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Closure of "Effects of Various Uncertainty Sources on Automatic Generation Control Systems"

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This is the response to the discussion submitted by Omid A. Mousavi and Rachid Cherkaoui regarding the presentations in the "Managing Uncertainty in Power Systems" session in 9th IREP Symposium 2013. The points made by the authors of the discussion are important to consider, especially if investigating the effects of uncertainty sources on overall system performance. Operators need to be prepared to cope with events that are rare but might have detrimental consequences to power systems. To this end, the risk is evaluated as the product of consequence and probability of an event.

In our paper "Effects of Various Uncertainty Sources on Automatic Generation Control Systems", we consider two sources of uncertainty arising from renewable-based generation and noise in communication channels. We model the wind generation as a function of wind speed, which is modeled as a stochastic process driven by a Wiener process. We also consider noise in communication channels, since the automatic generation control (AGC) systems, accept measurements of system's frequency and generation output from field devices. We assume that these two sources of uncertainty introduce small error, and therefore, we may approximate the system's behavior by a linearized model. In future work, we could include uncertainties due to occurrence of contingencies, i.e., change in topology or generation outages, by considering a switched linear system to model the system's behavior. In such a case, we need to investigate how to propagate the aforementioned uncertainties and study their effect on the AGC system performance.

Our paper is focused on evaluating the robustness of a power system. We only investigate the effects of a given class of perturbations on the AGC system, which are: larger net load variations due to renewable-based generation and noise in communication channels. The role of AGC systems is to send signals to generators to modify their output by a small amount in order to restore system frequency and real power interchange to the desired value. That is why the capacity reserved for AGC is only up to a few hundred MW even in large scale systems. Other ancillary services, such as operating reserves, need to deal with unexpected bigger perturbations. There might be a need to classify different time scales and magnitudes of perturbations. However, for our focus it may be an overkill to look at cascading blackouts and that is why in the Monte Carlo simulations, used to validate our proposed approach, such events are disregarded.

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