

THE 12TH INTERNATIONAL SYMPOSIUM ON ELECTRIC AND  
MAGNETIC FIELDS  
ONLINE, 6-8 JULY 2021

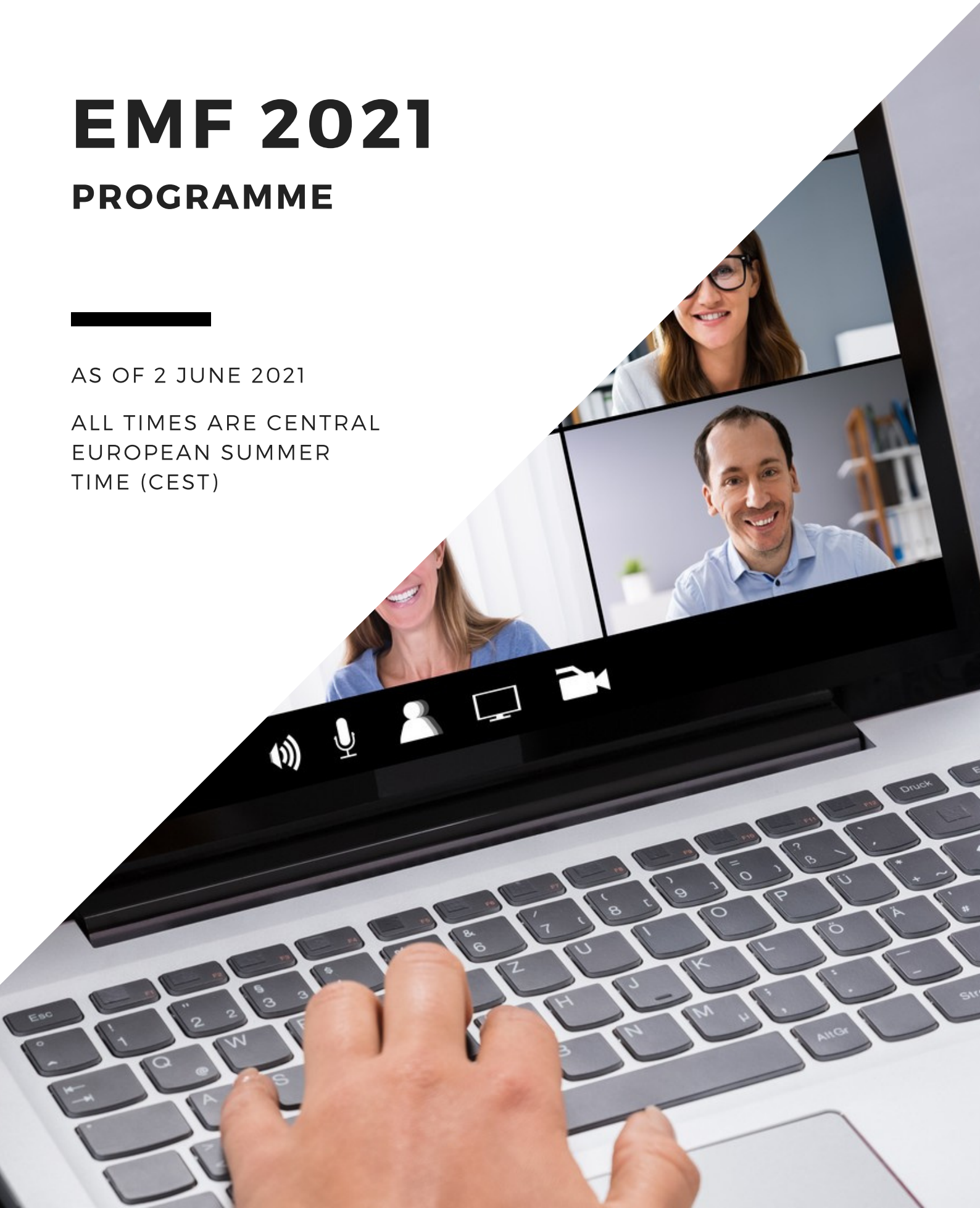
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# EMF 2021

