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Voltage stability indicators, where are we?

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Voltage stability assessment for electrical grids has had a long history. Researches have tackled the problem over more than three decades; yet accurate and reliable predictors still defy the power industry. Phil Harris, PJM President and CEO famously said, "Voltage collapse is still the biggest single threat to the transmission system. It's what keeps me awake at night." The increase in automation and wide area measurements have produced an improvement in following the progress of the network into potential proximity to voltage collapse, but many questions remain unanswered. Proper load behavior and modeling is a formidable problem, understanding reactive resource limitations and behavior under stressed conditions is another, but the main obstacle remains proper topology processing and modeling of the network under potential voltage collapse conditions. A contingency leading to a voltage emergency situation would have to be captured in a time-frame that is fast enough to avoid deterioration into an irreversible collapse, yet which gives opportunity to carry out the necessary calculations and state estimations. Two types of modeling approaches are discussed–both based on PMU measurements and status indicators; simplified Thévenin based models, which typically require tracking and time displaced measurements to improve the model and obtain more degrees of freedom, and single-shot measurements which require more network model complexity and assistance from topology processing algorithms. The problem is not unique to inter-area high voltage networks and has found increased interest and discussion in the context of microgrids and isolated distribution networks with distributed generation components.

Biography

Abdelrahman A Karrar is a PhD, IEEE Senior Member. He is the Associate Professor at the Electrical Engineering Department, University of Tennessee at Chattanooga. He received BSc and MSc degrees in Electrical Engineering from the University of Khartoum, Sudan, 1985 and 1989, and a PhD degree in Electrical Engineering from Loughborough University, UK, 1992. He also served as Head of Electrical Engineering Department at the University of Khartoum and a Consultant for the National Electricity Corporation, Sudan. His research interests include power systems stability and control, in particular voltage stability and related areas. Additionally, he is interested in power system stabilizers, power system PMU's for smart relaying, and his expertise generally covers power systems operation, and power systems modeling and simulation.

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