Special Session on

Advances in Multiphysics Topology Optimization of Electric Machines and Drives

Organized and co-chaired by:

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Abstract

Topology optimization (TO) has emerged as a powerful methodology for designing the next generation of electromagnetic, electrical, thermal, and multiphysics devices. Originally introduced in structural mechanics, recent advances have demonstrated that TO can successfully address the complex requirements of electrical machines and components. It can significantly improve performance metrics such as torque, torque ripple, and iron losses, while also reducing material usage. Simultaneous magnetic and structural TO for the design of electrical machines has also been introduced to ensure their mechanical integrity, and more recently, non-linear mechanics has begun to appear in electromagnetic TO for electrical machines.

At another level, novel algorithms have also been proposed, including gradient-based approaches and Pareto-based formulations. A growing trend is the integration of AI and topology optimization, particularly through deep learning (DL) based on deep neural networks (DNNs). Three perspectives can be used to classify DNN-based approaches in TO: regression-based and generative model–based strategies for data-driven learning; and, within the TO loop, direct design, sub-procedure substitution, post-processing, and parameterization techniques leveraging DNNs. Conversely, level-set–based shape optimization is increasingly establishing itself for the 3D optimization of electrical machines and for addressing multi-material design problems.

Finally, as additive manufacturing (AM) provides new design opportunities, TO is ideally suited for AM because it can be used to design high-performance structures that fully exploit the fabrication freedom offered by AM. Currently, coupled topology optimization and AM process constraints constitute an emerging research direction, with several challenges still to be addressed—particularly in lattice structures, the

integration of processing parameters into TO, and robust topology optimization in the context of AM.

This special session aims to assemble the latest contributions that push the boundaries of multiphysic topology optimization for electrical machines and electromagnetic devices, taking into consideration problem formulation or Novel algorithm, as well as cross-domain applications involving, power electronics, or AM.

Topics of interest include, but are not limited to:

- Multiphysics topology optimization.
- Advances in TO algorithms and methodologies.
- Machine Learning & Data-Driven Approaches.
- TO for Additive Manufacturing and Industrial Applications.

Important dates

- Full Paper Submission: February 1, 2026
- Full Paper Notification: May 1, 2026
- Final Paper Upload: June 1, 2026

Submission of papers

Paper submission follows the rules of regular papers. All the instructions for paper submission are included in the conference website:
https://icem2026.ubi.pt/submission.html