OAK RIDGE National Laboratory

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EMT Initiative: WG5
Training & Workforce Development

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Scope

- *To assess the current state* of education and training activities related to Electromagnetic Transient (EMT) simulation across academia, utilities, and industry.
- *To recommend* specialized, cross-disciplinary training programs and resources to prepare the next-generation workforce for future EMT simulation needs, particularly with increased power electronics-based devices in power grid.
- *To compile a comprehensive set* of resources and references including open-source documentation, videos, lectures, tutorials, tools, and articles to support EMT education and training.
- *To support development and dissemination of* EMT training materials through the EMT initiative.

Gaps and Challenges

- **Limited Exposure in Curricula**
  - Minimal to no exposure to EMT content in undergraduate curricula.
  - Courses generally lack on *EMT simulation related to system level studies, Large-Load scenarios, and power electronics-dominated systems*.
  - Lack of Industry/Academic/National Lab Collaboration on EMT training.
- **Lack of training on EMT Fundamentals**
  - Lack of trainings on *EMT fundamentals* to provide the core theoretical knowledge.
- **EMT as a Cross-Disciplinary Topic**
  - Lack of cross-disciplinary topics (e.g., use of HPC, parallel computing, GPU, use of AI).
  - Significant workforce gap in understanding EMT data structure.
- **EMT related Resources**
  - Lack of a centralized repository for EMT-related tools, references and training materials.
  - Limited trainings/workshops and ongoing opportunities for continuous learning.

Recommendations

- Develop **structured training modules** covering EMT fundamentals through advanced applications, adaptable for both short courses and full curricula.
- Compile and categorize EMT resources, map them to relevant modules, and host them on a centralized, publicly accessible **repository**.
- Regularly organize **webinars, tutorials, and panel discussions** on EMT topics.
- Encourage universities and industry to make lectures, presentations, and **training materials open and accessible**.
- Create open-source EMT tools, solvers, **test systems, practice problems**, **industry use cases**, and video lectures to support learning and skill development.

Timeline	Activities
<2 years	Course Modules on Basics and Fundamentals of EMT Create a repository of Resources Organize Panels/ Webinars
2-5 years	Course Modules on Applications and Advanced Features of EMT Develop real-world examples and test systems Develop and offer new modules/courses on EMT Develop and offer Tutorials on EMT topics
5-10 years	Develop open-source tools, solvers Develop training resources for continuous learning

WG5 Progress:

- Activities started on the development of multiple short course modules:
  - An Introductory Course on EMT
  - In-Depth Modules:
    - Circuit Analysis with Transients
    - Digital Signal Processing (DSP) for EMT
    - Numerical Linear Algebra for EMT
    - Modeling of Components for EMT Simulation
    - Power Electronics Components and Control
- EMT Tutorials (ECCE'26, Vancouver, Canada) and Webinars
- Poster Session/Student Activities on 2026 Annual EMT Workshop (Washington D.C, August 18-21)

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Need more volunteers to contribute to/adopt the education/training resources !!