



## Power Systems Engineering Research Center

# Hybrid EMTP and Transient Stability Simulation: Application to Power System Problems

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**Description:** This talk deals with the development of a new electromagnetic transient (EMT)-transient stability (TS) hybrid simulation platform and its application to a variety of problems in power systems. A new EMT-TS hybrid simulation platform, which integrates PSCAD/EMTDC and the open source power system simulation software InterPSS has been developed. A combined interaction protocol with an automatic protocol switching control scheme is proposed. A multi-port three-phase Thévenin equivalent is developed 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 developed. These techniques allow simulation of unsymmetrical faults within the internal network without the constraint of phase balance at the boundary. The proposed hybrid simulation approach is applied to a detailed FIDVR study on a large WECC system. The study shows that a normally cleared single-line-to-ground (SLG) fault in the transmission system could lead to a FIDVR event, with compressor motors of the air conditioning units on the faulted phases stalling first, followed by a propagation of motor stalling to the unfaulted phase. Moreover, similar events are observed in simulations with a wide range of load compositions. The effect of the point-on-wave (POW) at which a fault is applied on the occurrence of a FIVDR event is also analyzed. Test cases involving LCC HVDC and VSC based HVDC will also be discussed.

**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 Ph.D. degree from Iowa State University, Ames, IA, USA, in 1982. He is the Ira A. Fulton Chair Professor in the School of Electrical, Computer and Energy Engineering at Arizona State University, Tempe, AZ, USA. He currently is the Director of the Power Systems Engineering Research Center (PSERC) headquartered at Arizona State University. Dr. Vittal is a Fellow of the IEEE and a member of the National Academy of Engineering.