Foreword: Special Section on Electrical Performance for Highly Integrated Systems

NOT a day goes by without the issue of global warming and the depletion of the planet's resources being addressed in the media. And it is clear that the societal and environmental challenges posed are of considerable magnitude because we all must drastically reduce our carbon footprint. At the same time, the amount of data exchanged around the world is constantly increasing. Do we need to be reminded once again of the extent to which our global data infrastructures have made it possible, and are still making it possible, to fight the COVID-19 pandemic with all the necessary strength?

In this context, there is a pressing need for increasingly energy-efficient electronic devices with increased performance in terms of speed.

To achieve these goals, many public and private research teams are currently working hard around the world to improve analog and digital highly integrated systems, including, for instance, interconnects, power delivery network (PDN), and wireless circuits, all over their life cycle.

IEEE EPS conferences are perfect opportunities for experts working on interconnects, packaging, and all their related fields to present their work and develop collaborations. This Special Section seeks to provide an overview of the recent innovations across these fields through a Special Section built from the selected work initially presented at the SPI 2019 conference which is co-sponsored by IEEE EPS. It presents the latest and the most impacting topics that emerged from this conference in 2019.

Target impedance plays a critical role in guiding a robust PDN design. In their article "A Frequency-Dependent Target Impedance Method Fulfilling Voltage Drop Constraints in Multiple Frequency Ranges," the authors from the University of Osaka, Suita, Japan, propose a frequency-dependent target impedance methodology. Experimental results show that it tightly satisfies the given voltage drop constraints.

The article titled "Uniformly Stable Parameterized Macromodeling Through Positive Definite Basis Functions" is authored by members of the Politecnico di Torino, Turin, Italy. They propose a novel parameterized macromodeling strategy, leading to a robust model generation from tabulated frequency responses, at a computational cost that is dramatically reduced with respect to competing approaches.

"Analysis of Parameter Variability in an Integrated Wireless Power Transfer System via Partial Least-Squares Regression" is coauthored by members of the Georgia Institute of Technology, Atlanta, GA, USA, the EMC Group, Politecnico di Torino, and IETR, Rennes, France. This article deals with the application of the partial least squares regression to the uncertainty quantification of an integrated wireless power transfer to estimate statistical quantities of the converter efficiency with a relatively low computational cost compared to the standard brute-force Monte Carlo (MC) simulation, the MC simulation being considered as reference.

These articles give a good overview of the level of integration being pursued in EPS and the breadth of challenges encountered to develop high-bandwidth, energy-efficient systems that are a significant contribution in addressing the societal and environmental issues of our time.

PASCAL XAVIER, *Guest Editor*
Institut IMEP-LaHC
Univ. Grenoble Alpes
Univ. Savoie Mont Blanc
Grenoble INP
38000 Grenoble, France

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Pascal Xavier was born in France in 1964. He graduated in electrical engineering from the Polytechnical National Institute of Grenoble, Grenoble, France, in 1988. He received the Ph.D. degree in physics from the University Joseph Fourier of Grenoble, Grenoble, in 1994.

From 1994 to 2003, he was with the Very Low Temperatures Research Centre of Grenoble (CRTBT CNRS), where he was dealing with numerical methods for the analysis of coupled thermoelectromagnetics problems (wavelets method of moments) and design of microsensors in the field of microwaves. In 2003, he joined the Research Institute of Microelectronics, Electromagnetism and Photonics (IMEP-LaHC) of Grenoble, Grenoble, where he has been the Leader of the Radio-Frequency and Millimeter-Wave Team since January 2018. He is currently a Professor with the Department of Electrical Engineering, Technology University Institute of Grenoble (IUT1), Grenoble, where he is involved in the teaching of electronics and physics. He is responsible for the optics and RF specialty at the Doctoral School EEATS of the Grenoble, Alps University, Grenoble. He also participated in the publication of two scientific books and four international patents. He has directed 11 Ph.D. students. He is the author of 32 peer-reviewed international articles, has presented 39 communications in several international conferences, and is a referee in four international journals. His research interests include the design, characterization, and realization of microwave devices, sensors and systems for environmental applications, and bioelectromagnetism.

Dr. Xavier has co-chaired the 23rd edition of the IEEE Workshop on Signal and Power Integrity, Chambery, France. He is also an Associate Editor of the IEEE TRANSACTIONS ON COMPONENTS, PACKAGING, AND MANUFACTURING TECHNOLOGY.