

# PIERS 2010 Xi'an

---

Progress In Electromagnetics Research Symposium

**Final PIERS Abstracts will be available  
online by April 20, 2010.**

## Draft Abstracts

---

March 22 - 26, 2010

Xi'an, CHINA

---

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

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

<i>Jeong Ryeol Choi, Mustapha Maamache, .....</i>	253
An Alternative Explanation for the Fraunhofer Sun Lines	
<i>Sara Liyuba Vesely, Alessandro Alberto Vesely, .....</i>	254
Finite-element Analysis of Complex Axisymmetric Invisibility Cloaks	
<i>Yong-Bo Zhai, Xue Wei Ping, Wei Xiang Jiang, Tie Jun Cui, .....</i>	255
Simulations of an Electromagnetic Microsystem Used in Biomedical Applications	
<i>Tom Creutzburg, H. H. Gatzert, .....</i>	256
Characterization of Eddy-current Probe with Tilted Coil Using Multiphysics Finite Element Method	
<i>Cheng-Chi Tai, Yen-Lin Pan, .....</i>	257
Using Fictitious Currents for Calculating Electric Fields Produced by Capacitor Dielectrics	
<i>Romain Ravaut, Guy Lemarquand, .....</i>	258
Numerical Modeling of Light Sources with R-FEM Method in CFX Environment	
<i>Jan Mikulka, Tomáš Kríž, Eva Kroutilova, Pavel Fiala, .....</i>	259
Two-dimensional Magnetotelluric Regularization Inversion Jointed with TE- and TM-mode Data	
<i>Jian-Xin Liu, Ling-Hua Xu, Xiao-Zhong Tong, Ya Sun, Zhen-Wei Guo, .....</i>	260
Three-dimensional Magnetotelluric Forward Modeling for Static-shifted Model	
<i>Xiao-Zhong Tong, Jian-Xin Liu, Ya Sun, Zhen-Wei Guo, .....</i>	261
A Practical Scheme for 3D Geoelectrical Forward Modeling with Finite-infinite Element Coupling Method	
<i>Jing-Tian Tang, Jin-Zhe Gong, .....</i>	262
MPI-based Parallel FDTD for EM Scattering from Coated Complex Targets	
<i>Xiao-Fei Qi, Li-Xin Guo, Hao Zeng, .....</i>	263
Galerkin's Method Using the Annular Patch Segments to Solve a Round Disk Capacitor	
<i>Kyung-Soo Kim, Che-Young Kim, .....</i>	264
Determination of Eigenvalues of Closed Lossless Waveguides Using the Least Squares Optimization Technique	
<i>Oguzhan Demiryurek, Namik Yener, .....</i>	265
The Study of Numerical Simulation on Dual-frequency IP Method with FEM	
<i>Jiayong Lin, Maobin Ding, Jing-Tian Tang, Hong Yan, .....</i>	266
An Improved Algorithm of Orthogonal Vector Spectral Estimation Method	
<i>Dengshan Huang, Xingzhao Liu, Jie Ren, .....</i>	267
Parallel GPU Implementation of K-way Tree Classification Based on Semi-Greedy Structure Applied to Multisource Remote Sensing Images	
<i>Yanglang Zhang, .....</i>	268
Rigorous Computation of Large Radiation Problems by Means of an Iterative Approach	
<i>Carlos Delgado, Manuel Felipe Catedra, Ivan Gonzalez, Josefa Gómez, Abdelhamid Tayebi, .....</i>	269
Advantages of DOF's Continuous Matching in EIT Inverse Problem	
<i>Jarmila Dědková, Radek Kubásek, K. Ostanina, .....</i>	270
Modelling of One-dimensional Fractal Waveguide Structures: Recurrence Relation	
<i>Jouda Ben romdhane, Taoufik Aguil, .....</i>	271
Analysis of Bundled Conductors Electric Parameters Calculated from Conventional Methodology Applying GMR: Proposal of an Alternative Method	
<i>Sérgio Kurokawa, Eduardo Coelho Marques Da Costa, José Pissolato Filho, Afonso José Do Prado, .....</i>	272
A Calculation Method for Frequency Dependent Characteristic Impedance and Slow-wave Factor of Microwave Transmission Lines with a Perturbation	
<i>Jongsik Lim, Jun Lee, Jaehoon Lee, Yongchae Jeong, Sang-Min Han, Dal Ahn, .....</i>	273
The Measurements of RF Dielectric Constant, Dielectric Loss Coefficient, and Conductor Loss Coefficient in PCB	
<i>Yun-Hsih Chou, Ming-Jer Jeng, Yang-Han Lee, Yih-Guang Jan, .....</i>	274
Highly Miniaturized On-chip Impedance Transformer Employing Coplanar Waveguide with Periodic Ground Structure on GaAs MMIC	
<i>Young-Bae Park, Bo-Ra Jung, Suk-Youb Kang, Jang-Hyeon Jeong, Jeong-Gab Ju, Young Yun, ...</i>	275
Analysis of Characteristics of Coplanar Waveguide with Finite Ground-planes by the Method of Lines	
<i>Min Wang, Bo Gao, Yu Tian, Ling Tong, .....</i>	277
A Study on Equivalent Circuit of Highly Isolated Coupled Microstrip Line Employing PGS on GaAs MMIC	
<i>Jang-Hyeon Jung, Bo-Ra Jung, Young-Bae Park, Jeong-Gab Ju, Suk-Youb Kang, Young Yun, ....</i>	278

