fujita[3], <u>Soichiro Ikuno</u>[1]
[1]Tokyo University of Technology, Japan; [2]Gifu Shotoku Gakuen University, Japan; [3]Ritsumeikan University, Japan

PB-A1-10

First approach of a mixed domain decomposition method for magnetostatic simulation of rotating machines

<u>Aurélia Ruda</u>[1], François Louf[1], Pierre-Alain Boucard[1], Xavier Mininger[2,3]
[1]Université Paris-Saclay, ENS Paris-Saclay, CNRS, LMT, France; [2]Université Paris-Saclay, CentraleSupélec, CNRS, Laboratoire de Génie Électrique et Électronique de Paris, France; [3]Sorbonne Université, CNRS, Laboratoire de Génie Électrique et Électronique de Paris, France

PB-A1-11

Development of H-Matrix-Based Preconditioner for Symmetric Linear System in Shielding Current Analysis of HTS Film

<u>Ayumu Saitoh</u>
Yamagata University, Japan

PB-A1-12

Linearization of E(J) power law used for HTS superconductors modeling

<u>Kameni Abelin</u>, Matar Houssein, Queval Loic
GEEPS, France

PB-A1-13

Inductance Calculation of Soft Magnetic Composite Inductor Considering Anisotropy Due to Compression Molding and DC Bias

<u>Y. Gao</u>[1], Y Gotoh[1], K. Hamada[2], S. Araki[2], K. Muramatsu[2], Y. Takeuchi[3], Y. Takahashi[3], K. Fujiwara[3], T. Ogawa[4], C. Ishihara[4], K. Aiba[4], S. Otsuka[4]
[1]Oita Univeristy, Japan; [2]Saga University, Japan; [3]Doshisha University, Japan; [4]Showa Denko Materials Co., Ltd., Japan

PB-A1-14

Research on Magnetic and Stress-induced Anisotropy of Silicon Steel Considering Magnetic Domain Deflection

Tong Ben, Fangyuan Chen, Long Chen, <u>Yuqi Kong</u>
College of Electrical Engineering and New Energy, China Three Gorges University, Yichang

PB-A1-15

Model order reduction of electromagnetic field simulations in carbon fiber composite materials

<u>Suyang Lou</u>, Antoine Pierquin, Guillaume Wasselynck, Didier Trichet, Nicolas Bracikowski
Institute for Research in Electrical Energy of Nantes-Atlantique (IREENA), University of Nantes

PB-A2: Numerical techniques and modelling

PB-A2-1

Research on Vector Electromagnetic Vibration of Magnetically Controlled Reactor
Tong Ben, <u>Luqian Hou</u>, Long Chen, Ping Zhang
College of Electrical Engineering and New Energy, China Three Gorges University, Yichang 443002

PB-A2-2

Vector Hysteresis Modeling of a Variable Flux Reluctance Machine Combined with the Hybrid Analytical Modeling
<u>Doga Ceylan</u>, Reza Zeinali, Bram Daniels, Konstantin O. Boynov, Elena A. Lomonova
Eindhoven University of Technology, Netherlands

PB-A2-3

Model Order Reduction for Thermal Analysis of Wireless Power Transfer Systems Considering Radiation
<u>Myrel Tiemann</u>, Benedikt Schmuelling
Chair of Electric Mobility and Energy Sotrage Systems, University of Wuppertal, Germany

PB-A2-4

3-D Analytical Magnetic Field Analysis of the Electro-magnetic Eddy Current Coupling
<u>Ping Jin</u>, Yujing Guo, Xinyi He
Hohai University, China, People's Republic of China

PB-A2-5

Efficient Computation of Eddy Current Losses in Laminated Cores with Air Gaps by the Multiscale FEM
<u>Valentin Hanser</u>, Karl Hollaus
TU Wien, Austria

PB-A2-6

Efficient Modeling Approach of Magnetic Fields in Arbitrarily Deformed Air Gaps of Multi-Pole Synchronous Machines by Assembling Single-Pole FE-Solutions
<u>Christoph Mülder</u>, Alexander Kern, Fabian Müller, Kay Hameyer
RWTH Aachen University, Germany

PB-A2-7

Transient Modelling of Induction Machine Using Artificial Neural Networks
<u>Mikko Tahkola</u>[1], Victor Mukherjee[2], Janne Sami Keränen[1]
[1]VTT Technical Research Institute of Finland Ltd, Finland; [2]Motors & Generators, ABB Oy, Finland

PB-A2-8

Metrological and numerical Validation of electromagnetic Sub-Model Techniques for 3D-FEM
<u>Matthias Kowalski</u>[1], Christian Kreischer[2]
[1]Siemens Energy, Germany; [2]Helmut Schmidt University, Germany

PB-A2-9

Advanced numerical Methods for accelerating Calculation of Eddy Current Loss in Roebel-Bars in Turbogenerator End-Regions
<u>Matthias Kowalski</u>[1], Lucas Schmitz[1], Simon Gertz[1], Christian Kreischer[2]
[1]Siemens Energy, Germany; [2]Helmut Schmidt University, Gemany

PB-A2-10

A Twin-Model Based on Model Order Reduction for Rotating Induction Motor
<u>Shuai Yan</u>[1], Ze Guo[1], Xiaoyu Xu[1], Zhifu Chen[1], Zhuoxiang Ren[1,2]
[1]Institute of Electrical Engineering, Chinese Academy of Science, China, People's Republic of; [2]Group of Electrical and Electronic Engineering of Paris, Sorbonne Université, CNRS, F-75005 Paris, France

PB-A2-11

Reduced basis enrichment for the preservation of the time derivative in magneto-quasistatic
<u>Théo Delagnes</u>[1,2], Thomas Henneron[1], Stéphane Clenet[1], Mircea Fratila[2], Jean-Pierre Ducreux[2]
[1]Université de Lille L2EP, , F-59000 Lille, France; [2]2 EDF R&D, ERMES, 7 Boulevard Gaspard Monge, 91120 Palaiseau, France

PB-A2-12

Finite Element Calculation of Initial Condition for a Turbine Generator using Winding Vectors
<u>Victor Manuel Jimenez Mondragon</u>[1], Rafael Escarela-Perez[1], Felipe Gonzalez-Montañez[1], Juan Carlos Olivares-Galvan[1], Enrique Melgoza-Vazquez[2]
[1]Universidad Autonoma Metropolitana-Acapotzalco, Mexico; [2]Instituto Tecnológico de Morelia, México

PB-A2-13   **Modelling the Magnetic Field of an Arbitrary-Shaped Coil Using Magnetic Charge Method**
Jong Oh Park, Jun Seong Lee, Il Han Park
SungKyunKwan University, Korea, Republic of (South Korea)

PB-A2-14   **Interactice Motor Design System using 2D Finite Element Analysis with Fast Mesh Modification Method**
Ryota Seno[1], Tomohisa Manabe[1], Shinya Matsutomo[1], Yuki Hidaka[2]
[1]National Institute of Technology, Niihama College, Niihama 792-8580, Japan; [2]Nagaoka University of Technology, Nagaoka 940-2188, Japan

PB-A2-15   **Calculation of Zero Sequence Impedance for a Zig-Zag Transformer by 3-D Finite Element Method**
Jose Luis Hernandez-Avila[1], Alejandro Castillo-Pérez[2], Rodrigo Ocon-Valdez[3], Juan Carlos Olivarez-Galvan[1]
[1]Universidad Autónoma Metropolitana, México; [2]Universidad Nacional Autónoma de México, México; [3]Industrias IEM-Condumex S.A de C.V., México

PB-P1: Material modelling and multiphysics

Time:
Tuesday, 18/Jan/2022:
11:30am - 1:15pm

Session Chair: **Prof. Anouar Belahcen**
Aalto University, Finland

PB-P1-1   **Impact Analysis of Current Harmonics on Electromagnetic Noise of an Interior Permanent Magnet Synchronous Motor Through Coupled Electromagnetic-Mechanical Analysis**
Hyo-Seob Shin[1], Tae-Kyoung Bang[1], Gwi-Geun Park[2], Young-Jin Baek[2], Jang-Young Choi[1]
[1]Chungnam National University, Korea, Republic of (South Korea); [2]LG Electronics, Korea, Republic of (South Korea)

PB-P1-2   **Monitoring of False Lumen Thrombosis in Type B Aortic Dissection by Impedance Cardiography – A Multiphysical Simulation Study**
Vahid Badeli, Alireza Jafarinia, Thomas Stephan Müller, Gian Marco Melito, Alice Reinbacher Köstinger, Thomas Hochrainer, Günter Brenn, Katrin Ellermann, Oszkar Biro, Manfred Kaltenbacher
Graz University of Technology, Austria

PB-P1-3   **Geometry Optimization of a Multi-Turn Time-of-Flight Mass Analyzer**
Alexander Kalimov[1], Vyacheslav Shchepunov[2]
[1]Peter the Grate St.Petersburg Polytechnic University, Russian Federation; [2]Shimadzu Research Laboratory (Europe) Ltd, Manchester, UK

PB-P1-4   **Strongly Coupled Electromagnetic-Mechanical Problem with Analytical Solution**
Jasmin Smajic, Arif Güngör, Hande Ibili, Michal Maciejewski, Juerg Leuthold
Institute of Electromagnetic Fields, ETH Zurich, Switzerland

PB-P1-5   **Application of an Advanced Circuit Approach for Induction Machines in the Design of Electrified Drivetrains**
Daniel Biro[1], Franz Diwoky[1], Erich Schmidt[2]
[1]AVL List GmbH, Austria; [2]Vienna University of Technology

PB-P1-6   **Transcranial Magnetic Stimulation Systems: Computational Design of the Excitation Circuit and Stimulation Coils**
Angel D Ramirez-Galindo[1], Juan C. Olivares-Galvan[1], Manuel A Corona-Sanchez[2], Rafael Escarela-Perez[1]
[1]Universidad Autonoma Metropolitana, Mexico; [2]Instituto Tecnologico de Morelia, México

PB-P1-7   **Screening Current Simulation for High Magnetic Field REBCO Magnet Considering Deformation**
So Noguchi, Takanobu Mato
Hokkaido University, Japan

PB-P1-8   **Reduced-Order Model Based on POD/Q-DEIM for the Nonlinear Thermoelectric Coupling**
Cheng Chi[1,2], Fan Yang[1], Zhuoxiang Ren[2,3]
[1]State Key Laboratory of Power Transmission Equipment and System Security and New Technology, Chongqing 400044, China; [2]Group of Electrical and Electronic Engineering of Paris, Sorbonne Université, CNRS, 75005 Paris, France; [3]Group of Electrical and Electronic Engineering of Paris, Université Paris-Saclay, CentraleSupélec, CNRS, 91190 Paris, France

