Technology Innovation Project

Project Brief

TIP 325: Real-Time System Operating Limits (SOL) Computation and Visualization for BPA

Context

Real-time contingency analysis (RTCA) is an integral part of a utility's grid operations, but it is unable to assess post-contingency system performance at higher system stress levels. Analyzing system performance at a higher stress level is of great importance for real-time environment because impending system vulnerabilities such as voltage collapse can be identified more accurately, and operators can adjust the system and develop operating plans to respond adequately to potential weaknesses in the interconnected meshed power system network.

A significant factor contributing to enhancing the reliability and improving the economic efficiency of the bulk power system has been the recent installation of Phasor Measurement Units (PMUs) throughout the US.

Use of synchrophasor data allows for continuous monitoring of the power system and computation of operating margins at much higher resolution rates than are available today. BPA currently has a PMU infrastructure supplying measurements from 126 PMUs.

Description

Increasing variability of power system operating conditions and the influence of uncertain factors on grid operations require improving on-line power system security assessment and monitoring. Traditional off-line calculation of the power system transfer capabilities related to voltage limitation become inefficient in the face of variability and need to be conducted on-line in order to provide the "operators the situational awareness necessary to identify and plan for contingencies and reliably operate their systems"

The project is a demonstration study to (1) compute the system operating limits in real-time, (2) benchmark and validate the computation results with the results of BPA's off-line analyses, (3) develop prototype interfaces with BPA's State Estimator and synchrophasor data, and (4) visualize the results of real-time computation of system operating limits in an easy-to-understand concise way.

Three applications from VR Energy's ***Region Of Stability Existence (ROSE)*** software will be customized and used to perform computations for project.

Physical and Operational Margins (POM) performs automated AC transfer/contingency analysis with visualization while simultaneously monitoring and enforcing voltage constraints, thermal overloads and steady-state stability.

OPtimal Mitigation Measures (OPM) is a fast and efficient remedial actions software tool that determines the minimum amount of mitigation measures based on a user-defined priority schedule every time POM identifies a voltage, thermal or voltage stability violation.

Boundary of Operating Region (BOR) is an AC analysis tool that provides a boundary-based solution by identifying and graphically representing the region within which the system operation is secure

Why It Matters

Lack of real-time tools and capabilities for voltage stability assessment increases the probability of blackout occurrence and cascading outages. Computing voltage stability margins and system operating limits is essential for reliable operation of BPA's bulk transmission system. The need especially increases under increased uncertainties related to integration of intermittent resources, when the results of the off-line analysis might be not available or not applicable.

Goals and Objectives

The main objective of the project is demonstrating the effectiveness and feasibility of computing and visualizing system operating limits in real-time in order to increase the situation awareness of the operators and improve stability and reliability of BPA's transmission system.

Deliverables

The deliverables from the project will include: Technical Specifications for ROSE software customization; the appropriate testing and validation of computation results; analysis of the effectiveness and benefits of the proposed technology; an IEEE paper describing the project, lessons learned and results; a final report including next steps for the project; and a Technical workshop at BPA

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Project Start Date: October 1, 2014

Project End Date: March 31, 2016

Reports & References (Optional)

Links (Optional)

Funding

Total Project Cost:	$599,960
BPA Share:	$299,980
External Share:	$299,980
BPA FY2015 Budget:	$200,000

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Participating Organizations

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