## PROGRAMME

AS OF 2 JUNE 2021

ALL TIMES ARE CENTRAL  
EUROPEAN SUMMER  
TIME (CEST)



## Tuesday 6 July 2021

### 08:30-08:45 hrs : Opening session

### 08:45-10:00 hrs : Session 1

#### **145 A Class of Electromagnetic Quasistatic Darwin Field Formulations Based on Semi-Discrete Full Maxwell Continuity Gauge Equations**

Clemens, Markus (1); Henkel, Marvin-Lucas (1); Kasolis, Fotios (1); Schoeps, Sebastian (2)  
1: University of Wuppertal, Germany; 2: Technical University of Darmstadt

#### **140 Modeling of PCB based on Darwin's model combined with degenerated prism elements**

Taha, Houssein (1); Henneron, Thomas (1); Tang, Zuqi (1); Le-Menach, Yvonnick (1); Ducreux, Jean-Pierre (2); Goursaud, Benjamin (2)  
1: Univ. Lille, Arts et Metiers Institute of Technology, Centrale Lille, France; 2: EDF R&D, ERMES, France

#### **139 Quasistatic Electromagnetic Time Domain Field Calculations Comparing Two-Step Darwin and Full Maxwell Formulations**

Henkel, Marvin-Lucas; Kasolis, Fotios; Clemens, Markus  
University of Wuppertal, Germany

#### **161 Integro-Differential Formulations for Eddy Current Problems**

Wimmer, Georg (1); Lange, Sebastian (2)  
1: University of Applied Sciences Würzburg-Schweinfurt, Germany; 2: Bundeswehr Research Institute for Protective Technologies and CBRN Protection, Germany

#### **160 Semi-analytical Method for the Modeling of Thin Wires Taking Skin- and Proximity Effects into Account**

Velasco, Jonathan (1); Henrotte, Francois (1,2); Geuzaine, Christophe (1)  
1: Université de Liege, Belgium; 2: Université Catholique de Louvain, Belgium

### 10:30-12:00 hrs : Session 2

#### **118 3D Modelling of Inductive and Capacitive Coupling Between Surface-Mounted Multi-Layer-Capacitors**

Riener, Christian (1,2); Bauernfeind, Thomas (1,2); Baumgartner, Paul (1); Hackl, Herbert (2); Ibel, Martin (2); Kvasnicka, Samuel (1,2); Prestros, Ralph (2); Roppert, Klaus (1,2); Kaltenbacher, Manfred (1,2)  
1: Technical University of Graz, Austria; 2: Silicon Austria Labs, TU-Graz SAL GEMC Lab, Austria

#### **129 New commutator system for novel brushed synchronous machines**

Ristagno, Baptiste (1); Devornique, Geoffrey (2); Giraud, Dominique (1); Fontchastagner, Julien (1); Netter, Denis (1); Takorabet, Nouredine (1); Labbe, Nicolas (2)  
1: University of Lorraine, 2 Avenue de la forêt de Haye, 54500 Vandoeuvre-lès-Nancy, France; 2: Valeo, 10 Rue du Revolay, 38070 Saint-Quentin-Fallavier, France

**116 The Effects of Applying Ferro Fluid to Permanent Magnet Direct Current Motor**

Oyman Serteller, Necibe fusun  
Marmara University, Turkey

**126 Energy Transmission System Rectenna for Smart Buildings**

OUNESLI, Zahira (1); Yagoub, Mustapha (2); Touhami, Rachida (1)  
1: Université des Sciences et de la Technologie USTHB, Alger, 16111, Algérie; 2: 2 Ecole de Science Informatique et de Génie Electrique, Université d'Ottawa, Ottawa, ON, K1N 6N5, Canada

**137 Magnetic Field Exposure Simulations of Human Bodies close by a Wireless Power Transfer System of an Electrically Powered Taxi**

Zang, Martin; Haussmann, Norman; Mease, Robin; Clemens, Markus; Schmuelling, Benedikt  
University of Wuppertal, Germany

**110 A Real-Time Fault Identification Procedure in Magnetic Diagnostic Systems: the Mirror Approach.**

Andrea Gaetano Chiariello (1,2), Antonio Iaiunese (3), Raffaele Martone (2), Pasquale Zumbolo (3)  
1: Università degli Studi della Campania "Luigi Vanvitelli ", Italy; 2: CREATE Consortium, Napoli, Italy; 3: Università degli Studi di Padova, Italy

