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On-Line Dynamic Assessment of Transient Stability and Low-Damping of Large-Scale Power Systems

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Abstract

The PJM Interconnection has successfully designed and implemented an on-line transient stability assessment (TSA) system at its energy control center. The strategy of using an effective scheme to screen out a large number of stable contingencies, capture critical contingencies, and apply detailed simulation programs to only potentially unstable contingencies is well recognized. We extend this strategy to on-line dynamic assessment of transient stability and low-damping of a large list of contingencies. Given a set of credible contingencies, the strategy would break the task into three assessment stages:

Stage 1: Perform the task of dynamic contingency screening to quickly screen out contingencies that are definitely stable from a set of credible contingencies. Stage 2: Perform the task of low-damping contingency screening to quickly screen out contingencies that are definitely high-damping from the set contingencies screened out at Stage 1. Stage 3: Perform a detailed time-domain assessment of the dynamic performance for each contingency remaining at Stage 1 and Stage 2.

TEPCO-BCU was selected as a fast screening tool to improve on-line performance of the PJM TSA system. A set of BCU classifiers has been developed for Stage 1 while a set of low-damping classifiers has been developed for Stage 2. A fast time-domain program is used at Stage 3. An evaluation study of TEPCO-BCU in a real-time environment as a transient stability analysis and as a low-damping screening tool has been conducted on a 14,500-bus, 3000-generator realistic system. The evaluation study of the TEPCO-BCU accuracy as an on-line screening tool for dynamic assessment of transient stability and low-damping of a large list of contingencies will be based on off-line time-domain simulation and prony analysis.