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An operational state aggregation technique for transmission expansion planning based on line benefits

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Abstract— This article provides a novel technique to represent in a reduced, or compact, way temporal variability in Transmission Expansion Planning (TEP). This reduction is handled by means of «snapshot selection». Instead of taking into account all the possible operational states and their associated optimal power flow, a reduced group of them is selected that is representative of all the states that should have an influence on investment decisions. Considering this reduced group of operational states should lead to the same investment decisions as if all the snapshots in the target year were considered. Original operational states are compared in the space of the benefits produced by potential reinforcements considered, which are relevant drivers for investment decisions. The benefits produced by these potential reinforcements are computed based on the incremental change in operation costs resulting from their installation. A clustering algorithm is used to group together those operational states where similar line benefits are realized. Our algorithm has been tested on a modified version of the standard IEEE 24 bus system. The method produces promising results and proves to be more efficient than other snapshot selection methods used until now in computing an accurate enough selection of snapshots representing system operation variability in TEP.

Index Terms— Clustering, Dimension Reduction, Integer linear programming, Transmission Expansion Planning

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