**13:00 hrs - 14:00 hrs : Invited talk 1: Modelling superconductors: from materials to applications**

**Mark Ainslie, University of Cambridge (UK)**

**14:00-15:00 hrs : Session 3****141 Stability of H-A and T-A Finite Element Formulations**

Dular, Julien (1); Harutyunyane, Mané (2); Schöps, Sebastian (2); Vanderheyden, Benoît (1); Geuzaine, Christophe (1)  
1: Department of Electrical Engineering and Computer Science, University of Liège, Liège, Belgium; 2: T.U. Darmstadt, Darmstadt, Germany

**157 Automatic Mode Recognition and Exploration for Superconducting Cavities using Shape Morphing and Eigenvalue Tracking**

Ziegler, Anna (1,3); Georg, Niklas (1,2,3); Schöps, Sebastian (1,3)  
1: Technische Universität Darmstadt, Germany; 2: Technische Universität Braunschweig, Germany; 3: Centre for Computational Engineering, Technische Universität Darmstadt, Germany

**107 Damper design in superconducting wind turbine generators by analytical and numerical models**

Köster, Robin; Binder, Andreas  
Technical University of Darmstadt, Germany

**105 Quasi-3-D Spectral Wavelet Method for a Thermal Quench Simulation**

Bundschuh, Jonas (1); D'Angelo, Laura Anna Maria (1,2); De Gersem, Herbert (1,2)  
1: Institut für Teilchenbeschleunigung und Elektromagnetische Felder (TEMF), Technische Universität Darmstadt, Germany; 2: Centre for Computational Engineering, Technische Universität Darmstadt, Germany

**15:30-16:30 hrs : Session 4**

**101 A tunable magnetic stimulation system for elucidating the role of PEMF stimulation in bone tissue maturation in vitro in view of precision orthopedic medicine**

Canova, Aldo; Quercio, Michele; Gabetti, Stefano; Massai, Diana  
Politecnico di Torino, Italy

**144 Interwinding Capacitance Models for Transient Guitar Pickup Response Analysis**

Kotiuga, Peter Robert (1); Li, Ji (2)  
1: Boston University, United States of America; 2: National University of Defense Technology

**154 Analysis of efficiency and acoustic noise emission of different voltage generation methods and topologies of resistance spot welding systems**

Habjan, Gašper; Petrun, Martin  
Faculty of Electrical Engineering and Computer Science, Slovenia

**156 A FEM-BEM multiphysics coupling for the modeling of magnetoelectric composite structures**

Urdaneta Calzadilla, Alberto; Chadebec, Olivier; Galopin, Nicolas; Niyonzima, Innocent; Meunier, Gerard  
Univ. Grenoble Alpes, CNRS, Grenoble INP, G2Elab, F-38000 Grenoble

**Wednesday 7 July 2021****08:30-10:00 hrs : Session 5****111 A time discretization method for solving an electromagnetic contact problem with moving conductor**

Le, Van Chien; Slodicka, Marian; Van Bockstal, Karel  
Ghent University, Belgium

**136 Key Structures behind Discretization Strategies in Electromagnetism**

Kettunen, Lauri; Rossi, Tuomo  
University of Jyväskylä, Finland

**130 Low-Frequency Stabilization of Electro-Quasistatic Field Formulations**

Kasolis, Fotios; Henkel, Marvin-Lucas; Clemens, Markus  
University of Wuppertal, Germany

**143 Repairing the metric behind the space-time Maxwell's equations**

Hauser, Julia Ines Mareike (1); Kurz, Stefan (2); Steinbach, Olaf (1)  
1: Graz University of Technology, Austria; 2: Technische Universität Darmstadt, Germany

**132 A Frequency Domain Finite Element Method for Scattering Problems with Moving Boundaries**

Gasparini, David (1,2,3); Beise, Hans Peter (3); Schroeder, Udo (3); Antoine, Xavier (1); Geuzaine, Christophe (2)  
1: University of Lorraine; 2: University of Liège; 3: IEE S.A., Luxembourg

