Guest editorial

Highly efficient and reliable power converters for microgrid applications

Guerrero, Josep M.; Sathik M, Jagabar; Shalchi Alisha, Rasoul; Almakhles, Dhafer

Published in:
Frontiers in Energy Research

DOI (link to publication from Publisher):
10.3389/fenrg.2022.1101342

Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

frontiers | Frontiers in Energy Research

TYPE Editorial
PUBLISHED 12 January 2023
DOI 10.3389/fenrg.2022.1101342

OPEN ACCESS

EDITED AND REVIEWED BY
ZhaoYang Dong,
Nanyang Technological University,
Singapore

*CORRESPONDENCE
Jagabar Sathik M.,
srmmjs@gmail.com,
mjsathik@ieee.org

SPECIALTY SECTION
This article was submitted to Smart Grids, a section of the journal Frontiers in Energy Research

RECEIVED 17 November 2022
ACCEPTED 26 December 2022
PUBLISHED 12 January 2023

CITATION
Guerrero JM, Sathik M. J, Shalchi Alisha R and Almakhles D (2023), Guest editorial: Highly efficient and reliable power converters for microgrid applications. *Front. Energy Res.* 10:1101342. doi: 10.3389/fenrg.2022.1101342

Guest editorial: Highly efficient and reliable power converters for microgrid applications

Josep M. Guerrero[1], Jagabar Sathik M.[2]*, Rasoul Shalchi Alisha[3] and Dhafer Almakhles[4]

[1]Institute of Energy Technology, Aalborg University, Aalborg, Denmark, [2]Renewable Energy lab, Prince Sultan University, Saudi Arabia and SRM Institute of Science and Technology, Chennai, India, [3]Rasoul Shalchi Alishah, Sweden Mid Sweden University, Sundsvall, Sweden, [4]Renewable Energy lab, Prince Sultan University, Riyadh, Saudi Arabia

KEYWORDS

microgrid, power converters, reliability, renewable energy sources, DC and AC

Editorial on the Research Topic
Highly efficient and reliable power converters for microgrid applications

1 Introduction

The microgrid is self-contained and may operate independently or with the primary grid. A group of nano grids also constructs the microgrid structure, which is governed by centralized control algorithms. Microgrids' principal purpose is to shorten the length of power transmission. These microgrids are constructed with various integrated or independent energy sources, including renewable energy (RES). Maintaining a dependable and efficient power supply to end-users is crucial, as most RES is subject to natural variability.

The connection between power electronics and energy storage, robust and intelligent control, and an online monitoring system are crucial for achieving a highly efficient and reliable microgrid. Another aspect is how modern Artificial Intelligence algorithms are utilized in power electronics systems to make real-time autonomous decisions. Integration of several RES, which impacts the reliability of the electric power supply, is an additional issue. This research topic seeks to develop a microgrid system that is both highly efficient and robust.

2 Published papers

Several power converter topologies exist; however, this Research Topic strives to supply microgrid applications with highly efficient and reliable power converters. However, the majority of existing power converters do not emphasize reliable characteristics. This Research Topic accepted four research articles and one review article following rigorous peer review and editing.

The subject of the Research Topic can be divided into two categories.

(i) Development and Analysis of New Power Converter Topologies; and
(ii) Improving the Performance of microgrids using Advanced Control Techniques. The corresponding papers under each category are summarised below

2.1 Development and analysis of new power converter topologies and modulation schemes

Gopinath et al. proposed designing and developing a novel common ground type transformerless inverter topology for grid-connected photovoltaic applications. The experimental results confirm the voltage boost and decreased leakage current.

Multilevel inverters (MLIs) are more desirable for medium-voltage and high-power applications. However, traditional MLIs contain numerous power electronics. In this study, Kubendran and Shuaib proposed a new multi-source MLI with a reduced number of devices. In addition, the proposed topology features on-state switches with a low standing voltage. The results are finally confirmed using the HIL tool.

Palanisamy et al. developed an effective space vector modulation method for two- and three-level DC/AC inverters. This study focuses on a novel space vector pulse width modulation approach for a three-phase matrix converter, and the results were verified using hardware-in-the-loop.

2.2 Improving the performance of microgrids using advanced control techniques

Yuvaraja S et al. presented a thorough analysis of the various dynamic wireless power transfer systems for electric vehicle charging applications. In addition, the review focused on the present challenges associated with a DWPT system, including the design of a power converter, charging couplers, compensation network, foreign object detection system, economic aspects, and microgrid-integrated DWPT system. In addition, the economic analysis, electromagnetic compatibility, and interference of the charging system are examined in detail.

Suchitra D et al. studied the proportionate reactive power-sharing scheme in a grid-independent mode by analytically calculating the equivalent impedance without the need for communication lines. Incorporating virtual impedance and private loads provides the distribution generation with reactive power charging. The suggested system's validation is tested using a real-time OPAL-RT simulator.

3 Perspectives

At the time of writing this Editorial introduction, this Research Topic has received 5,925 views and 437 downloads from various publications from researchers worldwide. Improving the system's efficiency and dependability through further development of the power converter and its control for microgrid applications has gained considerable interest.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note