

# Editorial

## Special Issue on Power Electronics in Photovoltaic Applications, 2013

**T**HE observed climatic changes originating from the extensive use of fossil fuels as energy source and their evident depletion in the future have accelerated the utilization of renewable energy sources and the research in the area. Solar or photovoltaic (PV) energy is one of the most promising candidates, to substitute the fossil fuels in energy production in the future. Solar energy can be converted directly into electricity by means of solar cells, which produce electricity in dc form. Due to the low output voltage of a single PV cell, the practical energy harvesting usually necessitates to connecting a large number of single PV cells in series forming a PV generator. PV generator is known to have properties resembling both constant-current and constant-voltage sources depending on the operating point. Special interfacing arrangements are usually needed based on the use of power electronic converters until the energy is readily applicable to large scale utilization.

This Special Issue aims to address current challenges in the design and operation of PV energy systems, to report on novel ideas for enabling the wider utilization of PV energy and to explore optimal energy management control strategies for the PV-based Power Electronic System. The readers of this Special Issue will finally decide how well the previously stated goals are met. The accepted papers are not the only media by means of which the new ideas will be and have been promoted within the power electronics field. The most important media are actually the reviewers' comments stating exactly, why the paper is rejected or the major/minor revision is needed, because they initiate the necessary mental processes in the authors and also in the reviewers leading finally sooner or later to the more comprehensive understanding of the topic area.

This Special Issue received 151 original submissions of which 36 were accepted for publication at the time of writing this editorial. A couple of submitted papers are still in the process and will be published later according to the normal publishing practices. Majority of the accepted papers (51%) are related to different design and control aspects of grid-connected single- and three-phase inverters. The second largest category of papers (22%) is related to the maximum -power-point-tracking (MPPT) issues. The rest of the accepted papers are related to the implementation of distributed MPPT schemes (8%), the reliability issues in PV systems and converters (8%), the properties of PV generator, and other timely issues in the PV processing (11%).

According to the submitted papers, the PV generator is most often assumed to be a voltage source. As a consequence of this, all the analyses and even the validation of the proposed concepts

are performed by using a voltage source as an input source. This kind of behavior is quite expected, because the PV generator is known to have both current and voltage-source properties. This Special Issue contains one paper, which explicitly shows that the PV generator has to be considered as a nonlinear current source, where the output impedance changes along the changes in the operating point. It is also pointed out that the resistive part of the output impedances changes the dynamic behavior of the converter connected to the PV generator, which has to be taken into account in the design of the PV-related converters for ensuring their reliable operation. The inappropriate treatment of the PV generator in analyzing and validating the proposed converters and concepts has been the most significant single reason for rejecting the submitted papers. Even among the accepted papers there are still some papers not correctly treating the PV generator as an input source, but in those cases there are other important scientific contributions overriding the deficiencies in the PV-generator treatment.

Ninety percent of the 151 papers were submitted during the last two weeks the submission opportunity was open. The editorial team—Professors E. Acha, C. Chen, B. Choi, G. Escobar, T. Shimizu, S. Valkealahti, and M. Veerachary has made an enormous effort as Associate Editors in arranging the review process of the papers. The task was so enormous and the time so short for finalizing the review process in due time that other associated editors had to be called for help. The editorial team recognizes the valuable work carried out by the Associate Editors V. Agarwal, P. Barbosa, C. Canesin, S. Choi, A. Kwasinski, M. Liserre, D. Maksimovic, M. Malinowski, P. Mattavelli, H.-P. Nee, R. Redl, and M. Vitelli, as well as the huge number of reviewers in finalizing the review process.

We would also like to thank the IEEE TRANSACTIONS ON POWER ELECTRONICS Editor-in-Chief F. Blaabjerg and his assistant B. Johansen for the guidance and assistance during the course of this Special Issue development. From the call for papers to Scholar One operations to interfacing with authors and the final editing, their efforts have made our tasks a lot easier.

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From 1977 to 1991, he was at Fiskars Power Systems as a Design Engineer and R&D Manager. From 1991 to 1992, he was at Ascom Eergy Systems as an R&D Manager. From 1992 to 1994, he was an entrepreneur in power electronics design consultancy, and from 1994 –to 1998, he was at Efore as a Consultant, and Project Manager. Since 1998, he has been a Professor specializing in switched-mode power converter technologies first at Electronics Laboratory, the University of Oulu, Oulu, Finland, and from August 2004 with the Department of Electrical Engineering, the Tampere University of Technology, Tampere, Finland. His current research interests include dynamic modeling and control design of switched-mode power converters in dc–dc systems as well as in renewable energy applications. He holds several international patents and has authored more than 180 international scientific journal and conference papers, the book *Dynamic Profile of Switched-Mode Converter—Modeling, Analysis, and Control*, (Wiley-VCH, 2009) as well as

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Dr. Suntio is a Member of the IEEE Power Electronics, the IEEE Industrial Electronics, the IEEE Circuits and Systems, and the IEEE Power and Energy Societies, as well as a Member of the EPE Association. Since 2010, he has been an Associate Editor of the IEEE TRANSACTION ON POWER ELECTRONICS.