



TIP 310: New remedial action scheme (RAS) prototyping work to avoid cascading caused by intermittent output of renewable energy resources

Context

The increasing penetration of renewable energy resources (RERs) and electric vehicles (EVs) will likely add dynamics to the power system that produce greater risks of disturbances and outages.

These new sources of power system disturbances may affect the conventional remedial action schemes (RAS), designed to return the grid to normal operation.

The addition of synchrophasors to the grid may allow an increase to transmission system operating limits that would support integration of renewables with intermittent and variable characteristics, provided the data is properly integrated into new control tools of the operational repertoire.

Description

For this project, Hitachi will build a new RAS prototype using synchrophasor input and on-line contingency analysis. Hitachi will then evaluate its utility.

The RAS prototype consists of these components: a Real Time Digital Simulator (RTDS), a protection relay, Phasor Measurement Units (PMU), a Phasor Data Concentrator (PDC), a server, and a central control unit.

The project work will proceed in three steps.

First, Hitachi researches and describes the needed equipment specifications and builds a prototype system that connects all the components. At this stage, we consider a novel method to connect the protection relay to the system.

Second, Hitachi evaluates its on-line, real-time simulation technique using the RTDS. The power system models developed for the evaluation are actually a reduced model of a real power system. The models are then loaded into the RTDS. By using RTDS on-line data, we can evaluate the network topology recognition system and derive a state estimation result. Then, we appraise two items; the decision algorithm of a pre-event / post-event calculation & control method, and the effect of PMU measurement error against the simulation result. We can then compare the evaluation results between Hitachi's real time dynamic simulation program and the simulation results by an off-line digital analysis tool like PSS/E.

Finally, we show the comprehensive prototype system's usefulness by evaluating the on-line simulation control algorithm and analysis result with the off-line tool and RTDS action.

Why It Matters

Currently, there is no on-line (, real-time?) RAS using synchrophasor data. Therefore, requirements for system components have not been defined and the potential benefits of such a system have not been evaluated.

Accordingly, we develop a prototype system; evaluate its utility; and identify the system requirements needed for introducing it to a real power system.

Goals and Objectives

The objective of this project is to study a feasible new remedial action scheme (RAS) using synchrophasors and on-line contingency analysis. The concept of the on-line, real-time RAS, as identified in TIP 275, will be proven by prototyping in the FY2015 work.

Deliverables

Hitachi will provide the following project deliverables:

Step 1: Basic design of prototype system

- Prototype system configuration

Step 2: Evaluate the on-line, real-time simulation

- Verification result of prototype system development

Step 3: Evaluate the control algorithm

- Final report

Additionally, Hitachi will provide the following.

- Simulation results
- Final report and summary

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Project Start Date: May 1, 2014

Project End Date: September 30, 2015

Reports & References (Optional)

Links (Optional)

Funding

Total Project Cost: \$450,000

BPA FY2015 Budget: \$450,000

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