

# **8th IET International Conference on Computation in Electromagnetics 2011**

## **(CEM 2011)**

**IET Conference Publications'799**

**Wroclaw, Poland  
11 - 14 April 2011**

**ISBN: 978-1-61839-228-2**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2011) by the Institution of Engineering and Technology  
All rights reserved.

Printed by Curran Associates, Inc. (2011)

For permission requests, please contact the Institution of Engineering and Technology  
at the address below.

Institution of Engineering and Technology  
P. O. Box 96  
Stevenage, Hertfordshire  
U.K. SG1 2SD

Phone: 01-441-438-767-328-328  
Fax: 01-441-438-767-328-375

[www.theiet.org](http://www.theiet.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

<b>Review of Low and High Frequency Methods for Computational Electromagnetics .....</b>	1
<i>A. Kost</i>	
<b>A Finite Difference Polar-Catesian Grid Approach for Mode Computation in Rounded-End Waveguides .....</b>	2
<i>A. Fanti, G. Mazzarella</i>	
<b>Parallel FDTD Modeling of the Spherical Optical Black Hole .....</b>	4
<i>C. Argyropoulos, Y. Hao</i>	
<b>Numerical Analysis of Posture Variation Effect on the Ultra Wideband on-Body Radio Propagation Channels Using Advanced Modelling Techniques .....</b>	6
<i>Q.H. Abbasi, A. Sani, A. Alomainy, Yang Hao</i>	
<b>Improvement of Accuracy of Extraction of Radiation Patterns From FDTD Modelling of Axisymmetrical Antennas .....</b>	8
<i>W. Gwarek, M. Olszewska</i>	
<b>Comparative Analysis of A-V and A-T-T0 Calculations of Induced Currents in Multiply Connected Regions .....</b>	10
<i>R.M. Wojciechowski, A. Demenko, J.K. Sykulski</i>	
<b>Calculation of Field Distribution in Electromagnetic Problems with Random Domains .....</b>	12
<i>D.H. Mac, S. Clenet, J.C. Mipo</i>	
<b>Application of the Finite Element Method for the Analysis of the Grounding Grid Implying the Finite Line Elements.....</b>	14
<i>A. Habjanic, M. Jesenik, M. Trlep</i>	
<b>Boundary Recovery for Conforming Delaunay Triangulation of Curved Complexes.....</b>	16
<i>A.M.L.G. Cerqueira, A.C. Lisboa, R.C. Mesquita</i>	
<b>3-D Time-Harmonic Eddy Current Problems Solved by the Geometric Multigrid Preconditioned Conjugate Gradient Method.....</b>	18
<i>Chao Chen, O. Biro</i>	
<b>A Two-Level Solver for Nonlinear Magnetic Field Problems Using the P-Version of the FEM .....</b>	20
<i>A. Hauck, M. Kaltenbacher</i>	
<b>Boundary Element Computation of Line Parameters of On-Chip Interconnects on Lossy Silicon Substrate.....</b>	22
<i>D. Li, L. Di Rienzo</i>	
<b>Electromagnetic Source Reconstruction By Reversed-TLM Method .....</b>	24
<i>A. Ungureanu, T. Vuong, F. Ndagiijimana</i>	
<b>An Internal Fractional Boundary Placement Model for the Transmission-Line Modelling Method .....</b>	26
<i>M. Panitz, C. Christopoulos</i>	
<b>A Mode Matching Analysis of Rectangular Dielectric Discontinuities in Metal Waveguides Applicable to Characterisation of Liquids.....</b>	28
<i>O. Ogunlade</i>	
<b>New Coupling Between PEEC Method and an Integro-Differential Approach for Modeling Solid Conductors in the Presence of Magnetic-Conductive Thin Plates.....</b>	30
<i>T. Le-Duc, O. Chadebec, J.-M. Guichon, G. Meunier</i>	
<b>The Voronoi-Delaunay Dual Diagram: Mesh Generation and Cosmetics .....</b>	32
<i>Z.Q. Xie, O. Hassan, K. Morgan</i>	
<b>Estimation of an Equivalent Short Solenoid Model Using Different Numerical Methods.....</b>	34
<i>O. Miron, D. Desideri, D.D. Micu, A. Maschio, A. Ceclan, L. Czumbil</i>	
<b>Inner-Outer Preconditioning Strategy for 3D Inductance Extraction Coupling with Fast Multipole Method.....</b>	36
<i>T.-S. Nguyen, J.-M. Guichon, O. Chadebec, G. Meunier, T. Le-Duc</i>	
<b>Application of Wedge Functions to 2D Magnetostatic Problems.....</b>	38
<i>E. Huijer, S.H. Karaki</i>	
<b>A Review of Multi Physics in Machine Design .....</b>	40
<i>K. Hameyer</i>	
<b>Review of Eddy Current Analysis .....</b>	43
<i>O. Biro</i>	
<b>Verification of Boundary Conditions for Thermal Analysis of the Power Module with Various Methods .....</b>	44
<i>J. Popovic, D. Dolinar, M. Milanovic</i>	

