

IEEE Transactions on Power Electronics (TPEL)

Special Section on Advanced Model Predictive Control for Resilient Converter-Dominated Electrical Grids

Scheduled Publication Time: October 2026

Grid resilience has become a critical imperative for modern power systems, to ensure their capability to adapt, absorb, and recover from disruptive natural and cyber threats. The devastating impacts of recent grid outages underscore the urgent need to transition from reliability-focused to resilience-focused grid design paradigms. Converter-dominated systems, featuring high penetrations of distributed energy resources (DERs), create both unprecedented opportunities and significant vulnerabilities for power system operation. Compared to traditional synchronous generators, they are prone to reduced system inertia, complex dynamic interactions, and increased cybersecurity risks, demanding innovative control strategies that can ensure stable and resilient performance under diverse operating conditions and unexpected disturbances.

In the past four decades, Model Predictive Control (MPC) has emerged as a particularly promising advanced control technique for power electronics. MPC offers unique advantages, including multi-objective and multi-timescale optimization under constraints, predictive capability for proactive disturbance mitigation, and real-time adaptation to changing conditions. The significant progress in this field has also led to the industrial commercialization of power electronic products regulated by MPC. However, resilient MPC techniques still face critical research challenges, such as computationally intensive requirements, mitigating cyber-physical attacks, and seamless integration with existing grid infrastructure.

The objective of this special section is to engage the scholarly community in exploring advanced MPC methodologies for a wide range of power converters. It focuses on MPC and its innovative applications to enhance resilience in converter-dominated power systems. By delving into these solutions, we aim to advance resilient control technologies, ultimately propelling the development of advanced power electronics and enabling secure and stable modern grid operations. The topics covered in this special issue encompass various aspects, including but not limited to the following:

- Modelling and simulation techniques for robust/resilient MPC-based grid-connected converters.
- MPC for grid-forming and grid-following power converters: over-current-limiting, grid-supportive, weak/distorted grid, disturbance/unbalance mitigation etc.
- MPC for grid supportive DER inverters: voltage and reactive power regulation, grid fault ride-through, power quality control, and anti-islanding protection.
- MPC for grid-compliant power converters for renewable integration & battery energy storage.
- Robust/resilient MPC for micro-/smart-grids, MVDC grids, micro-energy systems, etc.
- MPC for optimal robust/resilient coordination of parallel/series converters.
- Artificial intelligence solutions for robust/resilient MPC in microgrids, grid-tied converters, etc.
- Cyber-resilient MPC for power converters under malicious attacks
- MPC for grid power conversion system maintenance: fault detection, diagnosis, etc.
- Grid-interactive EV infrastructure: MPC charging optimization, bidirectional EV charging control, EV grid support, etc.

All manuscripts must be submitted through ScholarOne at <https://mc.manuscriptcentral.com/tpel-ieee>. Submissions must be clearly marked “Special Section on Advanced Model Predictive Control for Resilient Converter-Dominated Electrical Grids” on the cover page. **Hardware based experimental results are desired to support proposed ideas.** When uploading your paper, please select your manuscript type “Special Section.” Refer to <https://www.ieee-pels.org/> for general information about electronic submission through ScholarOne. Manuscripts submitted for the special section will be reviewed separately and will be handled by the guest editorial board noted below.

Deadline for Submission of Manuscript: March 31, 2026

Guest Editors

1. Zhenbin Zhang, Shandong University, China
2. José Rodríguez, Universidad San Sebastian, Chile

Timeline

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| • March 31, 2026 | Manuscripts Submission Deadline |
| • May 15, 2026 | Revised Manuscripts Submission Deadline |
| • June 30, 2026 | Final Acceptance Notification |
| • July 31, 2026 | Manuscripts Forwarded to IEEE for Publication |
| • October, 2026 | Special Section Appears in IEEE TPEL |

Guest Associate Editors

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|-------------------------|---|
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