Guest Editorial

Teodorescu, Remus; Spagnuolo, G.; Petrone, G.; Veerachary, M.; Viteli, M.

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RENEWABLE sources and, in particular, the photovoltaic ones, are more often used together with the conventional ones in order to get a local production, allowing us to cut down on the use of classical fuels and to improve the reliability of the supply. Grid-connected applications fix mandatory constraints to be fulfilled by power electronic converters in order to meet power quality specifications and to draw the conversion of the maximum power from the renewable source into the electrical grid. On the other side, stand-alone applications of renewable energies are also gaining increasing interest due to the spread of portable systems for telecommunications, remote sensing, military apparatus, aerospace applications, etc. In the context of renewable energies, photovoltaic energy is the most promising due to its low environmental impact, nearly no need of maintenance after installation, and the encouraging perspectives in terms of costs and efficiencies.

It is a pleasure for us to present this "Special Section on Photovoltaic Power Processing Systems," which has the objective of bringing the ideas of the worldwide research community to a common platform, to present the latest advances and developments in design, mathematical modeling, power electronic control, computer simulation tools, and practical implementation of renewable energy systems based on photovoltaic cells.

The state-of-the-art paper proposed by the Guest Editors is focused on the topic of reliability, which represents the emerging issue in photovoltaic power processing systems. This aspect is confirmed by the contributions from Ristow *et al.* and Rodriguez and Amaratunga. In the former paper, the authors suggest a new methodology for improving inverter reliability. In the latter one, a long-lifetime microinverter for photovoltaic modules that allows one to maximize the energy production, even in the presence of mismatched arrays, is proposed. Distributed control of photovoltaic modules is also treated in the papers by Sahan *et al.* and Femia *et al.*, which propose a three-phase ac module and the modeling of series-connected photovoltaic modules equipped with dc/dc maximum power point tracking (MPPT) converters, respectively.

Many aspects concerning MPPT have been discussed in a large number of papers. Liu *et al.* and Sera *et al.* propose optimized versions of MPPT algorithms that allow one to improve steady-state and transient responses. Moreover, a useful model of the voltage ripple on the output of photovoltaic modules is introduced by Benavides and Chapman. Nguyen and Lehman instead propose an algorithm that reduces the drawbacks associated with mismatching.

As far as the dc/dc section of photovoltaic power processing systems is concerned, Lee *et al.*, Vassallo *et al.*, and Gules *et al.* introduce new topologies with flat efficiency and paralleled architectures for energy and cost saving.

A deep investigation of some issues related to the grid connection of photovoltaic systems is presented in the papers by Fortunato *et al.* and Gonzalez *et al.*, with special emphasis on transformerless and single-stage inverters. Multilevel topologies are considered in the contributions of Daher *et al.* and Busquets-Monge *et al.* in order to increase the robustness and efficiency of the converter and minimize the effects of mismatching, respectively. Control issues in photovoltaic inverters are treated in the contribution from Castilla *et al.*, which deals with a technique for reducing the harmonic content of the current injected into the grid, and that from Meza *et al.*, which discusses a systematic approach for loop control design.

The paper by Ueda *et al.* proposes a significant analysis, founded on a large database of experimental data, of losses due to the grid voltage rise.

Stand-alone systems are treated in the papers by Bialasiewicz and Dondi *et al.*, which provide an overview of power systems involving photovoltaic arrays, and in the paper by Lee *et al.*, which introduces an innovative solar energy harvester and a microcontroller-based battery charger.

The Guest Editors would like to express their deep gratitude to all the authors that have sent their valuable contributions and, in many cases, have also served as reviewers. We hope that their contributions will be of interest to the industrial electronics community and will enrich the current state of the art and motivate and encourage new ideas and solutions in this field. We would like to give a well-deserved acknowledgment to all the reviewers, whose generous and anonymous contributions have made this Special Section possible.

Finally, last but not least, we would like to thank Prof. B. M. Wilamowski, the Editor-in-Chief of the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, for giving us the opportunity to organize this Special Section and for all the encouragement, help, and support given throughout the process.

GIOVANNI SPAGNUOLO
Dipartimento di Ingegneria
dell'Informazione ed Ingegneria Elettrica
University of Salerno
84084 Salerno, Italy

GIOVANNI PETRONE
Dipartimento di Ingegneria
dell'Informazione ed Ingegneria Elettrica
University of Salerno
84084 Salerno, Italy

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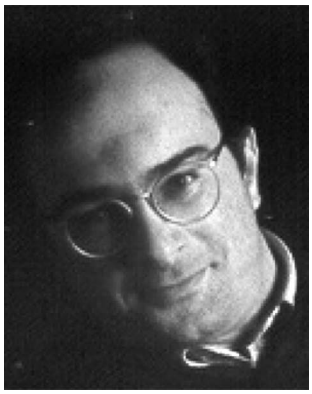
REMUS TEODORESCU
Institute of Energy Technology
Aalborg University
9220 Aalborg East, Denmark

MUMMADI VEERACHARY
Department of Electrical Engineering
Indian Institute of Technology Delhi
New Delhi 110016, India

MASSIMO VITELLI
Dipartimento di Ingegneria dell' Informazione
Seconda Università di Napoli
81031 Aversa, Italy



Giovanni Spagnuolo (M'98) was born in Salerno, Italy, in 1967. He received the "Laurea" degree in electronic engineering from the University of Salerno, Salerno, in 1993, and the Ph.D. degree in electrical engineering from the University of Napoli "Federico II," Naples, Italy, in 1997.