**151 A tree-cotree gauge for high order magnetic field computations**

Alonso Rodriguez, Ana Maria (1); De Los Santos Nuñez, Eduardo Antonio (1); Rapetti, Francesca (2)  
1: Università di Trento, Italy; 2: Université Côte d'Azur

**10:30-12:00 hrs : Session 6****112 Non-Conforming Finite Element Formulation for the Simulation of Impedance Cardiography**

Kaltenbacher, Manfred; Badeli, Vahid; Reinbacher-Köstinger, Alice  
TU Graz, Austria

**119 On the fly k-means algorithm for data compression**

Delagnes, Théo (1,2); Henneron, Thomas (1); Clenet, Stéphane (1); Fratila, Mircea (2); Goursaud, Benjamin (2)  
1: Univ. Lille, Centrale Lille, Arts et Metiers ParisTech, , France; 2: EDF R&D, ERMES, France

**133 First approach of a mixed domain decomposition method for magneto-static simulation of rotating machines**

Ruda, Aurélie (1); Louf, François (1); Boucard, Pierre-Alain (1); Mininger, Xavier (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

**127 Fast and Efficient Numerical Algorithm to Reconstruct the 3D Magnetization Distribution of EMAT block or Halbach Magnet**

MIHALACHE, Ovidiu; YAMAGUCHI, Toshihiko

Japan Atomic Energy Agency, Japan

**164 The Use of the Prescribed Potential Boundary Condition for Minimizing the Bandwidth and the Profile of Finite Elements Triangular Meshes**

Boutora, youcef (1); Ibtouen, rachid (2); Takorabet, Noureddine (3)

1: laboratoire de génie électrique LGE, Algeria; 2: Laboratoire de recherche en électrotechnique, Algeria; 3: GREEN Nancy, France

**158 Transient Modelling of Corrosion Protection Systems with a Coupled BEM-Electrical Circuit Approach**

Nale, Michaël (1); Chadebec, Olivier (1); Guichon, Jean-Michel (1); Pinaud, Olivier (1); Ramdane, Brahim (1); Bannwarth, Bertrand (1); Rouve, Laure-Line (1); Gôeau, Cédric (2); Lepretre, Jean-Claude (3); Minola, Marie (3); Roche, Virginie (3)

1: Univ. Grenoble Alpes, CNRS, Grenoble INP, G2Elab, France; 2: DGA Techniques Navales; 3: Univ. Grenoble Alpes, CNRS, Grenoble INP, LEPMI, France

**13:00 hrs - 14:00 hrs : Invited talk 2: Expansion(s) of electromagnetic fields on Dispersive Quasi Normal Modes**

Guillaume Demésy, Université d'Aix-Marseille (France)

**14:00-15:00 hrs : Session 7****104 Design of a Rectenna with a Three-Layer Metamaterial Lens for Wireless Energy Harvesting**

SANTOS GONÇALVES, YAN; RESENDE, URSULA DO CARMO; ARAUJO OLIVEIRA, WILLIAN  
CENTRO FEDERAL DE EDUCAÇÃO TECNOLÓGICA DE MINAS GERAIS (CEFET-MG), Brazil

**153 Evaluation of Graphene Plasmonic Mode Conversion due to Microstrip Bending**

Amanatiadis, Stamatios (1); Zygiridis, Theodoros (2); Kantartzis, Nikolaos (1)

1: Aristotle University of Thessaloniki, Greece; 2: University of Western Macedonia, Greece

**106 Performance Comparison of Perfectly Matched Layers Combined with 2.5D Finite Element Formulations for Solving Open Axisymmetric Cavity Problems**

Schnaubelt, Erik; Marsic, Nicolas; De Gersem, Herbert

Institute for Accelerator Science and Electromagnetic Fields (TEMF), Technische Universität Darmstadt, Germany

**102 Application of the IIEG Method on the Solution of a 2D Vector Scattering Problem**

Andrade, Márcio Fraga; Resende, Úrsula do Carmo

Federal Center of Technological Education of Minas Gerais, Brazil

**15:30-17:00 hrs : Session 8****159 Homogenization of 3D Laminated Cores Using the Heterogeneous Multiscale Method and h-Conforming Formulations**

