Communication Network Modeling for Simulation of Wide Area Control and Protection Applications in Power Systems

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ABSTRACT

This research investigates a queuing theoretic approach to model a packet-oriented communication network which links a set of phasor measurement units (PMU) to a phasor data concentrator (PDC) in a wide area protection and control system (WAPaCS). The PMU-PDC communication network is simplified as a cyclic polling system and the associated Markov chain is set up. Based on this model, closed-form expressions are derived for important reliability measures such as the packet loss probability and the communication delay. We then demonstrate how the proposed model can be used to predict the impact of the number of PMUs connected to the network, as well as the buffer capacity of the network switches, on the overall reliability of data communication. In this context, an important property of the proposed model is that its computational complexity is only linear in the number of PMUs, making it suitable for study of systems with a large number of PMUs.

REFERENCES