PB-P1-9 **Fast and Stable Calculation Convergence Method for Ion Flow Field of UHVDC Transmission Line**

<u>Liancheng Xiu</u>
Wuhan university, China

PB-P1-10 **Analysis of Magneto-Mechanical Coupling Model of Anodic Saturable Reactor with EHV DC Converter Valve**

<u>Changgeng Zhang</u>, Tao Chen, Yongjian Li, Qingxin Yang
State Key Laboratory of Reliability and Intelligence of Electrical Equipment, Hebei University of Technology, China

PB-P1-11 **Dynamic Model of Magnetic Screw Coupled to Mechanical System Using an Equivalent 2D Field Model**

Felipe Gonzalez-Montanez, <u>Efrain Romano-Abarca</u>, Victor Manuel Jimenez-Mondragon, Rafael Escarela-Perez
Universidad Autonoma Metropolitana, Mexico

PB-P1-12 **A Field-Circuit Coupling Model for Converter Transformer with Inter-tap Arcing Fault inside the On-load Tap Changer**

Ya Xu, Chenguang Yan, <u>Peng Zhang</u>, Xian Zhou, Bowen Luo, Hao Liu, Baohui Zhang
Xi'an Jiaotong University, China

PB-P1-13 **Multiphysics Field Analysis in Induction Heating: a CNN-based Surrogate Model**

Paolo Di Barba[1], Fabrizio Dughiero[2], <u>Michele Forzan</u>[2], Maria Evelina Mognaschi[1]
[1]University of Pavia, Italy; [2]University of Padova, Italy

PB-P1-14 **Design and Realization of a Magnetic Gear Test Bench**

Piergiorgio Alotto[1], Eric Armando[2], Elvio Bonisoli[3], Luca Dimauro[3], Mattia Filippini[1], <u>Maurizio Repetto</u>[2], Paolo Squilllari[2], Riccardo Torchio[1]
[1]Universita` degli Studi di Padova, DII; [2]Politecnico di Torino, DENERG; [3]Politecnico di Torino, DIMEAS

PB-P2: Material modelling and multiphysics

Time:
Tuesday, 18/Jan/2022:
11:30am - 1:15pm

Session Chair: **Prof. Markus Clemens**
University of Wuppertal, Germany

PB-P2-1 **Coupled Electromagnetic and Hydrodynamic Semiconductor Modeling for Terahertz Generation**

<u>Arif Can Gungor</u>, Michael Doderer, Jasmin Smajic, Juerg Leuthold
Institute of Electromagnetic Fields (IEF), ETH Zurich, Switzerland

PB-P2-2 **Electromagnetic Field Targeting Enhancement for Carbon Fiber Reinforced Polymers Induction Welding Application**

<u>Mansor Ndiaye</u>[1,2], Huu-Kien Bui[2], Didier Trichet[2], Antoine Pierquin[2]
[1]IRT Jules Verne, Bouguenais 44340, France; [2]IREENA, University of Nantes, Saint-Nazaire 44602, France

PB-P2-3 **AC losses in non-inductive high temperature superconducting coils: modeling and measurements**

<u>Frederic Trillaud</u>[1], Bruno Douine[2], Sara Fawaz[2], Hocine Menana[2], Nickolay Ivanov[3]
[1]Universidad Nacional Autonoma de Mexico, CDMX 04350, Mexico; [2]University of Lorraine, Vandoeuvre-lès-Nancy 54506, France; [3]Moscow Aviation Institute (MAI), Moscow 125993, Russia

PB-P2-4 **Separation of Stress Effect on Magnetic Property of Silicon Steel Sheet**

<u>Hidehiro Shimizu</u>, Yutaka Mishima, Tetsuji Matsuo
Kyoto University, Japan

PB-P2-5 **Simulation Method for Magnetic Hysteresis Characteristics of Electrical Steel Sheets under Mechanical Stress Using Energetic model**

<u>Hao Chen</u>, Lin Li
State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources, North China Electric Power University, Beijing, China, People's Republic of China

PB-P2-6 **Modelling the Flux-Line Cutting in the Magnetization of a Weak-Pinning Type-II Superconductor**

Omar Augusto Hernández-Flores[1], Raúl Cortés-Maldonado[2], <u>Carolina Romero-Salazar</u>[1]
[1]Universidad Autónoma Benito Juárez de Oaxaca, México; [2]Tecnológico Nacional de México, IT de Apizaco, Apizaco, México

PB-P2-7

Comparison of Energy Based Hysteresis Models

Herbert Egger[1], <u>Manfred Kaltenbacher[2]</u>, Klaus Roppert[2], Lukas Daniel Domenig[2]
[1]TU Darmstadt, Germany; [2]TU Graz, Austria

PB-P2-8

On identification of nonlinear material characteristics

<u>David Pánek</u>, Pavel Karban, Ivo Doležel
University of West Bohemia, Czech Republic

PB-P2-9

A Material Law Based on Neural Networks and Homogenization for the Accurate Finite Element Simulation of Laminated Ferromagnetic Cores in the Periodic Regime

<u>François Henrotte</u>, Florent Purnode, Christophe Geuzaine
ACE - Institut Montefiore - University of Liège, Belgium

PB-P2-10

An Improved Bouc-Wen Based Hysteresis Model Under Harmonic Magnetization

<u>Yongjian Li[1]</u>, Yating Li[1], Zhiwei Lin[1], Zhiguang Cheng[2], Yakun Tian[1]
[1]State Key Laboratory of Reliability and Intelligence of Electrical Equipment, Hebei University of Technology, Tianjin, China; [2]Institute of Power Transmission and Transformation Technology, Baobian Electric Co., Ltd, Baoding, Hebei, China

PB-P2-11

Integrodifferential modelling of the electromagnetic field in HTS Bulks

<u>Hocine Menana</u>, Mohamad Farhat, Melika Hinaje
Lorraine University, France

PB-P2-12

One-Dimensional Magnetodynamic Vector Hysteresis Model of Laminated Steel Sheets

<u>Reza Zeinali</u>, Dave Krop, Elena Lomonova
Eindhoven University of Technology, Netherlands

PB-P2-13

Finite Difference and Equivalent Circuit Modeling of Polarization in HVDC Cables

<u>Pasquale Cambareri[1]</u>, Carlo de Falco[2], Luca Di Rienzo[1], Paolo Seri[3], Gian Carlo Montanari[4]
[1]Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Italy; [2]MOX, Dipartimento di Matematica, Politecnico di Milano, Italy; [3]LIMES, Dipartimento di Ingegneria dell'Energia Elettrica e dell'Informazione, Università di Bologna, Italy; [4]Center for Advanced Power Systems, Florida State University, FL, USA

PB-P2-14

Hysteresis and Loss Modeling of Grain Oriented Silicon Steel Sheet under High Frequncy sinusoidal excitation

Xiaojun Zhao[1], <u>Liu Yang[1]</u>, Huawei Xu[1], Kang Huang[1], Lanrong Liu[2], Zhenbin Du[2]
[1]North China Electric Power University(Baoding), China, People's Republic of; [2]Hebei Province Key Laboratory of Electromagnetic & Structural Performance of Power Transmission and Transformation Equipment Baoding,China

PB-P2-15

Field Transients in HVDC Insulation Materials : Hierarchical Finite Element Modeling

Carlo de Falco[1], Pasquale Cambareri[1], <u>Luca Di Rienzo[1]</u>, Paolo Seri[2], Giancarlo Montanari[3]
[1]Politecnico di Milano, Italy; [2]Università di Bologna, Italy; [3]Florida State University, USA

PB-P2-16

An Improved Vector Hysteresis Model Incorporating the Effect of DC-Biased Field and Its Application to FEM Analysis of Three-Limb Transformer Core

<u>Minxia Shi[1]</u>, Cong He[2], Xuanrui Zhang[2], Aici Qiu[2], Junhao Li[2]
[1]Research Institute for Frontier Science, Beihang University, Beijing, China; [2]State Key of Electrical Insulation and Power Equipment, Xi'an Jiaotong University, Xi'an, China

OB2: Material modelling

1:30pm - 1:45pm

OB2-1

Energetic based hysteresis model implementation in LTspice

Fabien Sixdenier[1], Riccardo Scorretti[1], Nicolas Davister[2], Christophe Geuzaine[2], François Henrotte[2]

[1]Univ Lyon, Université Claude Bernard Lyon 1, INSA Lyon, ECLyon, CNRS, Ampère, F-69100, Villeurbanne, France; [2]Institute Montefiore - ACE - Université de Liège, B-4000 Liège, Belgium

1:45pm – 2:00pm

OB2-2

Utilizing Iron Loss Separation and ANN Models for Iron Loss Calculation in Electrical Steel Sheets

Zhiwei He, Jung-Seop Kim, Chang-Seop Koh

Chungbuk National University, Korea, Republic of (South Korea)

2:00pm – 2:15pm

OB2-3

A Multiscale Model for Ferromagnetic Material including Bloch Walls

Floran Martin[1], Ismet Gurbuz[1], Laurent Daniel[2], Abdelkader Benabou[3], Paavo Rasilo[4], Anouar Belahcen[1]

[1]Aalto University, Finland; [2]Laboratoire de Génie Electrique et Electronique de Paris, France; [3]ULR 2697 - Laboratoire d'Electrotechnique et d'Electronique de Puissance de Lille, France; [4]Tampere University, Finland

2:15pm – 2:30pm

OB2-4

A Dynamic Magnetostrictive Model Based on the Jiles-Atherton Hysteresis Model and Field Separation Approach

Yaqi Wang[1], Lin Ii[1], Xiaojun Zhao[2]

[1]State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources, North China Electric Power University, Beijing 102206, China; [2]Department of Electrical Engineering, North China Electric Power University, Baoding 071003, China

2:30pm – 2:45pm

OB2-5

A Homogenization Model for Soft Magnetic Composites Considering the Effect of Mechanical Stress

Romain Corcolle[1], Xiaotao Ren[2], Laurent Daniel[3,4]

[1]Division of Engineering and Computer Science, NYU Shanghai, 1555 Century Avenue, Shanghai 200122, People's Republic of China; [2]Integrated Actuators Laboratory (LAI), Ecole Polytechnique Fédérale de Lausanne (EPFL), Rue de la Maladière 71B, Neuchâtel 2000, Switzerland; [3]Université Paris-Saclay, CentraleSupélec, CNRS, Laboratoire de Génie Electrique et Electronique de Paris, 91192 Gif-sur-Yvette, France; [4]Sorbonne Université, CNRS, Laboratoire de Génie Electrique et Electronique de Paris, 75252 Paris, France