## A Calculation Method for Frequency Dependent Characteristic Impedance and Slow-wave Factor of Microwave Transmission Lines with a Perturbation

Jongsik Lim<sup>1</sup>, Jun Lee<sup>1</sup>, Jaehoon Lee<sup>1</sup>, Yongchae Jeong<sup>2</sup>, Sang-Min Han<sup>1</sup>, and Dal Ahn<sup>1</sup>

<sup>1</sup>Soonchunhyang University, Republic of Korea

<sup>2</sup>Chonbuk National University, Republic of Korea

**Abstract**— A frequency-dependent slow-wave factor (SWF) and equivalent circuit model of transmission lines with a perturbation such as photonic band-gaps (PBGs), defected ground structures (DGSs), and so on, is proposed in this work. DGS is adopted as an example of the perturbation structure imposed on the ground plane of transmission lines (Fig. 1). Once  $S$ -parameters of the transmission line with DGS are given, the conventional equivalent circuit elements are extracted using 3 dB cutoff and resonant frequencies ( $F_{c,3\text{dB}}$  and  $F_o$ ) as the first step. Using these initial equivalent circuit elements and simple transmission line theories, a frequency-dependent equivalent transmission line model is established through an analytical method. In the proposed method, the equivalent characteristic impedance ( $Z$ ) of the transmission line with a perturbation depends on frequency (Fig. 2), while it has been known to be a fixed value. Finally the frequency-dependent SWF is calculated (Fig. 3). The proposed equivalent circuit of the transmission line with a perturbation element is composed of frequency dependent series resistance ( $R_s$ ) and characteristic impedance ( $Z$ ). The obtained equivalent circuit and SWF are frequency-dependent and more reliable than the conventional result because even small insertion loss within the available pass band is considered in calculating characteristic impedance ( $Z$ ) and SWF, while they have been ignored in the conventional way. The  $S$ -parameters calculated using the obtained frequency-dependent equivalent circuit elements and frequency-dependent characteristic impedance ( $Z$ ) are in an excellent agreement with the original  $S$ -parameters of the transmission line with the perturbation. The proposed method is well applicable to find the more reliable equivalent characteristic impedance and SWF of all transmission lines having PBGs, DGSs, and other periodical perturbation patterns on the ground plane.

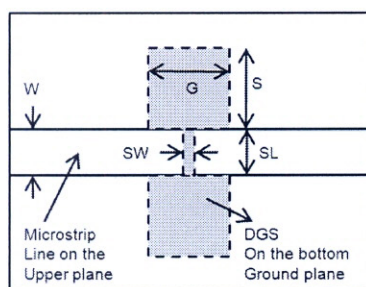


Figure 1.

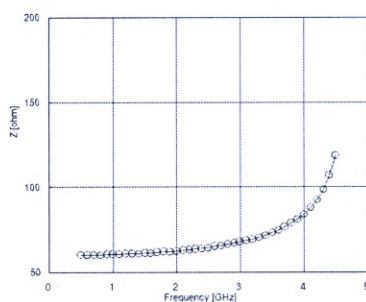


Figure 2.

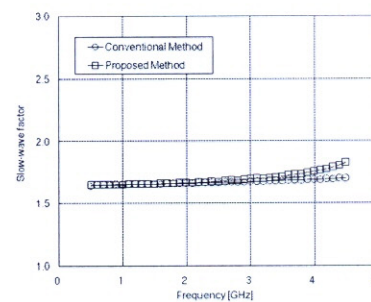


Figure 3.