Guest Editorial

Special Issue on ISTET’01

In the year 2001 the XI. International Symposium on Theoretical Electrical Engineering (ISTET’01) was held at the Johannes Kepler University of Linz, Austria. The ISTET conferences do have a long tradition. They were founded by a group of experts in theoretical fundamentals of electrical engineering from universities of the former East-European countries in order to establish a platform for integrating the scientific activities in the field of theoretical electrical engineering all over Europe. Thus, the first ISTET conference was held in Bratislava in 1981 and since then every two years the symposium took place in another European city. After the fall of the Iron Curtain this idea of European scientific integration could be more intensified, and by now, ISTET has gained an outstanding reputation as a forum of experts involved in electromagnetic field theory, electrical circuits and networks, and modern concepts of system theory of electromagnetic systems. Apart from the traditional fields of research in theoretical electrical engineering ISTET also aims to address the impact of these research activities on relatively new interdisciplinary technical disciplines such as mechatronics and information electronics. Furthermore, great emphasis is also laid on a permanent active discussion of educational problems in theoretical electrical engineering.

The ISTET’01 in Linz brought together approximately 120 researchers from more than 25 countries. The contributions covered a broad range of topics of theoretical electrical engineering including communications and control theory. The Special Issue on ISTET’01 contains a selection of nineteen papers which, on the one hand, aims to give the reader an idea of the variety of topics having been presented at the ISTET’01, and on the other hand, fits the scope of the International Journal of Applied Electromagnetics and Mechanics (IJAEM). Thus, in agreement with these demands a series of excellent papers on communication theory and signal processing were not considered for this Special Issue. To provide an overview of the papers, we briefly scan the issue below:

This Special Issue opens with the first part of the paper by P. Russer, who considers the application of network-oriented methods to the modelling of electromagnetic field problems. He shows that the distributed field problem can be systematically treated by dividing the overall problem into subdomains and connecting these subdomains via a special procedure, based on Tellegen’s theorem and an appropriate equivalent circuit representation. The paper by R. Lerch, M. Kaltenbacher, H. Landes, J. Hoffelner, M. Rausch and M. Schinnerl deals with the application of advanced numerical calculation schemes based on FEM/BEM in combination with multigrid methods for the description of the dynamic behavior of multiphysics sensors and actuators. A. Buchau and W.M. Rucker formulate an efficient method for the calculation of the capacitance coefficients of thin conductors by combining the boundary element method with the fast multipole method.

The following three papers are concerned with wave propagation and guided waves. R. Pregla and S.F. Helfert introduce an admittance/impedance transformation concept for the modelling of waveguide circuits which is applicable for anisotropic materials and which guarantees numerical stability. Based on the generalized telegrapher’s equations H. Haase and J. Nitsch develop a generalized transmission-line theory which allows the description of the wave propagation along almost arbitrary three-dimensional
wire structures. A ray tracing approach for modelling the wave propagation in graded index waveguides within the validity range of geometrical optics is presented by Y. Sönmez, A. Himmler, E. Griese and G. Mrozynski.

The next three papers are devoted to circuit and network theory. By means of two new approaches, the TC-method and the DPC-method, a detailed mathematical analysis of nonlinear resistive networks with dc-operating points is given by A. Reibiger, W. Mathis, T. Nähring and Lj. Trajković. In view of a combination of circuit theory and control design the paper by A. Kugi, K. Schlacher and G. Grabner considers a symbolic approach for the energy-based modelling of nonlinear RLC-networks based on a modified version of the theorem of Brayton-Moser. H. Loose and R. Pauli elaborate in their paper a coordinate-free formulation of the realizability conditions for passive, lossless and reciprocal multiports.

The next article is the paper of A. Cangellaris and P. Russer and is thought to continue the first part by P. Russer on network methods in electromagnetic field modelling. In this second part the authors show that in the context of order reduction methodologies and parameter identification methods the use of network concepts in electromagnetic field modelling leads to a drastic reduction of the complexity of the problems under consideration. C. Müller, G. Scheinert and F.H. Uhlmann describe in their paper an approach, based on a magnetic double-layer model, for the sensitivity analysis of electromagnetic devices. A neural network approach for the approximation of the nonlinear magnetisation curve of ferroelectric material is given by H. Vande Sande, U. Pahner, H. De Gersem, K. Hameyer and L. Froyen. Quite a similar topic is discussed by M. Dotterweich, G. Szymański and M. Waszak, who develop a neural network approximator of the Preisach function to obtain a smooth hysteresis model output.

The next two papers are related with skin effect problems. A. Hahn, A. Kost, L. Jänicke and K. Miethner investigate in their paper the influence of gaps on the shielding performance of a box by using FEM with adaptive mesh generation. The second paper on this topic is given by M. Ehrich, L.O. Fichte and M. Lüer and deals with a time domain solution of the plane transient eddy current problem of a system consisting of a finite number of arbitrary conductors with different magnetic permeability.

The following three papers are concerned with linear and nonlinear control theory. The paper by K. Schlacher and A. Kugi uses a Lie-group approach for testing the observability and accessibility (controllability) of dynamical systems described by a set of implicit ordinary differential equations. For the class of linear time-invariant discrete time multi-input multi-output systems A. Hofer and M. Horn present a procedure for designing a controller based on the $l_1$-system norm. The paper by B. Tibken, K.F. Dilaver and O. Hachicho introduces two algorithms for solving the problem of global robust positivity of polynomials with coefficients depending linearly on uncertain parameters.

Last, not least the paper by H. Irschik, M. Krommer and U. Pichler addresses the problem of dynamic shape control of piezoelectric beam-like structures where the spatial distribution of an actuating control agency is determined in order to reach a certain structural displacement field with a desired spatial distribution.
At the end, we want to express our appreciation to the authors for their effort and for their cooperation during the reviewing and editing process. We would also like to extend special thanks to the Editor-in-Chief of IJAEM Prof. T. Takagi and to R. Steenhuizen from IOS Press, for their encouragement and support, making this Special Issue possible. Finally, we want to acknowledge the time and effort of Dr.-Ing. Klaus Blug from the Saarland University throughout the reviewing and editing of this Special Issue.

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