

# Editorial for the Inaugural Special Issue on the Developing Trends of Power Electronics: Part 5

WITH this editorial, we sincerely welcome our readers to the brand-new publication — CPSS Transactions on Power Electronics and Applications (CPSS TPEA). It is sponsored and published by China Power Supply Society (CPSS) and technically co-sponsored by IEEE Power Electronics Society (IEEE PELS).

CPSS was founded in 1983 and has been the only top-level national academic society in China that solely focuses on the power supply/power electronics area. In the past 30-plus years CPSS has dedicated to provide to its members, researchers, and industry engineers nationwide with high quality services including conferences, technical training, and various publications, and this in deed has helped the society build up its membership rapidly, which now totals up to more than 4000 individual members plus 500 enterprise members. The fast growth of membership in turn compels CPSS to always work out better services for its members, one of which being the open-up of this periodical — a new journal in English language as a publication platform for international academic exchanging. This of course needs to be done through international cooperation, and that's why IEEE PELS is tightly involved, being the premier international academic organization in power electronics area and one of the fastest growing technical societies of the Institute of Electrical and Electronics Engineers (IEEE).

To fulfill the publishing need of the fast-developing power electronics technology worldwide is a more important purpose of launching this new journal. So far there are only 3 or 4 existing journals which are concentrated on power electronics field and have global reputation. For quite a few years people in the international power electronics community have had the feeling that, the existing journals have not even come close to meeting the huge demand of global academic and technology exchanges. E.g., the two existing IEEE power electronics journals, i.e. IEEE Transactions on Power Electronics (IEEE TPEL) and IEEE Journal of Emerging and Selected Topics in Power Electronics (IEEE JESTPE), now publish about 1000 papers a year, which is under a very low paper acceptance rate of around 25%, but still have a back-log of about one year for the newly accepted papers to finally appear in printed form to the public. The addition of this new dedicated journal would be an ideal improvement to fulfill such a tremendous need.

The booming of publishing need really is an indicator of how fast power electronics has been developing in recent years. Innovations have been continuously coming up from component (both active device and passive device), module, circuit, converter, to system level, covering different tech-

nical aspects as topology or structure conceiving, modeling and analysis, control and design, and measurement and testing. New issues and corresponding solutions have been continuously presenting as the applications of power electronics prevail horizontally in almost every area and corner of human society, from industry, residence and commerce, to transportations, and penetrate vertically through every stage of electric energy flow from generation, transmission and distribution, to utilization, in either a public power grid or a stand-alone power system. I personally believe that we are entering a world with “more electronic” power systems. The prediction around 30 years ago, that power electronics one day will become one of the major poles supporting the human society, is coming into reality. And I also believe, that power electronics is going to last for long time as an important topic since it is one of the keys to answer a basic question for human society, which is how human can harness energy more effectively and in a manner friendlier to both the user and the environment.

Therefore, I assume that there is probably no better fitting as for CPSS TPEA to publish its first few issues under a special topic about the developing trends of power electronics. We have invited a group of leading experts in different areas of power electronics to write survey/review papers or special papers with review/overview nature to some extent. To publish in a timely and regular style, we organize this inaugural Special Issue into 5 different parts. Part 1, 2, 3 and 4 were published in the December issue last year and previous issues of this year respectively, Part 5, appearing in this December issue, is the last part of the inaugural Special Issue.

In Part 5 we are honored to have 6 invited papers. The first four address four recently hot or emerging application areas of power electronics, all with reviews on the state-of-the-arts and discussions about future developing trends, whereas the next two provide overviews on specific technologies, such as components, packaging and integration, and power converters etc., for almost all kinds of application areas.

We begin with a paper on the power electronics applications to electric vehicles. It is authored by Dr. Rik De Doncker and his research group from RWTH Aachen University. It provides an overview of emerging technologies for modular power converter architectures for electric vehicles. Technologies like wide-bandgap power semiconductors, smart topology enhancements, control methods, and highly integrated bidirectional battery charger systems with intelligent charging strategies are all discussed.

The second paper is about power electronics applications to the electrification of subsea systems. It is written

by Dr. Kaushik Rajashekara and his research group from the University of Houston. It presents a summary on the requirements and challenges in the power distribution and conversion for subsea systems, which have become more predominant in recent years. The issues that are discussed include power architectures, power system components, power converters and motor drives, and health analytics and fault handling.

