

# Design, Control, and Maintenance Methods for High Reliability Power Electronic Systems

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Electrification is a megatrend in the modern economy, urged by the need for a more ecological and sustainable impact of new technologies, among many other electrification efforts. The widespread adoption of renewable energy, transportation electrification, energy storage systems and smart manufacturing are remarkable. As a result, power electronics has become the critical enabling technology for improving energy efficiency and sustainability. In recent years, the reliability of power electronic equipment has been under scrutiny, especially in mission-critical applications of power electronics converters. Recently, special attention has been paid to the development of lifetime models of the main electronic components, which could then be applied to probabilistic analysis based on the mission profile of system-level reliability. This prediction methodology has some limitations because it does not consider external factors and agents other than the wear itself. Redundancy has been the typical approach to improve the availability of mission-critical power electronic systems, which could be associated with considerable extra cost. Fault-tolerant converters were proposed as a more cost-effective alternative solution that could also extend the service life. The maintenance cost could be reduced by using active thermal control, which allows the balancing of wear damage in modular power electronic converters and, consequently, the scheduling maintenance events. A further step could be taken with the application of real-time condition monitoring of systems, which has evolved into the concepts of predictive and prescriptive maintenance that allows for prediction and mitigation of faults. These techniques are under active development and are expected to benefit from new methods and technologies from actively developing fields of IoT and artificial intelligence. This special section aims to gather the latest advancements in the design, control, and maintenance methods of power electronic systems that improve their reliability to meet lifetime design goals and/or reduce maintenance costs.

We encourage all researchers working in this area to submit papers to this Special Section. Topics of interest include, but are not limited to:

- ✓ Fault-tolerant converter topologies and their control
- ✓ Fault detection and identification techniques
- ✓ Active thermal control for modular power converters
- ✓ Condition monitoring techniques for power converters
- ✓ Predictive maintenance of power converters
- ✓ IoT in condition monitoring of power electronic systems
- ✓ Application of machine learning in condition monitoring and predictive maintenance
- ✓ Digital twins in condition monitoring and predictive maintenance
- ✓ Novel open-source tools along with data sets shared via IEEE Data Port for converter design and reliability analysis
- ✓ Improved mission-profile-based reliability analysis methods

## Manuscript Preparation and Submission

Check carefully the style of the journal described in the guidelines “Information for Authors” in the IEEE- IES website: <http://www.ieee-ies.org/pubs/jestie>. Please submit your manuscript in electronic form through: <https://mc.manuscriptcentral.com/jestie-ieee/>.

On the submitting page, in pop-up menu of manuscript type, select: “**SS on Design, Control, and Maintenance Methods for High Reliability Power Electronic Systems**”, then upload all your manuscript files following the instructions.

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