Guest Editorial

IT is a pleasure and an honor for me to present this "Special Section on Modern Rectifiers—Part I" of the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS.

The field of rectification is today one of the most challenging areas in power electronics. In general, the need to increase efficiency and performance, while reducing costs to be more competitive, has imposed additional demands on modern rectifiers. The development of this technology is driven today by two major forces.

1) The first is the increasing amount of electrical power being processed by electronic converters, which use a rectifier at the line side. In effect, new applications for power converters are continuously appearing with additional demands being made on the designer.
2) The second is the fact that the harmonics present in the input current can affect the behavior of the power supply. This highly distorted input current deteriorates the power factor and reduces the general efficiency of the electrical network, among other detrimental effects. To reduce these adverse consequences of rectification, several agencies have introduced regulations and standards, like IEC 61000-3-2, which make the connection of the simple diode rectifier with capacitor filtering unacceptable.

Three decades ago, locomotives were the only application requiring rectifiers with reduced input current harmonics. Today, this demand is present in all power levels, and this is one of the main reasons for the large activity in this field.

This Special Section is intended to focus on recent research in the area of rectifiers and make the results available to the power electronics community. As a consequence of the massive response from the authors, this Special Section will be organized into three parts, with Part I dedicated mainly to *single-phase rectifiers*.

Part I is grouped into the following main categories.

I. SURVEY PAPERS

These papers:

- "PWM Regenerative Rectifiers: State of the Art," by J. R. Rodríguez, J. W. Dixon, J. R. Espinoza, J. Pontt, and P. Lezana
- "Single-Phase Single-Stage Power-Factor-Corrected Converter Topologies," by G. Moschopoulos and P. Jain
- "Boost-Chopper-Derived PFC Rectifiers: Interest and Reality," by J.-C. Crébier, B. Revol, and J. P. Ferrieux
- "Helpful Hints to Select a Power-Factor-Correction Solution for Low- and Medium-Power Single-Phase Power Supplies," by A. Fernández, J. Sebastián, M. M. Hernando, P. Villegas, and J. García

have a survey nature, covering different aspects of the technology and establishing the state of the art in single-phase rectifiers. They review different topologies, working principles, control methods, operating characteristics, and application areas. The strengths and weaknesses of the converters for different applications to meet modern regulations are highlighted.

II. CONTROL METHODS FOR POWER-FACTOR CORRECTION

These papers:

- "Power-Mode-Controlled Power-Factor Corrector for Electronic Ballast," by F. J. Azcondo, C. Brañas, R. Casanueva, and S. Bracho
- "Robust Control of Power-Factor-Correction Rectifiers With Fast Dynamic Response," by E. Figueres, J.-M. Benavent, G. Garcerá, and M. Pascual
- "Dynamic Limits of a Power-Factor Preregulator," by A. Fernández, J. Sebastián, P. Villegas, M. M. Hernando, and D. G. Lamar
- "Digitally Controlled Boost Power-Factor-Correction Converters Operating in Both Continuous and Discontinuous Conduction Mode," by K. De Gussemé, D. M. Van de Sype, A. P. M. Van den Bossche, and J. A. Melkebeek
- "Implementation and Performance Evaluation of DSP-Based Control for Constant-Frequency Discontinuous-Conduction-Mode Boost PFC Front End," by Z. Z. Ye and M. M. Jovanović
- "Duty-Ratio Feedforward for Digitally Controlled Boost PFC Converters," by D. M. Van de Sype, K. De Gussemé, A. P. M. Van den Bossche, and J. A. Melkebeek
- "Pulse Regulation Control Technique for Integrated High-Quality Rectifier-Regulators," by M. Ferdowsi and A. Emadi

are mainly dedicated to studying several control aspects of the single-phase boost rectifier. Power control, robust control, and digital control are used to improve the dynamic performance of the rectifier. The operation in continuous and discontinuous modes is also addressed.

III. NEW CONNECTIONS AND TOPOLOGIES

These papers:

- "A Novel Forward AC/DC Converter With Input Current Shaping and Fast Output Voltage Regulation Via Reset Winding," by L.-K. Chang and H.-F. Liu
- "A Different Approach to Implement an Active Input Current Shaper," by N. Vázquez, J. López, J. Arau, C. Hernández, and E. Rodríguez
- "A Single-Stage Fast Regulator with PFC Based on an Asymmetrical Half-Bridge Topology," by T.-F. Wu, J.-C. Hung, S.-Y. Tseng, and Y.-M. Chen
- "Using the Multilevel Imbricated Cells Topologies in the Design of Low-Power Power-Factor-Corrector Con-

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verters," by F. Forest, T. A. Meynard, S. Faucher, F. Richardeau, J.-J. Huselstein, and C. Joubert

use additional windings or connections to improve the shape of the current waveform. In effect, an interesting solution is proposed in a converter with two outputs: the main output is to feed the load and the auxiliary output is used to shape the input current. In addition, in this group of papers new topologies are considered, like the use of flying capacitors to improve the performance of the rectifier.

IV. VIENNA RECTIFIER

This paper:

- "Novel Concept for Mains Voltage Proportional Input Current Shaping of a VIENNA Rectifier Eliminating Controller Multipliers," by J. Miniböck and J. W. Kolar

is dedicated to the well-established three-phase VIENNA Rectifier, proposing a control strategy without sensing of the mains voltages.

V. NEW APPLICATIONS OF HIGH QUALITY RECTIFIERS

Finally, these papers:

- "Regenerative Medium-Voltage AC Drive Based on a Multicell Arrangement With Reduced Energy Storage Requirements," by M. A. Pérez, J. R. Espinoza, J. R. Rodríguez, and P. Lezana
- "Module-Type Switching Rectifier for Cathodic Protection of Underground and Maritime Metallic Structures," by I.-D. Kim and E.-C. Nho

present two interesting applications of high-performance rectifiers. These papers show that some applications, like multiple connection, can improve the performance and the design, reducing the size of passive components.

The Guest Editor expresses his appreciation to the authors for the quality of their work and for their cooperation during the review process and preparation of the final versions of their manuscripts. The selection process was extremely difficult, due to the high quality of the submitted papers. More than 50% of the papers were not accepted. Much appreciation is given to the valuable contribution of hundreds of reviewers for the high quality of their evaluations. Special thanks to Prof. M. Kazmierkowski, Editor-in-Chief of the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, for his support in making this Special Section possible. Finally, the support of the Universidad Técnica Federico Santa Maria is also acknowledged.

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