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Editorial

Power Electronic Circuits for Electric Drives and Renewable Energy Sources

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This Special Issue was intended to consolidate the most recent advances in the field of power electronics for renewable energy sources and electric drives. The recent energy transition outlooks show a clear trend in increasing the penetration of renewables in the upcoming years to reach the green shift. In this scenario, the power electronics will play a key role in conditioning the power coming from highly variable renewable energy sources and help transition to fully renewable electric grids or smart grids.

The keywords of interest in this comprehensive Special Issue were efficiency and reliability, which are crucial when considering the improvement of various energy generation technologies, such as wind, tidal, wave, photovoltaic, and power electronic interfaced loads. Attracting the submissions on new advances in the materials of the power switching devices, new circuit topologies, and non-conventional converter layouts was of interest as well.

The Special Issue was closed on 25 May 2022, with 6 published papers. All in all, 35 authors from 15 affiliations collaborated in the excellent performance of the Special Issue. Authors' institutions belong to 7 nations worldwide, distributed as follows:

- Italy: 5 institutions with 11 Authors;
- Mexico: 4 institutions with 9 Authors;
- South Korea: 2 institutions with 3 Authors;
- India: 1 institution with 7 Authors;
- Saudi Arabia: 1 institution with 2 Authors;
- Singapore: 1 institution with 2 Authors;
- Spain: 1 institution with 1 Author.

In the following section, the papers accepted per each topic will be rapidly summarized along with their main achievements. The six articles are equally split into three different power electronic circuits subcategories:

1. Power converters for photovoltaic generation, [1,2];
2. Power electronics for innovative electric drives, [3,4];
3. Power converters modeling and control, [5,6].

As for the first topic, i.e., power converters for photovoltaic generation, the authors in [1] proposed a photovoltaic inverter for transformerless grid-connected applications. Analysis, design, and experimental validation broadly discuss high-efficiency, low component count, and negligible leakage current converter features. Similar topologies have been taken as a term of comparison. On the other hand, a photovoltaic chopper for stand-alone photovoltaic applications with battery energy storage is proposed in [2]. One of the most interesting characteristics is soft-switching operations and the absence of output voltage feedback. A 500 W prototype validates the proposed configuration.

The second topic, i.e., power electronics for innovative electric drives, features two papers; one is regarding the hybrid drivetrain with the tractor application [3] and the other the

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Citation: Loncarski, J.; Boström, C.; Mandrioli, R. Power Electronic Circuits for Electric Drives and Renewable Energy Sources. *Energies* **2022**, *15*, 5301. https://doi.org/10.3390/en15145301

Received: 18 July 2022
Accepted: 19 July 2022
Published: 21 July 2022

review paper on the high-frequency motor models and partial discharge phenomenon [4]. The innovative full-hybrid driveline based on an electric continuously variable transmission has been analyzed in [4]. System architecture and control have been compared with conventional tractors, while unprecedented features such as power boost, full-electric mode, optimized auxiliary drive and electric power delivery have been discussed and simulated. A tractor prototype demonstrates compact layout installation ease. Authors in [4] proposed a review paper on the impact of high-speed drives PWM voltage waveforms on dielectric aging and electrical stress. An extensive discussion of the partial discharge phenomenon and the high-frequency motor models necessary for its study is given. Overall, 85 manuscripts have been reviewed and compared, considering models' main features and experimental voltage waveforms.

The third topic, i.e., power converters modeling and control, features 2 papers [5] and [6]. Authors in [5] treated a fault-tolerant multilevel inverter with reduced switch count and its advanced fault ride-through control. The inverter is controlled utilizing an adaptable nearest-level control PWM that is updated thanks to an artificial intelligence-based decision tree with a reduced computational burden. On the other hand, the authors in [6] took care of the closed-loop instability for the voltage regulation in boost converters. Converter average linear model is split into minimum and normalized non-minimum phase. A non-integer order PID is employed; a fractional-order PID approximation is suggested for the minimum phase part to achieve voltage regulation with a single iso-damping control loop.

All the papers selected for this Special Issue have shown important insights and contributed to making this Special Issue successful in demonstrating the recent advances in the field of power electronics for electric drives and renewable energy sources.

Author Contributions: Conceptualization, J.L., C.B. and R.M.; methodology, J.L., C.B. and R.M.; resources, J.L., C.B. and R.M.; writing—original draft preparation, J.L., C.B. and R.M.; writing—review and editing, J.L., C.B. and R.M.; supervision, J.L., C.B. and R.M.; project administration, J.L., C.B. and R.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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