Spectral Analysis Baselining

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Project Objective

Objective
Utilize spectral analysis methods to investigate underlying oscillations in the power system and provide a means to detect them

Motivation
Explore and investigate other oscillatory behaviors on the power system beyond normal small signal stability, to help diagnose grid issues and increase the overall understanding of power system dynamics
Spectral Analysis for Oscillation Detection

- MATLAB-based tool and analysis
- Utilize spectral analysis techniques to extract information from phasor measurement unit data
- Determine existence of persistent oscillations
- Generate report summarizing events
PNNL Approach

- Off-line or “delayed online” approach
  - Post event analysis and follow-up
  - Operations engineer and planning engineer tool, not direct operator tool
- Detect oscillations that may be of interest
  - Spectral-based estimation method
  - Dynamic thresholds
- Output results to follow up on or investigate further
Spectral Coherence Analysis Tool
April 2013 Probing Test

Brake Insertion

Interesting Osc at 13 Hz

Pseudo-random Probing
Major Technical Accomplishments for FY14

- Evaluated initial version with Bonneville Power Administration
  - Feedback on algorithm robustness
  - Feedback on data output results
Deliverables and Schedule for FY14

• June 2014
  – Complete algorithm adjustments to increase reliability
  – Complete report output changes
  – Complete thresholding implementation

• August 2014
  – Complete report of study results and plan for future study
Risk Factors

• Scenarios that cause algorithm instability may be missed
  – Insure testing occurs on a variety of data sets and settings
  – Promote external testing

• Output report format may not be useful
  – Engage external collaborators for feedback and suggestions
  – Promote shorter reports to reduce “data overload”
Follow-on Work for FY15+

- Incorporation of algorithm into Data Integrity Situational Awareness Tool (DISAT)
- Further industry feedback
- Refinement of detection algorithm
- Transition final algorithm into commercial software tools
Questions?