Guest Editorial
Special Section on High-Power-Factor Rectifiers I

THE importance of ac/dc converters ("rectifiers") has been increasing continually since the 1970's. There are two main reasons.

1) An increasingly large fraction of the generated electric power is being processed through rectifiers prior to its use at the final load. This power includes the power for almost all applications *other* than motors, heaters, and lighting that are operated at the power-line frequency.
2) The high harmonic content of the current drawn from the power lines by the rectifiers, and the resulting low power factor of the load, have significant detrimental effects on the power-distribution system. Conventional capacitor-input rectifiers draw large-amplitude short-duration spikes of current from the power line, during the time intervals near the peaks of the voltage waveform. This current waveform has a large harmonic content and also causes the rectifier input to have a low power factor. These two effects cause the following four detrimental results.
   a) The harmonic currents can cause voltage distortion and electromagnetic interference, adversely affecting other users of the power system.
   b) In a Y-connected three-phase power system, the third harmonic currents in the three phases *add* in the neutral conductor, instead of *canceling*, as do the fundamental currents. This causes overheating of the neutral conductor in office buildings that have a high percentage of their loads supplied via rectifiers.
   c) The low power factor of the load causes increased i^2R losses in the power-distribution wiring in the user's facility, and in the power-utility's power lines and equipment.
   d) Depending on the relative locations of the power-utility's power-factor-correction capacitors and the loads that draw large-harmonic-content current, the capacitors and the line inductance can be series resonant at a frequency near the third harmonic of the power-system frequency. The result can be abnormally short life of a capacitor caused by degradation from overheating by the third harmonic currents and/or overvoltage.

To alleviate the adverse effects of the harmonic currents, governments and international agencies have imposed regulations to limit the harmonic content of the current drawn from the power line by the rectifiers, e.g., the European Norm IEC 1000-3-2, currently in force in many countries.

As a consequence, engineers have spent a great deal of effort in developing rectifiers that comply with the new regulations, making this topic one of the most important areas of research and development in power electronics.

This "Special Section on High-Power-Factor Rectifiers I" collects, and makes available to the international power-electronics and industrial-electronics communities, recent research results on this subject. It includes papers dealing with the most important and recent developments, from many authors in 23 countries. All relevant aspects are treated, such as topologies, control, modulation, filtering, commutation, analysis, design methodology, practical applications, and experimental results.

I would like to express my profound gratitude to the authors who submitted papers for this Special Section of this TRANSACTIONS, and to the 70 reviewers who carried out their reviews of the manuscripts with insight, professionalism, and dedication. To these authors and reviewers I attribute the quality of the papers selected for publication.

During the review process, I had the continual support of the Editor-in-Chief of the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, Prof. Joachim Holtz, to whom I address my special thanks.

I hope the readers find this Special Section useful and interesting.

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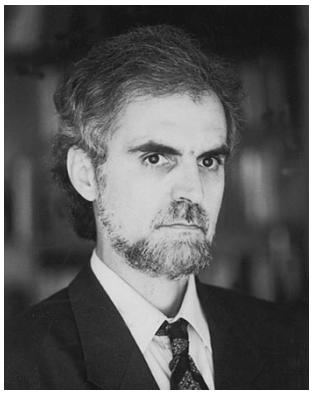

Ivo Barbi (M'78–SM'90) was born in Gaspar, Santa Catarina, Brazil, in 1949. He received the B.S. and M.S. degrees in electrical engineering from the Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil, in 1973 and 1976, respectively, and the Dr.Ing. degree from the Institut National Polytechnique de Toulouse, Toulouse, France, in 1979.

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Prof. Barbi has been an Associate Editor in the Power Converters Area for the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS since January 1992.