The third paper is regarding the power electronics applications to distributed energy storage systems (ESS) for electric power utilities. It is written by Dr. Liuchen Chang and his research group from the University of New Brunswick. A review of the energy storage market and technology is presented, with a classification of ESS grid support functions, followed by a detailed evaluation on the power electronic converters for distributed ESSs.

The fourth paper introduces power electronics applications to mobile communication systems. It is written by Dr. Xinbo Ruan and his research group from Nanjing University of Aeronautics and Astronautics. The paper sorts, compares and summarizes all different kinds of envelope tracking (ET) power supplies for different specific modern mobile communication systems. Ideas including soft-switching, slow envelope, and band separation are also proposed as possible solutions to further improve the efficiency of the ET power supplies.

The fifth paper is written by Dr. Laili Wang, Dr. Xu Yang and their students from the Power Electronics and Renewable Energy Center at Xi'an Jiaotong University, discussing integration technologies for power electronics systems. It reviews and evaluates the state-of-art integration technologies, including an active integration part which covers interconnection, packaging structure, and packaging material for power semiconductor devices, and a passive integration part which encloses magnetic integration, electromagnetic integration, and low-temperature co-fired ceramic (LTCC) technology.

Last but not least, the sixth paper is written by Dr. Conor Quinn and Mr. Dhaval Dalal, both representing the Power Sources Manufacturers Association (PSMA). PSMA publishes a technical report called Power Technology Roadmap

(PTR) every two years, supplying an in-depth review on the recent technological developments related to power sources. This paper summarizes the methodology used and the key findings captured in the most recent edition which was released in March 2017. I believe there is no better arrangement than having a paper like this, reflecting visions of so many technological leaders from power electronics industries, to conclude this Part 5 and the whole Special Issue as well.

I'd like to thank the authors of all these 6 invited papers. It's their high-quality contributions that finally leads to the launching of this new journal. I'd like to thank Dehong Xu, President of CPSS, who in 2015 initiated the idea of publishing the new journal and since then has been persistently supporting my work as the founding Editor-in-Chief. I'd also like to thank Jiaxin Han, Secretary General of CPSS, Jan A. Ferreira, President of IEEE PELS, 2015-2016, Don F. D. Tan, President of IEEE PELS, 2013-2014, and Frede Blaabjerg, IEEE PELS Vice President for Products, 2015-2018, who form the CPSS and IEEE PELS Joint Advisory Committee for our new journal with Dehong Xu and myself. Other IEEE officers and leading staffs like Dushan Borovjevic, PELS President, 2011-2012, Alan Mantooth, PELS President, 2017-2018, Mike Kelly, PELS Executive Director, and Frank Zhao, Director of China Operations, IEEE Beijing Office, just to name a few, also provided continuous support and constructive advices. My earnest thanks also go to the CPSS Editorial Office led by Lei Zhang, Deputy Secretary General of CPSS, for their wonderful editing work. It would not have been possible to create a new journal in such a short time without their efforts. I'd like to finally thank all the members of the Executive Council of CPSS and particularly the leaders of Chinese power electronics industry. They always firmly stand behind CPSS TPEA and ready to help whenever needed.

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Dr. LIU coauthored 3 books (including a textbook), published over 200 technical papers in peer-reviewed journals and conference proceedings, and holds more than 30 invention patents (China/USA). He received for 7 times governmental awards at national level or provincial/ministerial level for scientific research achievements or academic/teaching career achievements. He also received the 2006 Delta Scholar Award, the 2014 Chang Jiang Scholar Award, the 2014 Outstanding Sci-Tech Worker of the Nation Award, and the IEEE Transactions on Power Electronics 2016 Prize Paper Award. His research interests are power quality control and utility applications of power electronics, micro-grids for sustainable energy and distributed generation, and more/all electronic power systems.

Dr. Liu has served as the IEEE Power Electronics Society (PELS) Region 10 Liaison and then China Liaison for 9 years, an Associate Editor for the IEEE Transactions on Power Electronics for 9 years, and starting from 2015 the Vice President for membership of IEEE PELS. He is on Board of China Electrotechnical Society (CES) and was elected to a Vice President of the CES Power Electronics Society in 2013. He is the Vice President for International Affairs, China Power Supply Society (CPSS) and the inaugural Editor-in-Chief of CPSS Transactions on Power Electronics and Applications.