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Guest Editorial

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Guest Editorial

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.

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