Wednesday, 19/Jan/2022

OC1: Optimisation and design I

Time:
Wednesday, 19/Jan/2022:
8:00am - 9:15am

Session Chair: **Prof. Kay Hameyer**
RWTH Aachen University, Germany

8:00am – 8:15am

OC1-1

Multi-Objective Topology Optimization of Electrical Machines Using Variational Autoencoder

<u>Vivek Parekh</u>[1,2], Dominik Flore[2], Sebastian Schöps[1]

[1]Technical University Darmstadt, Computational Electromagnetics Group, Germany; [2]Robert Bosch GmbH, Engineering, Acquisition, Building Set, Germany

8:15am – 8:30am

OC1-2

Design of a High-Speed Fractional Power BLDC Motor Based on Surrogate Modeling and NSGA-III

<u>Marco Arjona</u>[1], Concepcion Hernandez[1], J. E. Moron-Monreal[1], Jorge Lara[1], Rafael Escarela[2], Jan Sykulski[3]

[1]TNM La Laguna Institute of Technology,Torreon, 27000, Mexico; [2]Universidad Autonoma Metropolitana-Azcapotzalco, Mexico City, 02200, Mexico; [3]University of Southampton, Southampton, SO17 1BJ, United Kingdom

8:30am – 8:45am

OC1-3

The Multi-objective Optimization of the Integrated Grounding System for High-speed Trains based on the Kriging Algorithm

<u>Song Xiao</u>[1], Yixiang Shen[1], Hao Hou[1], Yaoyao Jin[1], Jie Zhou[1], Jie Liu[1], Guoqiang Gao[1], Guangning Wu[1], Jan K. Sykulski[2]

[1]Southwest Jiaotong University, China, People's Republic of; [2]University of Southampton,U.K.

8:45am – 9:00am

OC1-4

Discovering Pareto-optimal magnetic-design solutions via Generative Adversarial Network (GANs)

Marco Baldan[1], <u>Paolo Di Barba</u>[2]

[1]Fraunhofer Institute for Industrial Mathematics, Germany; [2]Department of Electrical, Computer and Biomedical Engineering, University of Pavia, Italy

9:00am – 9:15am

OC1-5

Continuum Sensitivity Analysis for Shape optimization of Transient Eddy Current System

<u>Jun Seong Lee</u>[1], Seung Geon Hong[2], Il Han Park[1]

[1]SungKyunKwan University, Korea, Republic of (South Korea); [2]Korea Electrotechnology Research Institute

PC-A1: Optimisation and design I

Time:
Wednesday, 19/Jan/2022:
9:30am - 11:15am

Session Chair: **Prof. Shiyou Yang**
Zhejiang University, China, People's Republic of

PC-A1-1

Comb Pattern Sensing Coil Design for Metal Object Detection of Various Sizes in Wireless Power Transfer Systems

Yong Li, <u>Xiao Yang</u>, Xing Zhao, Zhengyou He
Southwest Jiaotong University, China, People's Republic of

PC-A1-2

2.5-D Multi-Phase Topology Optimization of Permanent Magnet Motor Using Gaussian Basis Function

<u>Yoshitsugu Otomo</u>[1], Hajime Igarashi[1], Tomohiro Sato[2], Yoshihisa Suetsugu[2], Eiji Fujioka[2]
[1]Hokkaido University, Japan; [2]AISIN CORPORATION, Japan

PC-A1-3

A Novel Robust Method for Topology Optimization based on α-Min-Cut Theorem

<u>Meng Xia</u>, Shiyou Yang
Zhejiang University, China, China, People's Republic of

PC-A1-4

Iron Loss Reduction of IPMSM Using Optimized Voltage Waveform in Inverter Circuit

<u>Rei Homma</u>, Ryu Hirayama
Nippon Steel Corporation, Japan

PC-A1-5

A Multi-objective Topology Optimization Methodology using Deep Learning and its Application to Electromagnetic Devices

<u>Yilun Li</u>[1], Shiyou Yang[2], Zhuoxiang Ren[3]
[1]Donghua University, China; [2]Zhejiang University, China; [3]Sorbonne University, France

PC-A1-6

Interpolation Multimodal Optimization Algorithm for Robust Optimization of Electric Vehicle Traction Motor Design

Ji-Chang Son, Dong-kuk Lim

Department of Electrical, Electronic, and Computer Engineering, University of Ulsan, Korea, Republic of (South Korea)

PC-A1-7

Robust Design Optimization of Interior Permanent Magnet Synchronous Motor with Specific Manufacturing Tolerances

Chan-Ho Kim[1], Sung-Bae Jun[1], Yong-Jae Kim[2], Sang-yong Jung[1]

[1]Departmnet of Electrical and Computer Engineering, Sungkyunkwan University, Suwon 16419, South Korea; [2]Department of Electrical Engineering, Chosun University, Gwangju 61452, South Korea

PC-A1-8

Topology Optimization of Electromagnetic Devices Using Digital Annealer

Akito Maruo[1,2], Takeshi Soeda[1], Hajime Igarashi[2]

[1]FUJITSU LTD., Japan; [2]Graduate School of Information Science and Technology, Hokkaido University, Japan

PC-A1-9

Optimal design method for SPMSM based on NSGA-Ⅱ and analytical method for a specific power

Woo-Hyeon Kim[1], Kyung-Hun Shin[2], Chang-Woo Kim[3], Tae-Kyung Bang[1], Jang-Young Choi[1,2,3]

[1]Department of Electrical Engineering Chungnam National University, Daejeon 34134, South Korea; [2]Department of Power System Engineering Chonnam National University, Jeonnam 59626, South Korea; [3]Advanced E&E Department, Hanon Systems, Daejeon 34325, South Korea

PC-A1-10

Deep Learning-Based Sizing Method of SPMSM Considering Axial Leakage Flux

Soo-Hwan Park[1], Jun-Woo Chin[1], Sun-Yong Shin[2], Kyoung-Soo Cha[1], Myung-Seop Lim[1]

[1]Department of Automotive Engineering, Hanyang University, Republic of Korea; [2]Department of Automotive Engineering (Automotive-Computer Convergence), Hanyang University, Korea, Republic of Korea

PC-A1-11

A Subdivided Novel Kriging-Assisted Multi Objective Optimization Algorithm for Optimal Design of SPMSM

Jong-Min Ahn, Dong-Kuk Lim

University of Ulsan, Korea, Republic of (South Korea)

PC-A1-12

Multi-Sensor Fusion and Optimal Control for Superconducting-Hybrid MagLev Conveyor System in Smart Factory

Chang-Hyun Kim[1], Jun-Ho Kang[2], Ho-Joon Lee[3]

[1]Kangnam University, Korea, Republic of (South Korea); [2]Hanyang University, Korea, Republic of (South Korea); [3]Cheongju University, Korea, Republic of (South Korea)

PC-A1-13

Automatic Design of PM Motor Using Monte-Carlo Tree Search in Conjunction with Topology Optimization

Hayaho Sato, Hajime Igarashi

Graduate School of Information Science and Technology, Hokkaido University, Japan

PC-A1-14

Topology Optimization based on ON/OFF Method and Immune Algorithms for Thrust Ripple Minimization of PMLSMs

Zhen Sun[1,2], Kota Watanabe[1], Xiaozhuo Xu[2]

[1]Muroran Institute of Technology, Japan; [2]Henan Polytechnic University

PC-A1-15

Continuum Sensitivity Analysis for Electrode Shape Optimization in Bipolar Space-Charge System

Chan Young Choi, Il Han Park

Sungkyunkwan University, Korea, Republic of (South Korea)

PC-A1-16

Topology Optimization of Permanent Magnet Synchronous Motor Considering Control System

Shogo Hayashi[1], Yoshihisa Kubota[2], Shingo Soma[2], Makoto Ohtani[2], Hajime Igarash[1]

[1]Graduate School of Information Science and Technology, Hokkaido University; [2]Honda R&D Co., Ltd. Automobile R&D Center

PC-A1-17

Multi-material Topology Optimization of Permanent Magnet Motors Based on ON/OFF Method

Zhen Sun, Kota Watanabe

Muroran Institute of Technology, Japan

PC-A2: Optimisation and design I

Session Chair: **Prof. Chang-seop Koh**
Chungbuk National University, Korea, Republic of (South Korea)

PC-A2-1

Optimal Design of Spoke-type Interior PM Machines with A General Pattern

Jiahui Huang[1], Yanding Bi[1], Huihuan Wu[1], Weinong Fu[2], Shuangxia Niu[1], Xing Zhao[1]
[1]The Hong Kong Polytechnic University, Hong Kong S.A.R. (China); [2]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences,Shenzhen, China

PC-A2-2

A General Pattern of Permanent Magnet Arrangement for Design Optimization of a High Torque Density Reluctance Magnetic Gear

Yanding Bi[1], Jiahui Huang[1], Weinong Fu[2], Shuangxia Niu[1], Xing Zhao[1]
[1]The Hong Kong Polytechnic University, Hong Kong S.A.R. (China); [2]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China

PC-A2-3

Improved Fireworks Algorithm for Electromagnetic Optimization Problems with Large Scale Variables

Siguang An, Qiang Deng, Guoping Zou, Dehui Lin
China Jiliang University, China, People's Republic of

PC-A2-4

Production of Main Magnetic Field for HTS Ironless Cyclotron

Wei Fu, Chuan Wang, Tianjue Zhang, Hongji Zhou, Fei Wang
China Institute of Atomic Energy, Beijing 102413, P. R. China

PC-A2-5

Optimization of Field Sources in the Magnetofluid Based Heat Exchanger

Bernardo BUONOMO, Alessandro Formisano, Oronzio Manca
Università della Campania "Luigi Vanvitelli", Italy

PC-A2-6

An Improved Multi-Objective GA for Low Frequency Metamaterial Unit Robust Optimization under Uncertainty

Yiying Li, Shiyou Yang
Zhejiang University, China, China, People's Republic of

PC-A2-7

Modelling and Research on a Laminated Tubular Linear Oscillat-ing Generator for Free-piston Stirling Energy Conversion

Rong Guo, Fengyu Zhang, Baocheng Guo
Beijing university of civil engineering and architecture, China, People's Republic of

