CONTROL SYSTEM FOR ACTIVE DAMPING OF INTER-AREA OSCILLATIONS (PASD)

Patent Pending
Technology Readiness Level: 7
Demonstration of an actual system prototype in an operational environment

Inter-area oscillations may develop on power grids with large generation and load complexes separated by long transmission lines. Poorly damped inter-area oscillations can have devastating effects, such as extensive blackouts like those experienced on the West Coast in August 1996. The current approach to prevent these effects is to operate the grid well below transmission capacity on these long lines, which is not economical. Sandia Labs has developed a control system for damping these inter-area oscillations in order to improve power grid reliability and enable higher power flows.

The Department of Energy has made significant investments in the installation and application of over 1000 Phasor Measurement Units (PMUs) across North America to provide high speed, accurate insight into grid dynamics and stress. Sandia's Control System leverages these PMUs by using their real-time measurements as feedback information to modulate real power flow over a High Voltage DC (HVDC) transmission line. The Control System has an integrated supervisory system that determines damping performance, maintains failsafe operation of the controller, and ensures the controller does no harm to the grid.

Extensive testing of Sandia's Control System on the Pacific DC Intertie (PDCI), an HVDC transmission line, has proven its effectiveness at damping critical inter-area oscillations without reducing the damping of peripheral oscillations. The Control System also demonstrated fast response times (≈100 ms) from the acquisition of PMU measurement data to the time it takes for the PDCI commanded power to reach the grid.

Sandia's Control System can be easily integrated into current grid systems and would improve damping of worrisome inter-area oscillations. It would also reduce and/or postpone the need for new transmission capacity, increase revenue by enabling higher power flows, and facilitate higher penetration of renewable energy on the grid.

TECHNICAL BENEFITS

- Improves grid reliability and efficiency
- Enables higher power flows on stability-limited transmission lines
- Utilizes existing PMUs and HVDC transmission lines
- Incorporates a supervisory system to ensure robust, reliable, and safe performance

Sandia's Control System that was recently tested on the PDCI

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