Power Systems Engineering Research Center

Slow Coherency Based Controlled Islanding in Large Power Systems

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PSERC Public Webinar
Tuesday, February 18, 2014
2:00-3:00 p.m. Eastern Time (11:00-12:00 p.m. Pacific)

Description

Cascading outages have resulted in significant disruptions to power systems all over the world. Controlled islanding can provide a corrective measure of last resort to alleviate the impact of large disturbances. This project presentation provides detailed demonstrations of using slow coherency based controlled islanding to prevent cascading outages in bulk power systems.

An integrated algorithm was developed to identify cutsets for large scale power systems for the application of slow coherency based controlled islanding schemes. The large scale power system was represented as a graph and a simplification algorithm was used to reduce the complexity of the system. Generators belonging to the same slowly coherent group were collapsed into a dummy node, and a graph partition library was used to split the graph into a given number of parts. Some extra islands formed by the partition library were merged into their adjacent large islands and the original cutset of the actual power system was recovered from the highly simplified graph. A software package was developed based on the algorithm, and dynamic simulations were run on the Western Electricity Coordinating Council (WECC) system to verify the effectiveness of the cutsets obtained.

Finally, to test the islanding performance, four extreme contingencies under two different operating conditions of the WECC system were tested using the time domain simulations. The cutsets used in the controlled islanding cases were obtained from the software package developed using the graph partition library. The time domain simulation results for the four contingencies with controlled islanding and uncontrolled islanding will be shown, and the dynamic performance in each case analyzed. Further analyses were conducted to examine the amount of load shed in each case. A discussion is provided of the cutset sensitivity and time sensitivity of islanding along with practical implementation issues and conclusions.

This research is one the PSERC projects coordinated by the Consortium for Electric Reliability Technology Solutions (CERTS) with funding provided by the U.S. DOE.

Biography: Vijay Vittal is the Director of PSERC and the Ira A. Fulton Chair Professor in the School of Electrical, Computer and Energy Computer Engineering at Arizona State University. From 1982 - 2004 he served as a faculty member at Iowa State University. His research interests are in the area of power system dynamics, dynamic security assessment of power systems, power system operation and control, and application of robust control techniques to power systems. He is the author and co-author of several papers in his field. In 1992 he co-authored the textbook entitled *Power System Transient Stability Assessment Using the Transient Energy Function Method* with A. A. Fouad, and in 1999 he co-authored the textbook entitled *Power System Analysis* with A. R. Bergen. He is a recipient of the 1985 Presidential Young Investigator Award. In 1997, he was elected as a Fellow of IEEE and in 2004 he was elected to the National Academy of Engineering. He was also the recipient of the 2000 IEEE Power Engineering Society Outstanding Power Engineering Educator Award and the 2013 IEEE Herman Halperin Transmission and Distribution Field Award. From 1998-2000 he was the Chairman of the IEEE Power Engineering Society System Dynamic Performance Committee. He was elected to the U.S. National Academy of Engineering in 2004. He was the Editor in Chief of the IEEE Transactions on Power Systems from 2005-2011.

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Professor Ajjarapu welcomes feedback on the webinars and suggestions for future ones.