PC-A2-8

Preliminary Design of a Double Sided Linear Induction Motor as a Catapult for Light Weight Unmanned Aerial Vehicle

Sami Barmada[1], Valentina Consolo[1], Antonino Musolino[1], Rocco Rizzo[1], Luca Sani[1], Francesco Schettini[2]
[1]University of Pisa, Italy; [2]Sky Eye Systems, Cascina, Pisa, Italy

PC-A2-9

Topology Optimization for IPM Motor Using Multitask CNN and Considering Current Conditions

Hidenori Sasaki
Hosei University, Japan

PC-A2-10

Optimal Design of a Power Transformer Using a Manufacturer Approach, Surrogate Modeling and NSGA-III

Concepcion Hernandez[1], Marco Arjona[1], Jorge Lara[1], Rafael Escarela[2], Jan Sykulski[3]
[1]TNM La Laguna Institute of Technology, Mexico; [2]Universidad Autonoma Metropolitana - Azcapotzalco, Mexico; [3]University of Southampton, Southampton, SO17 1BJ, United Kingdom

PC-A2-11

Spoke type Permanent Magnet Generator Design and Cogging Torque Reduction Study for Wind Power Generator considering Magnetization

Dong-Ho Kim[1], In-Jun Yang[1], Hyun-Jo Pyo[2], Ju Lee[1], Won-Ho Kim[2]
[1]Hanyang University, Republic of (South Korea); [2]Gachon University, Republic of (South Korea)

PC-A2-12   **Microplastic Separation Simulation from Seawater by Strong Magnetic Force Based on Magnetic and Fluid Analysis**

Takanobu Mato, So Noguchi
Hokkaido University, Japan

PC-A2-13   **Prediction of Current-dependent Motor Torque Characteristics Using Deep Learning for Topology Optimization**

Taiga Aoyagi[1], Yoshitsugu Otomo[1], Hajime Igarashi[1], Hidenori Sasaki[2], Yuki Hidaka[2], Hideaki Arita[2]
[1]Graduate School of Information Science and Technology, Hokkaido University, Sapporo 060-0814, Japan; [2]Advanced Technology Research and Development Center, Mitsubishi Electric Corporation, Amagasaki 661-8661, Japan

PC-A2-14   **Comparative Study of Axial Length and Efficiency According to Coil Pitch of 2-Pole 6-Slot Ultra-High-Speed Machine**

Jae-Hyun Kim[1], So-Yeon Im[2], Soo-Min An[2], Kyoung-Soo Cha[1], Myung-Seop Lim[1]
[1]Department of Automotive Engineering, Hanyang University, Seoul 04763, Republic of Korea; [2]Department of Automotive Engineering (Automotive-Computer Convergence), Hanyang University, Seoul 04763, Republic of Korea

PC-A2-15   **Analytical Model-based Optimal Design of Surface-Mounted Permanent-Magnet Motor with 3D Duct for Turbo Compressor**

Young-Yoon Ko[1], Hyung-Woo Kim[1], Hye-Won Yang[1], Yong-Jae Kim[2], Sang-Yong Jung[1]
[1]Sungkyunkwan University / South Korea, Korea, Republic of (South Korea); [2]Chosun University / South Korea, Korea, Republic of (South Korea)

PC-A2-16   **New Segmented Rotor Distribution to Minimize Torque Ripple and Vibration in Surface-Mounted Permanent Magnet Machine**

Chen Peng, Daohan Wang, Bingdong Wang, Xiuhe Wang
School of Electrical Engineering, Shandong University, China, People's Republic of

PC-A2-17   **A Topology Study for the Application of Magnetic Geared Motor as Traction for Urban Railway Vehicle**

Ik-Hyun Jo[1], Ju Lee[1], Geochul Jeong[2], Jae-Hyeon Lim[2], Seong-Hwi Kim[2], Chan-Bae Park[2]
[1]Hanyang University, Korea, Republic of (South Korea); [2]Korea National University of Transportation, Republic of (South Korea)

PC-A2-18   **Electromagnetic Performance Analysis and Multi-Objective Optimal Design of a SPM Motor with Non-Uniformly Magnet Spacing to Reduce Torque Ripple**

Bingdong Wang, Daohan Wang, Chen Peng, Xiuhe Wang
School of Electrical Engineering, Shandong University, China, People's Republic of

PC-P1: Optimisation and design II

PC-P1-1   **Particle Swarm Optimization with Varied Social Network for Reliable Parameter Estimation in Thermal Analysis of Electrical Machines**

Rafal Wrobel
Newcastle University, United Kingdom

PC-P1-2   **Level-set-based Shape Optimization on Soft Magnetic Composites with Isotropy Constraint**

Xiaotao REN[1], Adrien Thabuis[1], Romain Corcolle[2], Antti Hannukainen[3], Yves Perriard[1]
[1]EPFL, Switzerland; [2]NYU Shanghai; [3]Aalto University

PC-P1-3   **Global Sensitivity Analysis Using a Kriging Metamodel for EM Design Problems with Functional Outputs**

Arnold Bingler[1,2], Sándor Bilicz[1], Márk Csörnyei[2]
[1]Budapest University of Technology and Economics, Hungary; [2]Robert Bosch Kft., Budapest

PC-P1-4   **Acceleration of the Matrix Assembly and Solution of Linear Systems in an Electromagnetic Simulation Software Using GPU**

Damien Mancy, Ahmed Khebir, Ammar Kouki

ElectroMagneticWorks Inc., Montreal, QC, Canada

PC-P1-5   **Approaches for Multi-material Topology Optimization**

Reda El Bechari, Stéphane Brisset, Frédéric Guyomarch, Frédéric Gillon

L2EP, France

PC-P1-6   **A Study on Performance Improvement by Reducing Axial Force of Double-Layer Spoke-type PMSM with Core Skew Structure**

Dong-Woo Nam[1], Kang-Been Lee[2], Hyun-Jo Pyo[1], Min-Jae Jeong[1], Won-Ho Kim[1]

[1]Gachon University, Korea, Republic of (South Korea); [2]Michigan State University, United States

PC-P1-7   **A Deterministic Global Optimization Code with a 3D FEM Black-Box Constraint**

Julien Fontchastagner[1], Frédéric Messine[2]

[1]Université de Lorraine, GREEN, F-54000, Nancy, France; [2]Université de Toulouse, CNRS, LAPLACE, F-31000 Toulouse, France

PC-P1-8   **Electromagnetic Optimal Design of a PMSG Considering Many Objectives and Using NSGA-III**

Concepción Hernandez[1], Marco Arjona[1], Francisco Jacob Martinez[1], Jorge Lara[1], Rafael Escarela-Perez[2], Jan Sykulski[3]

[1]TNM La Laguna Institute of Technology; [2]Universidad Autonoma Metropolitana Azpotzalco; [3]University of Southampton

PC-P1-9   **Comparing Two Network Transformer Hysteresis Models with Power Transformer Measurements**

Dennis Albert[2], Lukas Domenig[1], Dragan Maletic[2], Alice Reinbacher-Köstinger[1], Klaus Roppert[1], Herwig Renner[2]

[1]Institute of Fundamentals and Theory in Electrical Engineering, TU Graz, Graz, Austria; [2]Institute of Electrical Power Systems, TU Graz, Graz, Austria

PC-P1-10   **Low Cost High Speed Permanent Magnet Motor modeling implementing a particular 3D-printed Magnetic Iron Material**

Antonios G. Kladas, Maria Sofia C. Pechlivanidou

School of Electrical and Computer Engineering, National Technical University of Athens, Greece

PC-P1-11   **Efficient Demagnetization Modeling in Radial Flux V-shaped Interior Permanent Magnet Motors**

Georgios K. Sakkas, Antonios G. Kladas

School of Electrical and Computer Engineering, National Technical University of Athens, Greece

PC-P1-12   **Optimization of Force-to-Weight-Ratio of Ironless Tubular Linear Motors Using an Analytical Field Calculation Approach**

Florian Dreishing, Christian Kreischer

Helmut Schmidt University / University of the Federal Armed Forces Hamburg, Germany

PC-P1-13   **Evaluating Optimization Approaches for Magnetorelaxometry Imaging Excitation Coil Configurations**

Peter Schier[1], Annelies Coene[2], Aaron Jaufenthaler[1], Daniel Baumgarten[1,3]

[1]UMIT - Private University for Health Sciences, Medical Informatics and Technology, Austria; [2]Ghent University, Belgium; [3]Technische Universität Ilmenau, Germany

PC-P1-14   **Application of Surrogate Models to the Multiphysics Sizing of Permanent Magnet Synchronous Motors**

Issah Ibrahim, Rodrigo Silva, David Lowther

McGill University, Canada

PC-P1-15   **Coupled electromagnetic, thermal, structural and rotor dynamic analysis for high-speed permanent magnet motor design**

Christos T. Krasopoulos[1], Adamos S. Ioannidis[2], Angelos F. Kremmydas[2], Ilias A. Karafyllakis[1], Antonios G. Kladas[1]

[1]School of Electrical and Computer Engineering, National Technical University of Athens, Greece; [2]School of Mechanical Engineering, National Technical University of Athens, Greece

PC-P2: Optimisation and design II

Session Chair: **Prof. Alessandro Formisano**
Università della Campania "Luigi Vanvitelli", Italy

PC-P2-1

Topology Optimization of a 3D Helmholtz Coils System
Adrien Thabuis, Xiaotao Ren, Trung Duong, Yves Perriard
Swiss Federal Institute of Technology (EPFL) Lausanne, Switzerland

PC-P2-2

Reinforcement Learning for Topology Optimization of a Synchronous Reluctance Motor
Arbaaz Khan, Chetan Midha, David Lowther
McGill University, Canada

PC-P2-3

ANN for Optimization Problem Control and Parameters Preselection
Valentin Mateev, Iliana Marinova
Technical University of Sofia, Bulgaria

PC-P2-4

Wireless Power Transfer System for Linear Drives
Reto Christen[1], Urs Fischli[1], Thomas Franz[1], Michael Schueller[1], Jasmin Smajic[2]
[1]Institute of Energy Technology (IET), Univ. of App. Sciences of Eastern Switzerland (OST), Rapperswil, Switzerland; [2]Institute of Electromagnetic Fields (IEF), ETH Zurich, Switzerland

PC-P2-5

Positioning Tank-Wall Magnetic Shunts Considering Thermal Effects of a Three-Phase Power Transformer
Marco Arjona[1], Concepcion Hernandez[1], Jonathan Sturgess[2]
[1]TNM La Laguna Institute of Technology, Mexico; [2]Retired