<b>Design of the High Frequency Electromagnetic Behavior of Planar Inductor for Resonant Circuits in Switching Power Converters.....</b>	46
<i>A. Nejadpak, M. Barzegaran, O.A. Mohammed</i>	
<b>Non-Linear FE-Based Modeling of Induction Machine for Integrataed Drives.....</b>	48
<i>A. Sarikhani, O.A. Mohammed</i>	
<b>On the Dynamics of an Hydropower Generator Subjected to Unbalanced Magnetic Pull.....</b>	50
<i>Y. Calleecharan, J.O. Aidanpa</i>	
<b>Characterization of Two-Axis Equivalent Circuit Model of PM-BLDC Motor by FEA .....</b>	52
<i>M. Jagiela, E.A. Mendrela, Gottipati</i>	
<b>Simulation of an Induction Motor Including Eddy-Current Effects in Core Laminations.....</b>	54
<i>H. Jorks, E. Gjonaj, T. Weiland</i>	
<b>Frequency Response of the Transformer Model with Simulated Windings Deformations and Electric Faults .....</b>	56
<i>S. Banaszak, K.M. Gawrylczyk</i>	
<b>Turbine-Generator End-Region Analysis using the Quasi-3D Method .....</b>	58
<i>T. Joshi, A.E. Baker</i>	
<b>Comparing Different Approaches for the Numerical Identification of R, L Parameters of HF Multi-Winding Transformers.....</b>	60
<i>Z. De Greve, O. Deblecker, J. Lobry</i>	
<b>Design of Linear Motor with Two Degrees of Freedom .....</b>	62
<i>M. Karbowiak, B. Jankowski, D. Kapelski, M. Przybylski, B. Slusarek</i>	
<b>3D Finite Element Analysis of the Turbogenerator Rotor Electromagnetic Field .....</b>	64
<i>M.G. Pantelyat, A.N. Saphonov, N.G. Shulzhenko</i>	
<b>Analysis of Contact Resistance Effect Between Magnet Segments on Eddy Current Losses .....</b>	66
<i>M. Mirzaei, B. Funieru, A. Binder</i>	
<b>Determination of Performance Parameters of s Small-Size High-Speed Induction Motor Using the Field-Circuit Method.....</b>	68
<i>K. Komeza, M. Dems</i>	
<b>Prospective Method for Partial Discharge Detection in Large AC Machines Using Magnetic Sensors in Low Electric Field Zones .....</b>	70
<i>S. Ait-Amar, D. Roger</i>	
<b>New Concept of Permanent Magnet Excited Synchronous Machines with Improved High-Speed Features .....</b>	72
<i>H. May, R. Palka, Paplicki, S. Szkolny, W.-R. Candres</i>	
<b>Magnetic Stresses Analysis of a Two Speed, Large Power, Synchronous Motor in Abnormal Working Conditions .....</b>	74
<i>J. Bialik, J. Zawilak</i>	
<b>Limitation of Higher Harmonics in Line Start Permanent Magnet Synchronous Motor by Star-Delta Mixed Stator Winding.....</b>	76
<i>T. Zawilak, M. Gwozdziejewicz</i>	
<b>The Field and Power Losses Computation in Structural Components of HV Power Transformer .....</b>	78
<i>S. Wiak, Drzymala, H. Welfle</i>	
<b>Effects of External Yoke and End-Bells on AC Motor External Field.....</b>	80
<i>J. Lecointe, F. Morganti, F. Zidat, J.F. Brudny, R. Romary, T. Jacq, F. Streiff</i>	
<b>Towards Accurate Evaluation of Iron Losses in Electric Machines.....</b>	82
<i>A.M. Michaelides, S.C. Taylor</i>	
<b>Review of Computational Electromagnetics in Electromagnetic Compatibility Applications .....</b>	85
<i>C. Christopoulos</i>	
<b>Review of HF and Coupled Problems .....</b>	87
<i>W.K. Gwarek, M. Celuch</i>	
<b>Layered Medium Discrete Dipole Approximation .....</b>	88
<i>E. Simsek, B. Sonmez</i>	
<b>Wave Propagation in Microstrip Lines with Gyrotropic Magnetic Substrate .....</b>	90
<i>A.V. Farahani, J.D. Lavers</i>	
<b>A Combined Bowtie-Peano Antenna for Wideband Performance .....</b>	92
<i>I.I. Papadopoulos-Kelidis, A.X. Lalas, N.V. Kantartzis, T.D. Tsiboukis</i>	
<b>A New Topology for Ultra-Wideband Directional Couplers.....</b>	94
<i>Miazga</i>	
<b>Effects of Electromagnetic Near-Field Stress on DC and RF Performances of Aigan/Gan HEMT .....</b>	96
<i>S. Khemiri, M. Kadi, A. Louis, B. Mazari</i>	

