Power Systems Engineering Research Center

Hybrid Time Domain Simulation: Application to Fault Induced Delayed Voltage Recovery

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PSERC Public Webinar
Tuesday, January 20, 2015
2:00-3:00 p.m. Eastern Time (11:00-12:00 p.m. Pacific)

Description: This webinar deals with the development of a new electromagnetic transient (EMT)-transient stability (TS) hybrid simulation platform and its application to fault-induced delay voltage recovery (FIDVR) study on the WECC system. The webinar focuses on the development of the EMT-TS hybrid simulation platform, which integrates PSCAD/EMTDC and the open source power system simulation software InterPSS. The developed platform features a decoupled architecture and flexible switch of interaction protocols. A combined interaction protocol with a corresponding protocol switching algorithm is also proposed. A multi-port three-phase Thévenin equivalent is proposed for representing an external network in an EMT simulator. Correspondingly, the external network is represented in three-sequence and a three-sequence TS simulation algorithm is proposed. These techniques allow simulation of unsymmetrical faults within the internal network without the constraint of balanced voltages at the boundary. The numerical example deals with detailed simulation of residential air conditioner (A/C) compressor motor stalling and the corresponding fault induced delayed voltage recovery (FIDVR) event in a region within the WECC system, using the EMT-TS hybrid simulation developed in PSERC Project S-58. A fault voltage magnitude-based criterion is proposed for internal network boundary identification. Modeling of the internal network with multi-port three-phase Thévenin equivalents in PSCAD is discussed. A special two-step initialization approach is introduced to initialize internal networks with a large percentage of induction motor loads. Detailed simulation of residential air conditioner (A/C) compressor motor stalling and FIDVR phenomenon within a large power system under symmetrical faults is realized for the first time. The phenomenon of A/C motor stalling spreading to A/C units on the unfaulted phase is observed and analyzed. In addition, the sensitivity of simulation results with respect to load composition is studied. Finally, the point-on-wave effects of the A/C stalling are also analyzed.

Biography: Vijay Vittal received the B.E. degree in electrical engineering from the B.M.S. College of Engineering, Bangalore, India, in 1977, the M.Tech. degree from the Indian Institute

of Technology, Kanpur, India, in 1979, and the Ph.D. degree from Iowa State University, Ames, IA, USA, in 1982.

He is the Ira A. Fulton Chair Professor in the Department of Electrical, Computer and Energy Engineering at Arizona State University, Tempe, AZ, USA. He currently is the Director of the Power System Engineering Research Center (PSERC), headquartered at Arizona State University.

Dr. Vittal is a member of the U.S. National Academy of Engineering and in 2013 received the IEEE Herman Halperin Transmission and Distribution Field Award.

Registration for Webinar Participation: None required. There is no charge for participating!

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Assistance: If you have any questions, please call 480-965-1643 or email pserc@asu.edu.

PSERC's Webinar Coordinator: Venkataramana Ajjarapu, Iowa State University, vajjarap@iastate.edu.

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