PC-P2-6

A Modified Min-Cut based Robust Topology Optimization Methodology Considering Manufacturing Errors
Meng Xia, Shiyou Yang
Zhejiang University, China, China, People's Republic of

PC-P2-7

Virtual Element Method and Optimal Shape Design in Magnetics
Franco Dassi[1], Paolo Di Barba[2], Alessandro Russo[1]
[1]Università di Milano-Bicocca, Milano, Italy; [2]Università di Pavia, Pavia, Italy

PC-P2-8

Torque Density Optimization of a 3D-Printed Switched Reluctance Motor Using a Genetic Algorithm
Ekaterina Andriushchenko[1], Hamidreza Heidari[1], Arbaaz Khan[2], Mohammad Hossain Mohammadi[2], David Alister Lowther[2], Ants Kallaste[1], Toomas Vaimann[1,3]
[1]Tallinn University of Technology, Estonia; [2]McGill University, Canada; [3]ITMO University, Russia

PC-P2-9

Optimization of an Electrostatic Micromotor with Adjoint-state Method Sensitivity Analysis
Matheus Henrique Sousa, André Luiz Paganotti, Adriano Chaves Lisboa, Rodney Rezende Saldanha
Graduate Program in Electrical Engineering, Federal University of Minas Gerais, Brazil

PC-P2-10

Passive Magnetic Bearing Performance in a Magnetic Levitation System for a Pediatric LVAD: A Numerical and Experimental Study
Neil Luo[1], Shweta Karnik[1], Simon Kiang[1], P. Alex Smith[1], Nobuyuki Kurita[2], O.H. Frazier[1], Yaxin Wang[1]
[1]Texas Heart Institute, Houston, TX 77030 USA; [2]Division of Electronics and Informatics, Gunma University, Kiryu, JAPAN

PC-P2-11

Multi-level Topological Approach based on Enhanced Binary GA and Morphological Reconstruction for a non-linear Actuator
Shabnam Ruzbehi, Ingo Hahn
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

PC-P2-12

Best Practice for Modeling and Simulation of Linear Induction Motors
Matthias Schneider[1], Raphael Baumeler[1], Reto Christen[1], Michael Schueller[1], Jasmin Smajic[2]
[1]Institute of Energy Technology (IET), Univ. of App. Sciences of Eastern Switzerland (OST), Rapperswil, Switzerland; [2]Institute of Electromagnetic Fields (IEF), ETH Zurich, Switzerland

PC-P2-13 **Algorithm for Designing and Analyzing the Performance of a Transverse Flux Permanent Magnet Synchronous Generator for its use in Small Wind Turbines**

Miguel Ángel Hernandez[1], <u>Reynaldo Iracheta Cortez</u>[2]

[1]Universisad del Istmo, Mexico; [2]CÁTEDRAS-CONACYT UNISTMO

PC-P2-14 **Multi-Objective Cascade Optimization of a 12/10 Variable Flux Reluctance Machine for High-Torque Operations**

<u>Doga Ceylan</u>, Konstantin O. Boynov, Elena A. Lomonova

Eindhoven University of Technology, The Netherlands

PC-P2-15 **Shape Optimization of a Photo-Electron Gun using Isogeometric Analysis**

Peter Förster[1], <u>Sebastian Schöps</u>[1], Joachim Enders[2], Maximilian Herbert[2], Abele Simona[3]

[1]Institute for Accelerator Science and Electromagnetic Fields, Technische Universität Darmstadt, Germany; [2]Institut für Kernphysik, Fachbereich Physik, Technische Universität Darmstadt, Germany; [3]Laboratory for Modeling and Scientific Computing, Politecnico Milano, Italy

PC-P2-16 **Evolutive Interdigital Micro Capacitor**

<u>Ramon Diaz de Leon-Zapata</u>[1], Brhayllan Mora[2], Heber Hernandez-Arriaga[3], Gabriel Gonzalez[2], Efren Flores-Garcia[1], Ariel Benjamin De la Rosa-Zapata[1], Javier Gonzalez[2]

[1]Tecnologico Nacional de Mexico/Imstituto Tecnologico de SLP; [2]Universidad Autonoma de San Luis Potosi; [3]Department of Materials Science and Engineering The University of Texas at Dallas

OC2: Optimisation and design II

Time:
Wednesday, 19/Jan/2022:
1:30pm - 2:45pm

Session Chair: **Prof. Paolo Di Barba**
University of Pavia, Italy

1:30pm – 1:45pm

OC2-1

Sensitivity-based Topology Optimization of Induction Motor in Time Domain with Magnetic Nonlinearity

<u>Masaki Yamano</u>, Kazuya Katayama, Yoshifumi Okamoto

Hosei University, Japan

1:45pm – 2:00pm

OC2-2

Sensitivity Analysis Using Time Domain Adjoint Variable Method for Topology Optimization of IPM Motor Supported by Finite Element Analysis Coupled with Three-phase Voltage Source

<u>Kazuya Katayama</u>, Masaki Yamano, Yoshifumi Okamoto

Hosei University, Japan

2:00pm – 2:15pm

OC2-3

Efficient Surrogate-Assisted Design Optimization for SPMVM Based on Subdomain Analysis

<u>Yiming Ma</u>[1], Jia Zhou[2], Libing Zhou[1], Jin Wang[1], Kang Shuai[1]

[1]State Key Laboratory of Advanced Electromagnetic Engineering and Technology, School of Electrical and Electronic Engineer-ing, Huazhong University of Science and Technology, Wuhan 430074, China; [2]Guangdong Power Grid Corporation Limited, Dongguan Power Supply Bureau, Dongguan 523129, China

2:15pm – 2:30pm

OC2-4

Model-Based Workflows for Multi-Physics Design Optimization of Superconducting Accelerator Magnets

<u>Michal Maciejewski</u>[1], Jasmin Smajic[1], Bernhard Auchmann[2,4], Douglas Martins[2], Giorgio Vallone[3], Juerg Leuthold[1]

[1]ETH Zurich, Switzerland; [2]Paul Scherrer Institut, Villigen, Switzerland; [3]Lawrence Berkeley National Laboratory, Berkeley, USA; [4]TE-MSC, CERN, Switzerland

2:30pm – 2:45pm

OC2-5

Input Parameters Uncertainty Quantification of Finite Element Based Simulation Model for Broken Rotor Bar in an Induction Machine

<u>Md Masum Billah</u>[1], Floran Martin[1], Anouar Belahcen[1,2], Aswin Balasubramanian[1], Toomas Vaimann[2], Jan Sobra[3]

[1]Aalto University, Finland; [2]Tallinn University of Technology, Estonia; [3]University of West Bohemia, Czech Republic

Thursday, 20/Jan/2022

OD1: Wave propagation and electromagnetic compatibility

Time:
Thursday, 20/Jan/2022:
8:00am - 9:15am

Session Chair: **Prof. Arnulf Kost**
Elektrische Antriebstechnik, TU Berlin, Germany

8:00am - 8:15am **OD1-1**	**Finite Element Extraction of Frequency-Dependent Parasitics** Jonathan Stysch[1], Andreas Klaedtke[1], Herbert De Gersem[2] [1]Robert Bosch GmbH, Germany; [2]Technical University of Darmstadt, Germany
8:15am - 8:30am **OD1-2**	**Vibration Characteristic Analysis of Laminated Core under DC Bias by Using Coupled Magneto-Mechanical Model in Frequency Domain** Xiaojun Zhao[1], Zhuo Yi[1], Lingyun Zhang[1], Zhenbin Du[2], Lanrong Liu[2] [1]Department of Electrical Engineering, North China Electric Power University, Baoding 071003, China; [2]Institute of Power Transmission and Transformation Technology, Baoding, 071056, China
8:30am - 8:45am **OD1-3**	**Numerical Stability Analysis of Space-Time Finite Integration Method Based on Concept of Dependent Domain** Keinoshin Katsuki, Shogo Asahino, Takeshi Mifune, Tetsuji Matsuo Kyoto University, Japan
8:45am - 9:00am **OD1-4**	**An Integral Representation Model for the Nonstandard Finite-Difference Time-Domain Scheme** Tadao Ohtani[1], Yasushi Kanai[2], Nikolaos Kantartzis[3] [1]Asahikawa-shi, Japan; [2]Niigata Institute of Technology, Japan; [3]Aristotle University of Thessaloniki, Greece
9:00am - 9:15am **OD1-5**	**Analysis of Surface Current Distribution in a 2D Metamaterial** Sami Barmada[1], Nunzia Fontana[1], Leonardo Sandrolini[2], Mattia Simonazzi[2] [1]University of Pisa, Italy; [2]University of Bologna, Italy

PD-A1: Wave propagation and electromagnetic compatibility

Time:
Thursday, 20/Jan/2022:
9:30am - 11:15am

Session Chair: **Prof. Yasushi Kanai**
Niigata Institute of Technology, Japan

PD-A1-1	**Application of FFT PEEC Method to Grounded Coplanar Waveguide Structures and Surface Mounted Multi-Layer Ceramic Capacitors** Christian Riener[1,2], Thomas Bauernfeind[1,2], Riccardo Torchio[3], Klaus Roppert[1,2], Samuel Kvasnicka[1,2], Paul Baumgartner[2], Manfred Kaltenbacher[1,2] [1]Silicon Austria Labs, TU-Graz SAL GEMC Lab; [2]Graz University of Technology, Institute of Fundamentals and Theory in Electrical Engineering, Austria; [3]University of Padua, Department of Industrial Engineering, Italy
PD-A1-2	**A Modified Conformal One-Step Leapfrog ADI-FDTD for Modelling Lossy Dispersive Media** Hao Qiu, Zhenxin Li, Ruting Tang, Shuhong Wang, Naming Zhang State Key Laboratory of Electrical Insulation and Power Equipment, School of Electrical Engineering Xi'an Jiaotong University, Xi'an, 710049 China
PD-A1-3	**1-D FEM-Based Approach for Extracting Dimension-Independent Material Properties of Toroidal Ferrite Cores** Reda Elkhadrawy, Jay Panchal, Timo Tarhasaari, Kari Lahti, Paavo Rasilo Tampere University, Finland
PD-A1-4	**A Hybrid High-Order Method for the Indefinite Time-Harmonic Maxwell Problem** Matteo Cicuttin, Christophe Geuzaine University of Liege, Montefiore Institute B28, B-4000, Belgium

PD-A1-5   **Consistent Mode Propagation Analysis of Magnetically-biased Graphene Microstrips via an Efficient Finite-Difference Scheme**