<b>On an Inverse Electromagnetic Procedure for Frequency and Spatial Reconstruction of the Lightning Return Stroke Current.....</b>	98
<i>A. Ceclan, V. Topa, D.D. Micu, L. Czumbil</i>	
<b>User Friendly EMI Software for Induced A.C. Potential Evaluation .....</b>	100
<i>L. Czumbil, D.D. Micu, G. Christoforidis, A. Ceclan, O. Miron</i>	
<b>Reduction of Sensitivity to Measurement Errors in the Derivation of Equivalent Models of Emission in Numerical Computation .....</b>	102
<i>Xin Tong, D.W. Thomas, A. Nothofer, Sewell, C. Christopoulos</i>	
<b>A Non-Homogeneous Dirichlet Boundary Condition on the Electric Potential for the Finite Element Analysis of Grounding Systems .....</b>	104
<i>L.B. Martinho, S.L.L. Verardi, M.L. Pereira Filho, M.F. Palin, V.C. Silva, J.R. Cardoso</i>	
<b>Numerical Investigation of Fano Resonances in Metamaterials with Electric Asymmetry.....</b>	106
<i>M. Rotaru, J.K. Sykalski</i>	
<b>Combination of Neural-Mass Models with Anisotropic Head Models to Simulate EEG Signals .....</b>	108
<i>U. Zimmermann, S. Petersen, L. Schwabe, U. Van Rienen</i>	
<b>Study On The Step Voltage Caused By Lightning Current With Postured Voxel-Based Human Body Models.....</b>	110
<i>J. Gao, I. Munteanu, S. Suchanek, W.F.O. Muller, T. Weiland, V. Hinrichsen</i>	
<b>Modeling of the Cell Membrane Response to Ultra Short Electric Pulses.....</b>	112
<i>J.A. Ramirez, D.A. Lowther</i>	
<b>Implications of Galilean Electromagnetism in Numerical Modeling.....</b>	114
<i>F. Rapetti, G. Rousseaux</i>	
<b>A Mobile Virtual Electromagnetics Laboratory for Iphone .....</b>	116
<i>D.R. Browne, S.C. Pomeroy, J.A. Flint</i>	
<b>Review of Optimisation Techniques &amp; Strategies for CEM.....</b>	119
<i>D.A. Lowther</i>	
<b>FE Analysis of Coupled Phenomena in Actuators with Magnetorheological Fluids .....</b>	121
<i>W. Szela, C. Jedryczka</i>	
<b>Monolithic Model of Continuous Induction Hardening of a Steel Mandrel .....</b>	122
