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Comparative study of clustering techniques for real-time dynamic model reduction

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Abstract

Dynamic model reduction in power systems is necessary for improving computational efficiency. Traditional model reduction using linearized models or offline analysis is not adequate to capture dynamic behaviors of the power system, especially with the new mix of intermittent generation and intelligent consumption, making the power system more dynamic and nonlinear. Real-time dynamic model reduction has emerged to fill this important need. This paper explores using clustering techniques to analyze real-time phasor measurements to identify groups of generators with similar behavior, as well as a representative generator from each group for dynamic model reduction. Two clustering techniques—graph clustering and k-means—are considered. These techniques are compared with a previously developed dynamic model reduction approach using singular value decomposition. Two sample power grid datasets are used to test these different model reduction techniques. Based on the algorithms' relative performance, recommendations are provided for practical use.

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