Niyonzima, Innocent (1); Marteau, Antoine (1); Meunier, Gérard (1); Chadebec, Olivier (1); Galopin, Nicolas (1); Sabariego, Ruth (2); Geuzaine, Christophe (3)

1: Univ. Grenoble Alpes, CNRS, Grenoble INP, G2ELab, France; 2: KU Leuven, Departement of Electrical Engineering (ESAT), Leuven & EnergyVille, Genk, Belgium; 3: University of Liège, Departement of Electrical Engineering and Computer Science, Liège, Belgium.

**142 Homogenization of the Eddy Current Problem in 3D Using Effective Materials**

Schöbinger, Markus (1); Hollaus, Karl (1,2)

1: TU Wien, Austria; 2: Silicon Austria Labs, Austria

**120 Reduced Order Models for Describing the Transient Steady State Behavior of Nonlinear NFC Systems**

Baumgartner, Paul (1); Kvasnicka, Samuel (1,2); Riener, Christian (1,2); Schneider, Marlene (1); Bauernfeind, Thomas (1,2)

1: Graz University of Technology, Austria; 2: Silicon Austria Labs, Austria

**134 Remanence Deviations in Permanent Magnet Synchronous Machines Evaluated Using a Model Order Reduction Approach**

Kolb, Johann; Müller, Fabian; Hameyer, Kay

Institute of Electrical Machines (IEM), RWTH Aachen University, Germany

**150 Multiscale Finite Element Method for Ventilation Grills**

Leumüller, Michael (1); Hollaus, Karl (1,2)

1: Technische Universität Wien, Austria; 2: Silicon Austria Labs, Austria

**117 Electromagnetic Modelling of Magnetic Components for Increased Frequency Applications**

Davister, Nicolas; Geuzaine, Christophe; Fabrice, Frebel

ULiège, Belgium

## Thursday 8 July 2021

### 08:45-10:00 hrs : Session 9

#### **123 A Gauss-Newton method for simultaneous permittivity and conductivity full waveform inversion in the frequency domain**

Adriaens, Xavier; Geuzaine, Christophe  
Université de Liège, Belgium

#### **114 Efficient Sensitivity Analysis of Lumped Elements with Respect to Finite-Element Geometry Changes**

Stysch, Jonathan (1); Klaedtke, Andreas (1); De Gersem, Herbert (2)  
1: Robert Bosch GmbH, Germany; 2: Technical University of Darmstadt, Germany

#### **131 A Well-Conditioned Weak Coupling of Boundary Element and High-Order Finite Element Methods for Time-Harmonic Electromagnetic Scattering**

badia, Ismail (1,3,4); caudron, boris (2); antoine, xavier (3); geuzaine, christophe (4) 1: Thales defense Mission Systems, France; 2: Thales defense Mission Systems, France; 3: Université de Lorraine, CNRS, Inria, France; 4: Université de Liège, Institut Montefiore, Belgium

#### **147 Semi-Explicit Time Integration of a Reduced Magnetic Vector Potential Magneto-Quasistatic Field Formulation**

Kähne, Bernhard; Clemens, Markus  
University of Wuppertal, Germany

#### **125 Tensor approach for high-performance solution of harmonic Maxwell's equations**

Baray, Matthias (1); Levadoux, David (1); Poirier, Jean-René (2)  
1: ONERA, France; 2: University of Toulouse, INPT, LAPLACE, ENSEEIHT, Toulouse, France

### 10:30-11:45 hrs : Session 10

#### **163 Analytical modeling of Stress and thermal effects on anhysteretic curves**

MOHELLEBI, Hassane; Tamazirt, Souad  
Mouloud MAMMERI University, Algeria

#### **135 Statistical Approach to choose the impedance calculation surface in the MET for 3D- cylindrical metamaterial waveguides**

BELLOUCH, Ayoub; LARROUY, Audrey; RAVEU, Nathalie; FRANC, Anne-Laure; POIRIER, Jean-René  
University of Toulouse, INPT, LAPLACE, ENSEEIHT, France