<i>Karban, I. Dolezel, B. Ulrych, J. Barglik</i>	
<b>Actuator with Permanent Magnet Controlled by Very Short Current Pulses .....</b>	124
<i>I. Dolezel, D. Panek, B. Ulrych</i>	
<b>Finite Element Scheme Based on Magnetic Vector Potential and Mechanical Displacement for Modeling Magnetostriction.....</b>	126
<i>A. Volk, M. Kaltenbacher, A. Hauck, M. Ertl, R. Lerch</i>	
<b>Coupling Between FDTD Electromagnetic and FEM CFD Software Packages for Simulation of Microwave Heating.....</b>	128
<i>M. Soltysiak, M. Celuch, U. Erle</i>	
<b>3-D Optimal Design of Maminated Yoke of Billet Heater for Rolling Wire Rod Using ON/OFF.....</b>	130
<i>N. Takahashi, S. Nakazaki, D. Miyagi, N. Uchida, K. Kawanaka, H. Namba</i>	
<b>Optimization of the Layer Thickness Distribution in Electrochemical Processes Using the Level Set Method.....</b>	132
<i>M. Purcar, V. Topa, C. Munteanu, R. Chereches, A. Avram, L. Grindei</i>	
<b>Application of a PSO Algorithm for Identification of the Parameters of Jiles-Atherton Hysteresis Model .....</b>	134
<i>L. Knypinski, L. Nowak, Sujka, K. Radziuk</i>	
<b>Two-Level Approach for Solving the Inverse Problem of Defect Identification in Eddy Current Testing-Type NDT .....</b>	136
<i>Putek, G. Crevecoeur, M. Slodicka, K. Gawrylczyk, R. Van Keer, L. Dupre</i>	
<b>Reliability Analysis of the SMES System in the Team Workshop Benchmark Problem 22 Utilizing Reliability Index Approach.....</b>	138
<i>Dong-Wook Kim, Young Hwa Sung, Dong-Hun Kim</i>	
<b>A Novel Adaptation Approach for Electromagnetic Device Optimization .....</b>	140
<i>J. Ouyang, D.A. Lowther</i>	
<b>Bootstrapping Neural Network Regression Model for Motor Drive Vibration Optimization Through Genetic Algorithm .....</b>	142
<i>F.H. Pereira, D.A. Correa, W.M. Da Silva, S.I. Nabeta</i>	
<b>Finite Element Analysis of Transient Electromagnetic-Thermal Phenomena in a Squirrel Cage Motor Working at Cryogenic Temperature.....</b>	144
<i>M. Baranski, W. Szela</i>	

