

GRID EMT

SIMULATION INITIATIVE

Activities and Impact of the EMT Features WG

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Key Challenges in Using EMT For Engineering Decisions

Interpreting large EMT datasets

GBs of simulation outputs
Manual waveform review
Slow time-to-insight

Diagnosing reliability risks

Oscillations
Controller interactions
Instability and protection actions

Standardizing EMT workflows

Ad-hoc scripts and manual steps
Reduced consistency
Limited reproducibility

Translating compliance needs

Convert standards and compliance needs into EMT scenarios, measurable criteria, and clear pass/fail evidence.

Understanding converter-dominated dynamics

Converter controls
Weak-grid and ride-through behavior
Limited dynamic visibility

EMT complexity is rising faster than ability to analyze results



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The Scope of the Features WG

Goal: Advance EMT Analysis capabilities through standardized workflows, automated analytics, intelligent post-processing, and AI-assisted decision support to make ***EMT studies more insightful, actionable and efficient*** for converter-dominated power systems.

Techniques: Dynamical system theory, Physics-inspired Data-driven techniques and LLM fine tuning for EMT.

***Systematic Processing of EMT Simulation Output Data to
Provide Insight to End Users***



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Research Thrusts

- Weak-grid and voltage stability screening
- Control design support
- Automated model validation
- LLM assisted visualization and analytics
- Integrated large-load EMT workflow
- **Expected Outcome:** Streamlined EMT workflows that includes model verification, automated control tuning, better screening of stability risks, and verifiable AI-assisted decision support.



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Ongoing WG Activities in FY26

- **Webinars:**
 - Yunjie Gu (Imperial) discussed methods to characterize stability of power-electronic-dominated grids on June 30
 - Meng Wu (ASU): LLMs for EMT model validation, Nov 17
- **2026 EMT Workshop :**
 - Topics include: Control design, EMT-based stability and screening metrics, LLM-enhanced EMT usability and automation & Model verification and validation automation
- **WG Webpage in Progress** - Technical dissemination and public-facing outreach for the Feature WG.



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FY26 Impact Expected from WG Activities

Impact

Value Delivered

Planning & Operations

Earlier identification of weak regions and dynamic risks

Control Design

Reduced effort to determine stabilizing controls for power electronics dominated systems

Model Quality & Trust

Faster, scalable EMT model validation

Time-to-Insight

Post-processing reduced from days to minutes

Large-Load Integration Tool

More realistic EMT analysis of data centers and converter-dominated loads, support better usability and automation (Focus in 1st year)

Goal Setting

Clear features roadmap (1-, 3-, 5-, 10-yr) to accelerate use of EMT by utilities and ISOs to address emerging challenges



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Brainstorming Activity with ISOs and Utilities

Goal: Identify where ISO/Utility engineers spend the most manual effort in EMT post-processing, what events and risks are difficult to detect, and what features would make EMT simulation results more actionable.

- Majority of time spent in manually plotting and analyzing results to diagnose unexpected behavior such as oscillations and device tripping
- **Participants want automation, but only if it is traceable and supported by engineering evidence.**
- Initial Focus: automated event detection + evidence highlighting + intelligent plotting.
- Next: root-cause diagnosis, case comparison, model validation, and full AI-generated reports.



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Thank You

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