Engineering Analysis
Task Team

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NASPI Virtual Meeting
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Advanced Model Validation & Calibration

- New EATT White Paper
- Lead: Honggang Wang (GE)

Objective: Document industry advancements in model validation and calibration
Outline

1. Introduction
   1.1 Motivation for Model Validation & Calibration
   1.2 Datasets and Data Requirements for Model Validation & Calibration
   1.3 Power System Model Validation Overview
   1.4 State-of-the-Art Methods and Tools for Model Validation & Calibration
   1.5 Limitations of Existing Methods and Desired Features of Advanced MVC

2. Advanced Model Validation
   2.1 Proposed Method (GE)
   2.2 Other Proposed Method
   2.3 Performance Validation Process and Metrics

3. Advanced Model Calibration
   3.1 Advanced Parameter Selection
      3.1.1 Trajectory Sensitivity Approach
      3.1.2 PCA and Similarity Based Methods (GE)
      3.1.3 Other
   3.2 Advanced Model Parameter Tuning/Estimation
      3.2.1 Estimation Based Approach
         3.2.1.1 Kalman Filter (PNNL)
         3.2.1.2 Other
      3.2.2 Optimization Based Approach
         3.2.2.1 Efficient Trust Region Approach (GE)
         3.2.2.2 Other
   3.3 Performance Validation Process and Metrics

4. Multiple Event Based Model Validation & Calibration
   4.1 Event Selection
   4.2 Aggregation of Performance Metrics Across Multiple Events
   4.3 Multiple Event Model Calibration

5. Conclusions

6. References
MVC Motivation

- System reliability studies
  - Planning
  - Operations

<table>
<thead>
<tr>
<th>NERC Standards</th>
<th>Validation Focus</th>
<th>Validation Method</th>
<th>Entities</th>
<th>Interval</th>
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</thead>
<tbody>
<tr>
<td>MOD-026-1</td>
<td>Validate generator voltage and reactive power response</td>
<td>Staged test (for GO) and POI disturbance-based model validation (for TP)</td>
<td>TP, GO</td>
<td>Every 10 year or significant change to the plant that modify its response capability</td>
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<tr>
<td>MOD-027-1</td>
<td>Validate generator frequency and active power response</td>
<td>Staged test (for GO) and POI disturbance-based model validation (for TP)</td>
<td>TP, GO</td>
<td>Every 10 year or significant change to the plant that modify its response capability</td>
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<tr>
<td>MOD-032-1</td>
<td>Interconnected transmission system model</td>
<td>NA</td>
<td>PC, TP, BA, GO, LSE, RP, TO, TSP</td>
<td>Every 13 calendar months</td>
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<tr>
<td>MOD-033-1</td>
<td>Interconnected transmission system model</td>
<td>disturbance based model validation (for PC)</td>
<td>PC, RC, TO</td>
<td>Every 24 calendar months</td>
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MVC Process

Phasor Measurements

Before

Verification
Comparing measured and simulated results
Oscillations (FRQ, DAMP, Mode Shape, Sources)

Calibration
Tuning model parameters

Simulation Engine

After