Stamatios Amanatiadis[1], Tadao Ohtani[2], Theodoros Zygiridis[3], <u>Yasushi Kanai</u>[4], Nikolaos V. Kantartzis[1]

[1]Aristotle University of Thessaloniki, Greece; [2]21-17-134, Omachi, Asahikawa, Japan; [3]University of Western Macedonia, Greece; [4]Niigata Institute of Technology, Japan

PD-A1-6   **An Improved Locally Conformal FDTD Approach for Curved Perfect Electric Conducting Surfaces**

<u>Lucas Lobo Latorre Fortes</u>, **Sandro Trindade Mordente Gonçalves**

Centro Federal de Educação Tecnológica de Minas Gerais, Brazil

PD-A1-7   **Parallel Perfectly Matched Layer in Nonconforming Mixed-Element DGTD for Negative Index Metamaterials**

<u>Olivier Cotte</u>, **Dennis Giannacopoulos**

McGill University, Canada

PD-A1-8   **Optical Analysis of Fractal Nanostructured Materials using FDTD**

<u>Yoshihisa Fujita</u>[1], **Hiroaki Nakamura**[2,3], **Soichiro Ikuno**[4]

[1]Ritsumeikan University, Japan; [2]National Institute for Fusion Science, Japan; [3]Nagoya University, Japan; [4]Tokyo University of Technology, Japan

PD-A1-9   **High-accuracy electromagnetic field simulation based on voxel mesh smoothing**

<u>Amane Takei</u>[1], **Shinya Nakamura**[2], **Kaoru Yodo**[2], **Akio Miyoshi**[2]

[1]University of Miyazaki, Japan; [2]Insight, Inc.

PD-A1-10   **Electromagnetic Penetration and Reflection Analysis in Fractal Structures using Three-dimensional Empirical Mode Decomposition**

<u>Ran Dong</u>[1], **Yoshihisa Fujita**[2], **Hiroaki Nakamura**[3], **Soichiro Ikuno**[1]

[1]Tokyo University of Technology; [2]Ritsumeikan University; [3]National Institute for Fusion Science

PD-A1-11   **Electrostatic discharge simulation using a GPU-accelerated DGTD solver targeting modern graphics hardware**

<u>Matteo Cicuttin</u>[1], **Peter Binde**[2], **Christophe Geuzaine**[1]

[1]University of Liege, Montefiore Institute B28, B-4000, Belgium; [2]Dr. Binde Ingenieure Design & Engineering

PD-A2: Wave propagation and electromagnetic compatibility

Time:
Thursday, 20/Jan/2022:
9:30am - 11:15am

Session Chair: **Prof. Manfred Kaltenbacher**
TU Graz, Austria

PD-A2-1   **Geometry Optimization of Broadband and Efficient Plasmonic Modulator Antennas**

<u>Hande Ibili</u>, **Arif Can Gungor, Jasmin Smajic, Juerg Leuthold**

Institute of Electromagnetic Fields (IEF), ETH Zurich, Switzerland

PD-A2-2   **Novel Design of Dual Voice Coil Microspeaker with Reduced Back Volume**

Zhi-Xiong Jiang, Ki-Hong Park, <u>Sang-Moon Hwang</u>

Pusan National University, Korea, Republic of (South Korea)

PD-A2-3   **A Study of the Shape of Polar Anisotropic Magnetizing Yoke to Reduce the Dead Zone of a Ring Bonded Magnet**

<u>Jeong-Yeon Min</u>, **Dong-Woo Nam, Won-Ho Kim**

Gachon University, Korea, Republic of (South Korea)

PD-A2-4   **Large Power Transformers Under the Effect of Geomagnetically Induced Currents: Behavioral Study**

Mohammed Naidjate, <u>Nicolas Bracikowski</u>

University of Nantes, France

PD-A2-5   **Computation of Coupling Parameters between Neighboring Panels in Photovoltaic Arrays**

<u>Alessandro Formisano</u>[1], **Jesus C. Hernandez**[2]

[1]Università della Campania "Luigi Vanvitelli", Aversa (CE), Italy; [2]University of Jaen, Jaén, Spain

PD-A2-6

Multiscale Finite Element Method for Ventilation Panels

Michael Leumüller[1], Karl Hollaus[1,2]

[1]Technische Universität Wien, Austria; [2]Silicon Austria Labs, Austria

PD-A2-7

Metal Object Detection for Wireless Power Transfer Using Differential Coils Based on Neural Network

Yunyi Gong, Yoshitsugu Otomo, Hajime Igarashi

Hokkaido University, Japan

PD-A2-8

Numerical Analysis of DC-biased Eddy Current Sensor Considering Hysteresis Effects

Dae Yong Um, Min Jae Kim, Hyo Seung Nam, Jung Min Jo, Gwan Soo Park

Pusan National University, Korea, Republic of (South Korea)

PD-A2-9

Novel Inductive Flow Meter Design with Feedback Based on Measurement of Chemical Properties

Pavel Karban, Iveta Petrášová, Petr Kropík, Lenka Stachová

University of West Bohemia, Czech Republic

PD-A2-10

Harmonic quasi-stationary modeling of coaxial cable impedance via Darwin approximation

Klaus Roppert[1,2], Susanne Bauer[1], Samuel Kvasnicka[1,2], Christian Tuerk[3], Manfred Kaltenbacher[1,2]

[1]Institute of Fundamentals and Theory in Electrical Engineering, Technical Graz, Graz, Austria; [2]Silicon Austria Labs, TU-Graz, SAL GEMC Lab, Austria; [3]Federal Ministry of Defense, Vienna, Austria

PD-A2-11

Projection of Magnetic Vector Potential on Large Phantoms for Low Frequency Magnetic Field Numerical Dosimetry

François Tavernier[1], Riccardo Scorretti[1], Noël Burais[1], Hubert Razik[1,3], Jean-Yves Gaspard[2]

[1]Univ Lyon, Université Claude Bernard Lyon 1, INSA Lyon, ECLyon, CNRS, Ampère, F-69100, Villeurbanne, France; [2]Mag-tech (www.magtech.fr), 297 rue des Pinsons, Gleize, F-69400, France; [3]School of Logistics Engineering, Shanghai Maritime University, PRC

PD-A2-12

Worst Case Postures Scenario Assessment For The Human Exposure Around A High Power Wireless Transfer System

Paul Lagouanelle[1,2], Fabio Freschi[1], Lionel Pichon[2], Luca Giaccone[1]

[1]Dipartimento Energia ``G. Ferraris'', Politecnico di Torino, 10129 Torino, Italy; [2]GeePs – Group of electrical engineering - Paris, UMR CNRS 8507, CentraleSupélec, Université Paris-Saclay, Sorbonne Université, 3 & 11 rue Joliot-Curie, Plateau de Moulon 91192 Gif-sur-Yvette, France

PD-P1: Novel computational methods for machines, biomagnetics, and education

Time:
Thursday, 20/Jan/2022:
11:30am - 1:15pm

Session Chair: **Prof. Antonios G. Kladas**
National Technical University of Athens, Greece

PD-P1-1

Hybrid Analytical Model of Halbach Array Permanent-Magnet Motors Considering Iron Saturation
Zhaokai Li, Xiaoyan Huang, Zhuo Chen, Tingna Shi
Zhejiang University, China, People's Republic of China

PD-P1-2

Co-Simulation Based on the PGD Approach of a Low Frequency Electromagnetic Device Coupled with an Electrical Circuit

Jérôme Tomezyk, Thomas Henneron
University of Lille, L2EP, France

PD-P1-3

An Integrated Analytical Model of Permanent Magnet Machines System

Bining Zheng[1], Zhen Zhang[2], Tingna Shi[1], Yanfei Cao[1], Changliang Xia[1]

[1]College of Electrical Engineering, Zhejiang University, Hangzhou 310027, China; [2]Zhejiang University Advanced Electrical Equipment Innovation Center, Hangzhou 311107, China

PD-P1-4

A General Pattern of Assisted Flux Barriers for Design Optimization of an Asymmetric V-shape Interior Permanent Magnet Machine

Yanding Bi[1], Jiahui Huang[1], Huihuan Wu[1], Weinong Fu[2], Shuangxia Niu[1], Xing Zhao[1]

[1]The Hong Kong Polytechnic University, Hong Kong S.A.R. (China); [2]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China

PD-P1-5

A Novel Asymmetric Hybrid-pole Permanent Magnet Machine and Its Design Method

Jiahui Huang[1], Yanding Bi[1], Huihuan Wu[1], Weinong Fu[2], Shuangxia Niu[1], Xing Zhao[1]
[1]The Hong Kong Polytechnic University, Hong Kong S.A.R. (China); [2]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences,Shenzhen, China

PD-P1-6

Design of Non-fixed frequency Metamaterial and Its Application in Wireless Charging System

Yingying WANG, Xingyu ZHONG, Xu CHEN
China University of Mining and Technology, Beijing, China, People's Republic of China

PD-P1-7

Modeling and Dynamic Analysis of Three-Degree-of-Freedom Spherical Actuator under Deep Reinforcement Learning Control

Hirotsugu Fusayasu[1], Akira Heya[2], Katsuhiro Hirata[2]
[1]Panasonic Corporation, Japan; [2]Osaka University, Japan

PD-P1-8

Advanced Circuit Approach for Induction Machines Parametrized by Field Calculations

Daniel Biro[1], Franz Diwoky[1], Erich Schmidt[2]
[1]AVL List GmbH, Austria; [2]Vienna University of Technology

PD-P1-9

A Dynamic Phasor Finite Element Model to Simulate a Grid-Connected Doubly Fed Induction Generator

Mohamed A. Almozayen, Andrew M. Knight
University of Calgary, Canada

PD-P1-10

A Fast Model for Permanent Magnet Machines with Segment Stator Based on Magnetic Equivalent Circuit

Baocheng Guo[1], Ahmed Hemeida[2], Haorui GE[1], Xin QIU[1]
[1]Nanjing Normal University, China, People's Republic of; [2]Cairo University, Egypt

PD-P1-11

Modeling and Dynamic Analysis of Two-Degree-of-Freedom Voice Coil Actuator Driven by Three-Phase

Akira Heya, Katsuhiro Hirata
Osaka University, Japan

PD-P1-12

A Novel Method for Determining Residual Flux Density of Power Transformers Based on Phase Difference

Youhua Wang, Yuzhan Ren, Chengcheng Liu
Hebei University of Technology, China, People's Republic of China