<b>Simulations to the Influence of the Side-Metal-Effect for Inductive Proximity Sensors Using 3D Eddy-Current Field Solver.....</b>	146
<i>F. Lebahn, H. Kruger, H. Ewald</i>	
<b>Analysis and Simulation of Novel Hexagonal Electrode Electrical Capacitance Tomography Sensor .....</b>	148
<i>K. Brandisky, D. Sankowski, R. Banasiak</i>	
<b>Numeric Design Engineering of a Magneto-Inductive Foil Sensor.....</b>	150
<i>C. Weissinger, A. Oswald, H.-G. Herzog</i>	
<b>New Physical Interpretation of Equivalent Circuit for 3-Phase Wye Connected Winding Without Neutral Wire .....</b>	152
<i>W. Burlkowski, K. Kluszczyński</i>	
<b>On Modelling Electrets and Piezo-Electric Actuators .....</b>	154
<i>A. Bossavit</i>	
<b>Design and Analysis of Magnetostrictive Actuator with the Terfenol-D Core .....</b>	156
<i>B. Jankowski, D. Stachowiak, D. Kapelski, M. Karbowiak, M. Przybylski, B. Slusarek</i>	
<b>Future of Computer Hardware .....</b>	159
<i>M. Clemens</i>	
<b>Computational Electromagnetics for Nanodevices .....</b>	161
<i>Erping Li</i>	
<b>Towards a Case-Based Computational Model for the Creative Design of Electromagnetic Devices.....</b>	162
<i>J. Ouyang, D.A. Lowther</i>	
<b>Global and Distributed Torque Calculations Using the CDSA Approach.....</b>	164
<i>M. Li, D.A. Lowther</i>	
<b>AMELET-HDF Converters for Computational Electromagnetics in Aeronautic Projects.....</b>	166
<i>J. Rudnicki, M. Sypniewski</i>	
<b>GPU Accelerated Multiplatform FDTD Simulator.....</b>	168
<i>Konczak, M. Sypniewski</i>	
<b>Comparison of Automatic Planar Mesh Generation Schemes Facilitating Edge Meshing.....</b>	170
<i>T.A. Linkowski, M. Stobodzian</i>	
<b>Efficient Calculation of the Resonant Frequencies of a SIW Resonator with FDFD-Based Macromodel Algorithm .....</b>	172
<i>J. Podwalski, M. Mrozowski</i>	
<b>Evaluation of Circular Aperture Transmission Coefficients in the Presence of Obscurations .....</b>	174
<i>J.G. Davis, Shakespeare, N. Kiley</i>	
<b>Axisymmetric Electromagnetic Resonant Cavities Solution by a Meshless Local Petrov-Galerkin Method.....</b>	176
<i>R.D. Soares, R.C. Mesquita, F.J.S. Moreira</i>	
<b>A Deflated Preconditioned Conjugate Gradient Solver for Electro-Quasistatic Finite Element Simulations.....</b>	178
<i>D. Schmidthauser, M. Clemens</i>	
<b>Numerical Simulation of Electrical Machines by Means of a Hybrid Parallelisation Using MPI and Openmp for FEM .....</b>	180
<i>S. Boehmer, T. Cramer, M. Hafner, E. Lange, K. Hameyer</i>	
<b>Shielded Cable Model Development for Time Domain CEM Techniques .....</b>	182
<i>C.J. Smartt, S. Greedy, D.W. Thomas, C. Christopoulos, Sewell</i>	
<b>Coupling Field Analysis and Non-Deterministic Optimization by Means of Multiprocessor Parallel Computation for Characterizing Magnetic Anisotropy .....</b>	184
<i>Di Barba, K. Komeza, E.N. Juszczak, J. Lecointe, N. Hihat</i>	
<b>Percolation Effects in Electrical Conductivity of Carbon Fibre Composites.....</b>	186
<i>R.D. Chippendale, I.O. Golosnoy</i>	
<b>Modelling Minor Hysteresis Loops by Using Modified Preisach Technique .....</b>	188
<i>T. Karaguler</i>	

<b>Time-Dependent Numerical Model for Localised Zinc Corrosion .....</b>	190
<i>A. Demeter, V. Topa, J. Deconinck</i>	
<b>Finding a Crack in a Material and Determining of Depth .....</b>	192
<i>M. Jesenik, V. Gorican, A. Hamler, M. Trlep</i>	
<b>Development of an Novel Approach for the Simulation of Nanodevices Using FDTD .....</b>	194
<i>I. Ahmed, Er-Ping Li, Qing Hou Liu</i>	
<b>Lorentz Force Eddy Current Testing: Modelling of Permanent Magnets in Dynamic Simulation Using Logical Expressions .....</b>	196
<i>M. Zec, R. Uhlig, M. Ziolkowski, H. Brauer</i>	
<b>Lorentz Force Eddy Current Testing: Force Dependency in Respect to the Lift-Off Distance Computation &amp; Validation .....</b>	198
<i>R. Uhlig, M. Zec, H. Brauer</i>	
<b>Author Index</b>	