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EMT Initiative: WG4: Features

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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

IBR/IBL controls
Weak-grid and ride-through behavior
Limited dynamic visibility

EMT study complexity is increasing faster than engineers' ability to analyze results.

The Scope of the Features WG is the Systematic Processing of EMT Simulation Output Data to Provide Insight to End Users

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.

Research Thrusts

- Weak-grid and voltage stability screening
- Control design support
- Contingency and scenario prioritization
- Stability, oscillation and root-cause 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.

Relevant Ongoing WG Activities in FY26



- **Webinars Planned**
 - Yunjie Gu (Imperial) will discuss 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 from Aug 18-21 in Washington DC:**
 - 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.

FY26 Impact Expected from WG

Impact	Value Delivered
<i>Planning & Operations</i>	Earlier identification of weak regions and dynamic risks
<i>Control Design</i>	Reduced effort to determine stabilizing controls for power electronics dominated systems
<i>Model Quality & Trust</i>	Faster, scalable EMT model validation
<i>Time-to-Insight</i>	Post-processing reduced from days to minutes
<i>Large-Load Integration</i>	More realistic EMT analysis of data centers and converter-dominated loads, support better usability and automation
<i>Goal Setting</i>	Clear features roadmap (1-, 3-, 5-, 10-yr) to accelerate use of EMT by utilities and ISOs to address emerging challenges
<i>Non-technical Impact</i>	Webinars (2+), talks (2+), peer-reviewed articles (2+)

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.

Thank you

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