PD-P1-13

Level-set based method to model high-performance commutator

Baptiste Ristagno[1], Geoffrey Devornique[2], Julien Fontchastagner[1], Denis Netter[1], Noureddine Takorabet[1], Nicolas Labbe[2]
[1]Université de Lorraine, GREEN, F-54000, Nancy, France; [2]Valeo Electrical Systems, 38070 Saint-Quentin-Fallavier, France

PD-P1-14

Frequency-Dependent Behavior of the Lumped Parameter Model of the Windings of Electrical Machines in Transient Simulations

Kaoutar Hazim[1,2], Guillaume Parent[1], Stéphane Duchesne[1], Christophe Geuzaine[2]
[1]Univ. Artois, UR 4025, Laboratoire Systèmes Électrotechniques et Environnement (LSEE), Béthune, F-62400, France; [2]Department of Electrical Engineering and Computer Science, Montefiore Institute, University of Liege, Liège B-4000, Belgium

PD-P1-15

A Novel Approach based on Recurrent Neural Networks Applied to Adaptive Beamforming

Ioannis Mallioras[1,6], Zaharias Zaharis[1], Pavlos Lazaridis[2], Ioannis Chochliouros[3], Keyur Mistry[4], Tian Loh[5]
[1]Aristotle University of Thessaloniki, Greece; [2]University of Huddersfield, UK; [3]Hellenic Telecommunications Organization S.A. Member of the Deutsche Telekom Group of Companies, Greece; [4]Oxford Space Systems, UK; [5]National Physical Laboratory, UK; [6]Maggioli SpA, Santarcangelo di Romagna, Italy

PD-P1-16

Comparison of DC-Biased Vernier Reluctance Linear Machines Under Different Winding Pole Pairs and Secondary Poles Combinations

Zhenyang Qiao[1], Dingguo Shao[1], Jian Luo[1], Weinong Fu[2], Yunpeng Zhang[1]
[1]School of Mechatronic Engineering and Automation, Shanghai University, Shanghai, China; [2]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China

PD-P1-17   **Novel Computation Method of Carrier Harmonics Losses for Synchronous Reluctance Motors**

Sihun Noh[1], Sung-Bae Jun[1], Yong-Jae Kim[2], Sang-Yong Jung[1]
[1]Sungkyunkwan University, Korea, Republic of (South Korea); [2]Chosun University, Korea, Republic of (South Korea)

PD-P1-18   **A Novel Ontological Structure Design for Power Transformer Considering Joints and Magnetostriction**

Li Jingsong[1], Liang Zhenzong[1], Li Linyu[1], Qi Yushuai[1], Li Guofeng[1], Zheng Nianfeng[2], Wang Zhongqing[2]
[1]Dalian University of Technology, China, People's Republic of; [2]R & D, LUTE Electric Co., Ltd, China, People's Republic of China

PD-P1-19   **A General Method to Analyze Cogging Torque and Torque Ripple of Rotating Machines by Time and Space Harmonic Magnetic Fields**

Katsumi Yamazaki, Kento Utusnomiya, Kota Shimada
Chiba Institute of Technology, Japan

PD-P2: Novel computational methods for machines, biomagnetics, and education

Session Chair: **Prof. Sheppard Salon**
RPI, United States of America

PD-P2-1   **Comparison of Electromagnetic Field Distribution Estimated by Three-Channel U-net Neural Network**

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PD-P2-2   **Nonlinear Analytical Modelling of Dual-rotor Segmented-stator Axial-Flux Permanent Magnet Machines for Open-Circuit Field Prediction**

Lun Jia, Mingyao Lin, Keman Lin, Wei Le, Anchen Yang
Southeast University, China, People's Republic of China

PD-P2-3   **Analytical Model of Flux Fringing Effect in Surface Permanent Magnet Motor by Schwarz-Christoffel Mapping**

Baocheng Guo[1], Yunlu Du[2], Fei Peng[2], Jianning Dong[3], Yunkai Huang[2]
[1]Nanjing Normal University, China; [2]Southeast University, China; [3]Delft University of Technology, Netherlands

PD-P2-4   **Magnetic Field Calculation in Axial Flux Permanent Magnet Motor with Rotor Eccentricity**

Baocheng Guo[1], Yunlu Du[2], Fei Peng[2], Jianning Dong[3], Yunkai Huang[2]
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PD-P2-5   **Modified Winding Function Analysis of Synchronous Reluctance Motor for Design Iteration Purposes**

Muhammad Usman Naseer, Ants Kallaste, Bilal Asad, Toomas Vaimann, Anton Rassõlkin
Dept. of Electrical Power Engineering and Mechatronics, Tallinn University of Technology, Tallinn 19086 Estonia

PD-P2-6   **A Novel Air-cored Linear-Rotary Induction Machine and its 3-D Hybrid Analytical Magnetic Field Analysis**

Ping Jin, Yujing Guo, Xinyi He
Hohai University, China, People's Republic of China

PD-P2-7   **Wireless Power Transfer System in Dynamic Conditions: a Field-Circuit Analysis**

Manuele Bertoluzzo[1], Paolo Di Barba[2], Michele Forzan[1], Maria Evelina Mognaschi[2], Elisabetta Sieni[3]
[1]University of Padua; [2]University of Pavia; [3]University of Insubria, Italy

PD-P2-8   **A Study on the Improvement of Electronic Brake using Iron Loss**

Jae-Kwang Lee[1], Yong Woo Shin[1], Rae-Eun Kim[1], Jung-Moo Seo[1], Dong-Hoon Jung[2]
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PD-P2-9

A Study on Harmonic Reduction According to the Combination of the Number of Pole/slots of an External Synchronous Generator for Drones

Jeongwon Kim[1], Junho Kang[1], Yeji Park[1], Hyunwoo Kim[1], Jae-jun Lee[3], Jaenam Bae[2], Sol Kim[3], Ju Lee[1]

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PD-P2-10

Optimal Electromagnetic Design of a Solid-State Transformer

Jorge Lara[1], Concepcion Hernandez[1], Marco Arjona[1], David A. Lowther[2]

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PD-P2-11

Design of the Electrical Main Insulation of Power Transformers Using FEA and a Knowledge-Based System

Concepcion Hernandez[1], Marco Arjona[1], Jorge Lara[1], Enrique Melgoza[2], Karla Puente[3], David Lowther[4]

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PD-P2-12

Effective electromagnetic force calculation for NVH simulation in electric vehicle traction drives

Dan Ilea, B.S. Bilquis Mohamodhosen, Christopher Peter Riley

SIMULIA Opera, Dassault Systemes, United Kingdom

PD-P2-13

Accuracy Assessment of Simplified Computation of Active and Passive Magnetic Shielding for Optically Pumped Magnetometers

Bojana Petkovic[1], Marek Ziolkowski[1,2], Hermann Sonntag[3,4], Hannes Töpfer[1], Jens Haueisen[3]

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PD-P2-14

Mitigation of numerical artifacts using tetrahedral meshes in low frequency numerical dosimetry

Alice Conchin Gubernati[1], Fabio Freschi[1], Luca Giaccone[1], Riccardo Scorretti[2]

[1]Dipartimento Energia "G. Ferraris", Politecnico di Torino; [2]Univ Lyon, INSA Lyon, EC Lyon, CNRS Ampére,

PD-P2-15

Posture-free exposure calculation with realistic phantom models

Alice Conchin Gubernati[1], Fabio Freschi[1], Luca Giaccone[1], Riccardo Scorretti[2]

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PD-P2-16

Evoked Compound Action Potential Studies based on Cochlear Implant Models

Charles T. M. Choi, Dong Lin Wu

National Yang Ming Chiao Tung University, Taiwan

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Efficient Assessment of the Human Exposure to Low-Frequency Magnetic Fields Based on Free Space Field Measurements

Norman Haussmann[1], Martin Zang[1], Steven Stroka[1], Robin Mease[1], Benedikt Schmuelling[2], Markus Clemens[1]

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PD-P2-18

Experimental Setup for Demonstration and Analyzing of Magnetomotive Forces in Education

Alexander Kalimov, Sergey Vazhnov, Simon Dubitsky

Peter the Great St.Petersburg Polytechnic University, Russian Federation

PD-P2-19

Solution of a Coupled Magneto-Mechanical 2D Problem Using FEM in Python with FEniCS

Manuel Pineda-Arciniega, Marco Arjona, Concepción Hernandez

TNM La Laguna Institute of Technology, Mexico

OD2: Novel computational methods for machines and devices

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Session Chair: **Prof. Herbert De Gersem**
Technische Universität Darmstadt, Germany

1:30pm - 1:45pm

OD2-1

Physics informed Neural Networks for Electromagnetic Analysis

Arbaaz Khan, David Lowther
McGill University, Canada

1:45pm - 2:00pm

OD2-2

Isogeometric Mortaring for the 3D Simulation of Electric Machines

Melina Merkel[1,2], Bernard Kapidani[3], Sebastian Schöps[1,2], Rafael Vázquez[3]
[1]Computational Electromagnetics Group, Technische Universität Darmstadt; [2]Centre for Computational Engineering, Technische Universität Darmstadt; [3]Chair of Numerical Modelling and Simulation, École Polytechnique Fédérale de Lausanne

2:00pm - 2:15pm

OD3-3

Model Order Reduction Applied to a Non-Linear Finite Element Model of a Squirrel Cage Induction Machine

Martin Nell, Fabian Müller, Kay Hameyer
Institute of Electrical Machines (IEM), RWTH Aachen University, Germany

Keynote 2: Future Trends in Optimal Design of Electromagnetic Devices

Time:
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Future Trends in Optimal Design of Electromagnetic Devices
Prof. Paolo Di Barba
University of Pavia, Italy