From November 1993 to October 1994, he was a Researcher and worked on the design, building, and tuning of a high-voltage test bed of a cryogenic superconducting cable. In 1993, he joined the Dipartimento di Ingegneria dell'Informazione ed Ingegneria Elettrica, University of Salerno, where he was a Postdoctoral Fellow (1998–1999) and an Assistant Professor of electrotechnics (1999–2003) and, since January 2004, has been an Associate Professor. His main research interests are numerical methods for the analysis of electromagnetic fields, the analysis and simulation of switching converters, and tolerance analysis and design of electronic circuits.

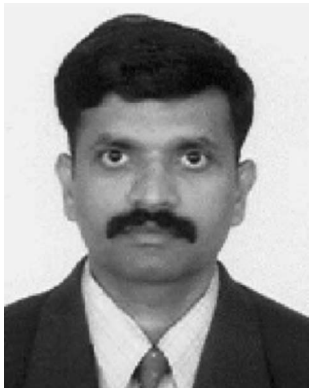
Giovanni Petrone was born in Salerno, Italy, in 1975. He received the "Laurea" degree in electronic engineering from the University of Salerno, Salerno, in 2001, and the Ph.D. degree in electrical engineering from the University of Napoli "Federico II," Naples, Italy, in 2004.

Since January 2005, he has been an Assistant Professor of electrotechnics with the Dipartimento di Ingegneria dell'Informazione ed Ingegneria Elettrica, University of Salerno. His main research interests are the analysis and design of switching converters for telecommunication applications, renewable energy sources in distributed power systems, and tolerance analysis of electronic circuits.

Remus Teodorescu (S'94–A'97–M'99–SM'02) received the Dipl.Ing. degree in electrical engineering from the Polytechnic University of Bucharest, Bucharest, Romania, in 1989, and Ph.D. degree in power electronics from the University of Galati, Galati, Romania, in 1994.

From 1989 to 1990, he was with the Iron and Steel Plant Galati, and then, he moved to Galati University, where he was an Assistant Professor with the Department of Electrical Engineering. In 1998, he joined the Power Electronics Section, Institute of Energy Technology, Aalborg University, Aalborg, Denmark, where he is currently an Associate Professor. He has coauthored more than 100 technical papers, 12 of them published in journals, and two books. He is the holder of five patents. His research interests include power converters for renewable energy systems (photovoltaic wind turbines) and electrical drives.

Dr. Teodorescu is currently an Associate Editor for the IEEE TRANSACTIONS ON POWER ELECTRONICS and the Chair of the IEEE Danish IAS/IES/PELS chapter. He has been the recipient of Technical Committee Prize Paper Awards, a 1998 IEEE Industry Applications Society Prize Paper Award, and the OPTIM-ABB Prize Paper Award at OPTIM 2002.



Mummadi Veerachary (SM'04) was born in Survail, India, in 1968. He received the B.Tech. degree from the College of Engineering, Anantapur, Jawaharlal Nehru Technological University (JNTU), Hyderabad, India, in 1992, the M.Tech. degree from the Regional Engineering College, Warangal, India, in 1994, and the Dr.Eng. degree from the University of the Ryukyus, Okinawa, Japan, in 2002.

From 1994 to 1999, he was an Assistant Professor with the Department of Electrical Engineering, College of Engineering, Anatapur, JNTU. From October 1999 to March 2002, he was a Research Scholar with the Department of Electrical and Electronics Engineering, University of the Ryukyus. Since July 2002, he has been with the Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi, India, where he is currently an Associate Professor. He is an Editorial Member of the *Journal of Power Electronics*. His research interests include power electronics and applications, modeling and simulation of large power electronic systems, design of power supplies for spacecraft systems, control theory application to power electronic systems, and intelligent controller applications to power supplies.

Dr. Veerachary is a member of the IEEE Industrial Electronics Society and the Institution of Engineers India. He is currently serving as an Associate Editor for the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS and the IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS. He was the recipient of the IEEE Industrial Electronics Society Travel Grant Award for the year 2001, the Best Paper Award at the International Conference on Electrical Engineering (ICEE-2000) held in Kitakyushu, Japan, and the Best Researcher Award for the year 2002 from the President of the University of the Ryukyus. He is listed in *Who's Who in Science* and *Engineering 2003*.

Massimo Vitelli was born in Caserta, Italy, in 1967. He received the "Laurea" degree (with honors) in electrical engineering from the University of Naples "Federico II," Naples, Italy, in 1992.

In 1994, he joined the Department of Information Engineering, Seconda Università di Napoli, Aversa, Italy, as a Researcher. In 2001, he was appointed Associate Professor with the Dipartimento di Ingegneria dell' Informazione, where he is currently teaching courses on electrotechnics. His main research interests include the electromagnetic characterization of new insulating and semiconducting materials for electrical applications, electromagnetic compatibility, and the analysis and simulation of power electronic circuits.

Dr. Vitelli is an Associate Editor for the IEEE TRANSACTIONS ON POWER ELECTRONICS.