encoord
Plan the Energy Future

Planning for Future Stability Needs

In Q1 and Q2 of 2024, we talked with 40 power system researchers, consultants, and planners to survey today and tomorrow's dynamic stability assessment needs.

Motivation

Modern dynamic stability assessment studies face growing complexity as power grids evolve. While phasor-domain analyses were traditionally sufficient to ensure reliability, complementing them with higher-fidelity electromagnetic transient (EMT) simulations is often necessary due to the relatively faster control dynamics of inverter-based resources. However, doing such complementary analyses is difficult today for multiple reasons, including existing software limitations.

Motivated by these limitations, encoord, with the support of a National Science Foundation Small Business Innovation Research (NSF SBIR) grant, is researching novel simulation architectures and paradigms to address the contemporary and future dynamic stability assessment needs.

Shared Viewpoints

We conducted a qualitative analysis to determine industry challenges for dynamic stability assessments.

Data

70% — **Source data barriers**

Seventy percent of participants noted that either the amount of high quality data required, or the proprietary nature of device models, are barriers to system-wide EMT simulations.

Execution

50% — **More detail needed, at times**

Half of participants expressed that EMT detail is needed to assess grid stability in certain cases, but it's difficult to know when and where such detail is needed.

Reporting

60% — **Cognitive overload**

Sixty percent of participants expressed that cognitive burdens are a significant barrier to EMT simulations. Specifically, many participants noted they believe the barriers to present and future EMT adoption were primarily cognitive, not computational.

>50% — **These challenges make replacing industry tools difficult**

Over half of participants noted that replacing simulation tools is difficult for the energy industry.

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Planning for Future Stability Needs

Select Viewpoints

Viewpoints we found particularly interesting.

Contemporary Approaches With Existing Software Will Not Work

Today's solutions to speedup EMT simulation tools, or create hybrid phasor/EMT models with existing software, are not sustainable.

Numerical Noise Vs. Results

Numerical noise from solvers can be indistinguishable from meaningful simulation results. This can be a major source of cognitive burden.

Model Precision

System-wide EMT simulations will not be useful if individual device models do not precisely reproduce real device behavior.

Grid-Forming Inverters May Absolve Need For EMT Detail

Emerging research suggests that EMT detail may not be required for systems with grid-forming inverter-based resources. However, this assumption may not be valid for all system stressors (e.g., faults).

Separation of Domains from Tools

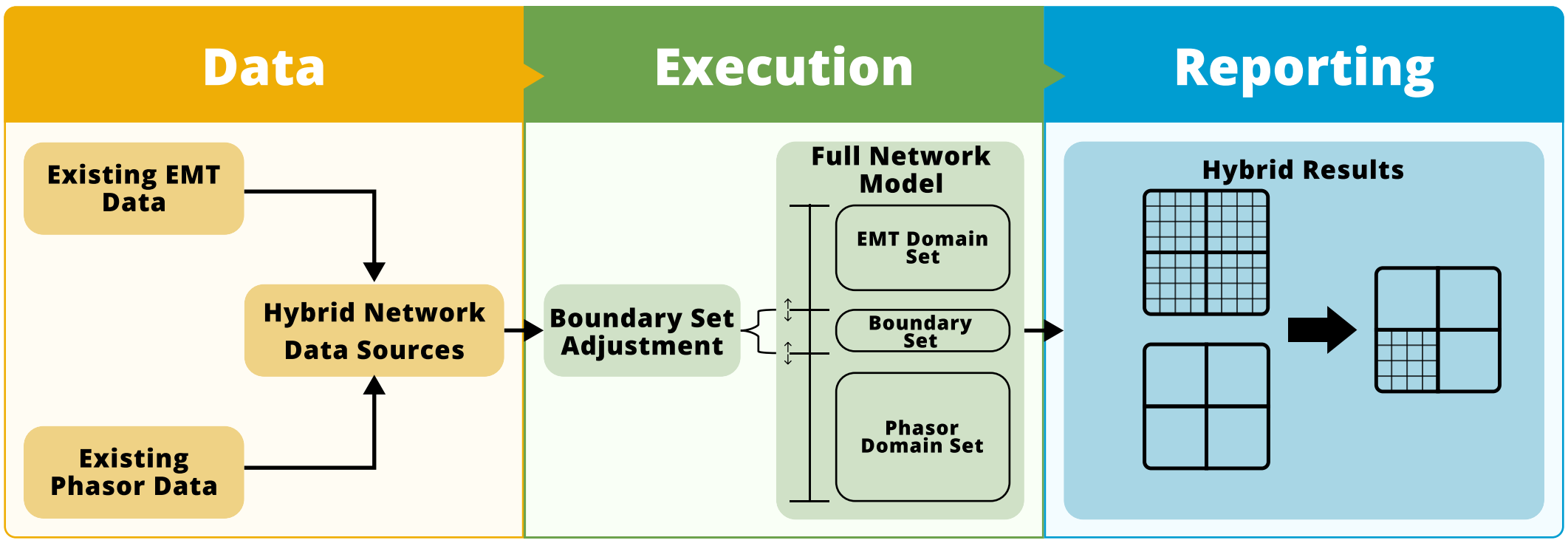
If all you have is a hammer, everything looks like a nail... Our industry may need to think about new applications of modeling domains to answer tomorrow's questions.

Model Standardization

There may be room for test-driven standard models that would alleviate existing data needs. Standardization could be incentivized with shorter interconnection approval processes.

Our Solution

Here at encoord, we are using these insights to revolutionize the dynamic stability assessment process. Based on the challenges highlighted through our market research, we believe that a hybrid phasor-EMT tool, built on a single software platform, will be a key component for meeting the ever-evolving needs of our industry.



Our hybrid solution alleviates the need for system-wide high fidelity data.

Our solution autoadaptively determines when phasor or EMT detail is needed.

Our solution generates targeted insights based on where detail is needed.

We are currently creating a proof-of-concept for our hybrid tool as part of our NSF SBIR Phase I. We have promising preliminary results and expect to be commercializing by 2025.

Follow along with the project

Follow us on LinkedIn to stay updated on the project and see what else encoord is up to by following the QR Code or visiting:

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