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Nyzkiy, Roman	PA-P1	**Repetto**, Maurizio	PB-A1, PB-P1
Ocon-Valdez, Rodrigo	PB-A2	**Rho**, Seung-Eun	PA-P1
Ogawa, T.	PB-A1	**Riener**, Christian	PA-P1, PD-A1
Oh, Seungtaek	PA-A1	**Riley**, Christopher Peter	PD-P2
Ohtani, Makoto	PC-A1	**Ristagno**, Baptiste	PD-P1
Ohtani, Tadao	OD1, PD-A1	**Rizzo**, Rocco	PC-A2
Okamoto, Yoshifumi	OC2, PA-P2	**Rodriguez-Rodriguez**, Juan Ramon	PA-A1
Okazaki, Keichi	PA-P2	**Rodríguez**, Eduardo	PA-A1
Olivares-Galvan, Juan Carlos	PB-P1, PB-A2	**Romano-Abarca**, Efrain	PB-P1
Osanai, Kenta	PA-P2	**Romero-Salazar**, Carolina	PB-P2
Ostrowski, Joerg	OA2	**Roppert**, Klaus	PA-P1, PB-P2, PC-P1, PD-A1, PD-A2
Otomo, Yoshitsugu	PC-A1, PC-A2, PD-A2		
Otsuka, S.	PB-A1	**Ruda**, Aurélia	PB-A1
Park, Il Han	OC1, PA-A2, PA-P1, PB-A2, PC-A1	**Russo**, Alessandro	PC-P2
		Ruuskanen, Janne	OB1
Paganotti, André Luiz	PA-P2, PC-P2	**Ruzbehi**, Shabnam	PC-P2
Panchal, Jay	PD-A1	**Ryu**, Jaeho	PA-P1
Parekh, Vivek	OC1	**Scorretti**, Riccardo	OB2
Parent, Guillaume	PD-P1	**Sixdenier**, Fabien	OB2
Park, Byungsu	PA-A2	**Statra**, Yazid	PA-A1
Park, Chan-Bae	PC-A2	**Sabariego**, Ruth V.	OA1, OB2
Park, Gwan Soo	PD-A2	**Sadowski**, Nelson	PA-A1
Park, Gwi-Geun	PB-P1	**Saitoh**, Ayumu	PB-A1
Park, Jong Oh	PB-A2	**Sakkas**, Georgios K.	PC-P1
Park, Ki-Hong	PA-P2, PD-A2	**Saldanha**, Rodney Rezende	PA-P2, PC-P2
Park, Soo-Hwan	PC-A1	**Salmi**, Tiina	OB1
Park, Yeji	PA-A1, PD-P2	**Salon**, Sheppard	PD-P2
Passarotto, Mauro	PA-P2	**Sandrolini**, Leonardo	OD1
Pechlivanidou, Maria Sofia C.	PC-P1	**Sani**, Luca	PC-A2
Peng, Chen	PC-A2	**Sasaki**, Hidenori	PC-A2
Peng, Fei	PD-P2	**Sato**, Hayaho	PC-A1
Perriard, Yves	PC-P1, PC-P2	**Sato**, Tomohiro	PC-A1
Perrin-Bit, Rémy	PB-A1	**Schettini**, Francesco	PC-A2
Petkovic, Bojana	PD-P2	**Schier**, Peter	PC-P1
Petrášová, Iveta	PA-A2, PD-A2	**Schmidt**, Erich	PB-P1, PD-P1
Pichon, Lionel	PD-A2	**Schmitz**, Lucas	PB-A2
Pierquin, Antoine	PB-A1, PB-P2	**Schmuelling**, Benedikt	PB-A2, PD-P2
Pineda-Arciniega, Manuel	PD-P2	**Schneider**, Matthias	PC-P2
Pitassi, Silvano	PA-P1, PA-A2	**Schoeps**, Sebastian	OA1
Pourkeivannour, Siamak	PA-P1	**Schueller**, Michael	PC-P2
Puente, Karla	PD-P2	**Schuhmann**, Rolf	PA-A2
Purnode, Florent	PB-P2	**Schäfer**, Uwe	PA-A1
Pyo, Hyun-Jo	PC-A2, PC-P1	**Schöbinger**, Markus	PA-A2, PA-P2
Pánek, David	PB-P2	**Schöps**, Sebastian	OC1, OD2, PC-P2
Qin, Wei	PA-P2	**Scorretti**, Riccardo	PD-A2, PD-P2
Qiu, Xin	PD-P1	**Semba**, Kazuki	PA-P2
Qiao, Zhenyang	PD-P1	**Seno**, Ryota	PB-A2
Qiu, Aici	PB-P2	**Seo**, Jung-Moo	PD-P2

Seri, Paolo	PB-P2	**Torchio**, Riccardo	PB-P1, PD-A1
Shao, Dingguo	PD-P1	**Trevisan**, Francesco	PA-P1
Shchepunov, Vyacheslav	PB-P1	**Trichet**, Didier	PB-A1, PB-P2
Shen, Sheng	PA-P2	**Trillaud**, Frederic	PA-A1, PB-P2
Shen, Yixiang	OC1	**Tsukerman**, Igor	PA-P2
Shi, Minxia	PB-P2	**Tuerk**, Christian	PD-A2
Shi, Tingna	PD-P1	**Ugwuanyi**, Nnaemaka	PB-A1
Shimada, Kota	PD-P1	**Um**, Dae Yong	PD-A2
Shimizu, Hidehiro	PB-P2	**Utusnomiya**, Kento	PD-P1
Shimonishi, Toru	PA-A1	**V. Sabariego**, Ruth	PA-A2
Shin, Hyo-Seob	PB-P1	**Vaimann**, Toomas	OC2, PC-P2, PD-P2
Shin, Kyung-Hun	PC-A1	**Valdivieso**, Carlos A.	PA-A2
Shin, Sun-Yong	PC-A1	**Vallone**, Giorgio	OC2
Shin, Yong Woo	PD-P2	**Vanbroekhoven**, Brent	OA1
Shuai, Kang	OC2	**Vanderheyden**, Benoît	PA-A1, PA-P1
Siau, Jonathan	PB-A1	**Vazhnov**, Sergey	PD-P2
Sieni, Elisabetta	PD-P2	**Vialardi**, Enrico	PB-A1
Silva Rezende, Rodrigo	PA-A2	**Villone**, Fabio	PA-P2
Silva, Rodrigo	PC-P1	**Vàzquez Hernandez**, Rafael	OB1
Simona, Abele	PC-P2	**Vázquez**, Rafael	OD2
Simonazzi, Mattia	OD1	**Wang**, Yingying	PD-P1
Sirois, Frédéric	PA-P1	**Wang**, Bingdong	PC-A2
Smajic, Jasmin	OC2, PB-P1, PB-P2, PC-P2, PD-A2	**Wang**, Chuan	PC-A2
Smith, P. Alex	PA-A2, PC-P2	**Wang**, Daohan	PC-A2
Sobra, Jan	OC2	**Wang**, Fei	PC-A2
Soeda, Takeshi	PC-A1	**Wang**, Jin	OC2
Soma, Shingo	PC-A1	**Wang**, Shuhong	PD-A1
Son, Ji-Chang	PC-A1	**Wang**, Xiuhe	PC-A2
Sonntag, Hermann	PD-P2	**Wang**, Yaqi	OB2
Sousa, Matheus Henrique	PC-P2	**Wang**, Yaxin	PA-A2, PC-P2
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Squilllari, Paolo	PB-P1	**Watanabe**, Kota	PC-A1
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Stysch, Jonathan	OD1	**Wu**, Dong Lin	PD-P2
Suetsugu, Yoshihisa	PC-A1	**Wu**, Guangning	OC1
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Sun, Zhen	PC-A1	**Wu**, Tong	PA-A1
Sykulski, Jan K.	OA1, OC1, PC-A2, PC-P1	**Xia**, Changliang	PD-P1
Tagami, Daisuke	PA-A2	**Xia**, Meng	PC-A1, PC-P2
Taha, Houssein	PA-A1	**Xiao**, Song	OC1
Tahkola, Mikko	PB-A2	**Xiu**, Liancheng	PA-A1, PB-P1
Takahashi, Yasuhito	OA2, PB-A1	**Xu**, Huawei	PB-P2
Takei, Amane	PA-P1, PD-A1	**Xu**, Lei	PB-A1
Takeuchi, Y.	PB-A1	**Xu**, Xiaoyu	PB-A1, PB-A2
Takorabet, Noureddine	PD-P1	**Xu**, Xiaozhuo	PC-A1
Tang, Ruting	PD-A1	**Xu**, Ya	PB-P1
Tang, Zuqi	PA-A1, PA-P2, PB-A1	**Xu**, Zheng	PA-P2
Tarek, Md Tawhid Bin	PA-P2	**Xu**, Zhiwei	PA-A2
Tarhasaari, Timo	OB1, PD-A1	**Xuan**, Liang	PA-P2
Tavernier, François	PD-A2	**Yang**, Fan	PB-P1
Teixeira, Julio Carlos	PA-A2	**Yamada**, Takashi	PA-P2
Thabuis, Adrien	PC-P1, PC-P2	**Yamano**, Masaki	OC2
Thomas, Olivier	PB-A1	**Yamashita**, Yuki	PA-P2
Tian, Yakun	PB-P2	**Yamazaki**, Katsumi	PD-P1
Tiemann, Myrel	PB-A2	**Yan**, Chenguang	PB-P1
Tobita, Miwa	OB1	**Yan**, Shuai	PB-A1, PB-A2
Tomezyk, Jérôme	PB-A1, PD-P1	**Yang**, Anchen	PD-P2
Töpfer, Hannes	PD-P2	**Yang**, Fan	PB-A1

Yang, Hye-Won	PC-A2
Yang, In-Jun	PC-A2
Yang, Liu	PB-P2
Yang, Qingxin	PB-P1, PD-P2
Yang, Shiyou	PA-A2, PC-A1, PC-A2, PC-P2
Yang, Xiao	PC-A1
Yi, Zhuo	OD1
Yin, Shuli	PA-P1
Yodo, Kaoru	PD-A1
Yoon, Jinhee	PA-A2
Yu, Xiao	PA-A2
Yu, Xuze	PA-A1
Yuhua, Ma	PA-P2
Yushuai, Qi	PD-P1
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Zhang, Baohui	PB-P1
Zhang, Changgeng	PB-P1, PD-P2
Zhang, Fengyu	PC-A2
Zhang, Lingyun	OD1
Zhang, Louxing	PA-P1
Zhang, Naming	PD-A1
Zhang, Peng	PB-P1
Zhang, Ping	PB-A2
Zhang, Tianjue	PC-A2
Zhang, Wenting	PD-P2
Zhang, Xuanrui	PB-P2
Zhang, Yunpeng	PD-P1
Zhang, Zhen	PD-P1
Zhao, Xiaojun	OB2, OD1, PB-P2
Zhao, Xing	PC-A1, PC-A2, PD-P1
Zhao, Yanpu	PA-A1
Zheng, Bining	PD-P1
Zhenzong, Liang	PD-P1
Zhongqing, Wang	PD-P1
Zhou, Hongji	PC-A2
Zhou, Jia	OC2
Zhou, Jie	OC1
Zhou, Libing	OC2
Zhou, Xian	PB-P1
Zhu, Xiongjian	PA-P1
Ziolkowski, Marek	PD-P2
Zou, Guoping	PC-A2
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Zygiridis, Theodoros	PD-A1

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