

Modelling of magnetic and electric circuits

It is a great pleasure to introduce this special issue of *COMPEL* (*The International Journal for Computation and Mathematics in Electrical and Electronic Engineering*), with selected extended papers presented originally at the 25th Symposium on Electromagnetic Phenomena in Nonlinear Circuits (EPNC 2018) held from June 26th to 28th 2018 in Arras, France. The 25th EPNC Symposium was organized by Artois University, Environment and Electrotechnical Systems Research Lab (LSEE, www.lsee.fr), Faculty of Applied Sciences (France), Polish Academy of Sciences and Poznan University of Technology and Faculty of Electrical Engineering (Poland). Professor Ewa Napieralska and Professor Jean-Philippe Lecoq from the Artois University were the Chairmen of the Organizing Committee.

The first EPNC Symposium took place in Poznań, Poland, in November 1972. The first 11 conferences were local meetings, although speakers from other countries also participated. The last 14 conferences were international events, with proceedings published in English. Initially selected papers from the EPNC conferences were submitted to regular issues of *COMPEL*. After EPNC 2004, for the first time, selected and extended papers from the EPNC were published as a special issue of *COMPEL*. The current issue of *COMPEL* is the eighth consecutive special issue. The aim of the EPNC conferences was to present the recent advances in the analysis and synthesis of nonlinear electric and magnetic circuits and in nonlinear optics and nonlinear electromagnetic problems in medicine, as well as to provide a forum for discussion and dissemination of recent results on applications of nonlinear phenomena in electrical engineering. The EPNC conferences are intended to be an opportunity for specialists and young PhD students to exchange ideas and experiences in electromagnetic field modelling, electric drives, electronics, electrical machines and electric and magnetic materials. The topics of the symposiums included ferromagnetics and magnetic circuits, semiconductors and nonlinear electric circuits, nonlinear optics and wave propagation and nonlinear electromagnetic problems in medicine. For the 2018 edition of the EPNC, two special sessions have been introduced. The first special session was dedicated to “Smart and Integrated Motor Drive.” It focused on problems related to the integration of the power electronic converter within the motor drive, while keeping a high level of reliability of the system. The second special session revolved around insulation problems of electrical machines. Trends in the electric isolation systems for electrical machinery were discussed: materials, manufacturing process, machine integration and problems arising from the converter/machine combination.

At the EPNC in Arras, 97 papers were presented by participants from 15 countries. Two-page versions of all papers were published in the conference proceedings prepared in an electronic version. A limited number of 30 extended papers, selected in a peer-review process, were chosen by EPNC 2018 Editorial Board and *COMPEL* Guest Editors for publication in this special issue of *COMPEL*. The papers and the discussion at the Symposium confirmed the recent trends in electromagnetism and electrical engineering. The modern-field models are applied in the analysis and design of electrical machines, electric drives and other electromagnetic devices. These models consider the multi-physical phenomena in electrical systems and include the new accurate descriptions of magnetic and conducting materials. For example, during EPNC 2018, the coupled electromagnetic–thermal–mechanical models were discussed. These models have, among others, been applied in the design of electrical machines working at high ambient temperature. Many



authors of the papers were motivated by the increasing efficiency requirements for electrical drives because of the European and international regulations regarding these devices. The other motivation is driven by the need to construct more reliable electrical machines and electromagnetic actuators with modern isolation systems. EPNC 2018 showed that there is still a lot of interest in the design and simulation of permanent magnet machines and drives. Moreover, the problems related to more accurate numerical models of materials, e.g. hysteresis models, and cutting-edge models are still being developed and deployed for optimized designs.

As during the past few EPNC conferences, a special Emerald/*COMPEL* award for the best paper delivered by a young researcher was offered to Benedikt Groschup (Institute of Electrical Machines IEM, RWTH Aachen University) for the presentation of the paper entitled “Iron loss simulation using a local material model” by Professor Jan Sykulski, Editor-in-Chief of *COMPEL*. The paper by this award-winning researcher may be found in this special issue of *COMPEL*.

We hope that this issue of *COMPEL* will provide new, stimulating information to the readers.

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