**109 The use of a modified Elliot's expression and parameters' determination for hysteresis modelling**

Jesenik, Marko; Trbušić, Mislav; Hamler, Anton; Trlep, Mladen  
University of Maribor, Slovenia

**113 A Numerical Analysis of the Cooling Effect in a Ferrofluid Immersed Power Transformer using the Finite Element Method**

NASSER EL DINE, Sleimane (1); MININGER, Xavier (1); Nore, Caroline (2)  
1: GeePs-Laboratoire de Génie Electrique et Electronique de Paris , France; 2: LISN-Laboratoire Interdisciplinaire des Sciences du Numérique, France

**155 Asymptotic Models For Ferromagnetic Materials in Eddy Current Problem**

ABOU EL NASSER EL YAFI, Dima (1); PERON, Victor (1); PERRUSSEL, Ronan (2)  
1: Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, LMAP, Anglet ou Pau, France; 2: Université de Toulouse, Laplace (CNRS UMR5213), INPT, France

**13:00-14:00 hrs : Invited talk 3: Shape and topology optimization of electric machines**

Peter Gangl, Graz University of Technology (Austria)

**14:00-15:00 hrs : Session 11****121 3D Magnetic Modeling of Axial Flux Machines Using Genereric Reluctance Networks**

HATOUM, Mostafa (1); AL ASMAR, Abed Al Kader (1); BARAKAT, Georges (1); AMARA, Yacine (1); GHANDOUR, Mazen (2)  
1: Université Le Havre Normandie, France; 2: Department of Electrical and Electronics Engineering, Lebanese University, Lebanon

**124 A Frequency-Dependent Lumped Parameter Model of Electrical Machine Windings**

Hazim, Kaoutar (1,2); Parent, Guillaume (1); Duchesne, Stéphane (1); Geuzaine, Christophe (2)  
1: Univ. Artois, UR 4025, Laboratoire Systèmes Électrotechniques et Environnement (LSEE), France; 2: Department of Electrical Engineering and Computer Science, Montefiore Institute, University of Liège, Belgium

**146 Topology Optimization for a Station Class Surge Arrester Design**

Zhang, Dudu; Kasolis, Fotios; Clemens, Markus  
University of Wuppertal, Germany

**148 Optimum Design of PMASynRM according to the Rated Wattages for Power Improvement**

YAN, QIAN (1); LU, KAI (2)  
1: HANBAT NATIONAL UNIVERSITY, Korea, Republic of (South Korea); 2: HANBAT NATIONAL UNIVERSITY, Korea, Republic of (South Korea)

**15:30-16:30 hrs : Session 12**

**152 Electromagnetic Fields Generated by a Vertical Dipole in the Air and Near Ground: A Sensitivity Analysis**

Silva, Samuel J. S. (1); Schroeder, Marco A. O. (1); Moura, Rodolfo A. R. (1); Procopio, Renato (2); Mestriner, Daniele (2)

1: Federal University of São João del-Rei (UFSJ), Brazil; 2: University of Genoa

**103 High Frequency Grounding System Analysis by Using Meshless Method**

MARTINS VIERA, JEAN LUCAN; RESENDE, URSULA DO CARMO

CENTRO FEDERAL DE EDUCAÇÃO TECNOLÓGICA DE MINAS GERAIS (CEFET-MG), Brazil

**162 High-Performance Computing for Electromagnetic Finite Element Simulations**

Volz, Stefan (1); Wimmer, Georg (1); Lange, Sebastian (2)

1: University for Applied Sciences Würzburg-Schweinfurt, Germany; 2: Bundeswehr Research Institute for Protective Technologies and CBRN Protection, Germany

**128 Magnetic Dosimetry Simulations of Wireless Power Transfer Systems with High Resolution Voxel Models Utilizing the Co-Simulation Scalar Potential Finite Difference Scheme**

Hausmann, Norman (1); Zang, Martin (1); Mease, Robin (1); Clemens, Markus (1); Schmuelling, Benedikt (2)

1: Chair of Electromagnetic Theory, University of Wuppertal, Germany; 2: Chair of Electric Mobility and Energy Storage Systems, University of Wuppertal, Germany