Power-capacity and ramp-capability reserves for wind integration in power-based UC

G. Morales-España, R. Baldick, J. García-González, A. Ramos

Abstract— This paper proposes a power-based network-constrained unit commitment (UC) model as an alternative to the traditional deterministic UCs to deal with wind generation uncertainty. The formulation draws a clear distinction between power-capacity and ramp-capability reserves to deal with wind production uncertainty. These power and ramp requirements can be obtained from wind forecast information. The model is formulated as a power-based UC, which schedules power-trajectories instead of the traditional energy-blocks and takes into account the inherent startup and shutdown power trajectories of thermal units. These characteristics allow a correct representation of unit's ramp schedule which define their ramp availability for reserves. The proposed formulation significantly decreases operation costs compared to traditional deterministic and stochastic UC formulations while simultaneously lowering the computational burden. The operation cost comparison is made through 5-min economic dispatch simulation under hundreds of out-of-sample wind generation scenarios.

Index Terms— Mixed-integer programming, operating reserves, power-based UC, power-capacity reserves, ramp-capability reserves, unit commitment.