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How to solve the transmission expansion planning (TEP) problem faster: acceleration techniques applied to benders decomposition

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Abstract-

Transmission Expansion Planning, TEP, is receiving an increased attention, primarily due to the large-scale grid upgrades that will be necessary to accommodate the forthcoming renewable generation or to increase cross-border capacity. The intermittency of renewables, together with the uncertainties inherent to long-term planning, make it advisable to use solution methods that cope with uncertainty explicitly. Stochastic Optimization and, in particular, Benders’ decomposition, is one of the most widely applied approaches in this context. However, large-scale planning can still present computational problems. Several techniques have been proposed to accelerate Benders’ decomposition. However, they appear disperse in the literature and usually without a clear application scope. Most of them have not been applied to TEP yet. This paper presents a comprehensive view on TEP applied to Benders’ decomposition and the techniques available to accelerate its resolution, together with semi-relaxed cuts, a technique proposed in previous work by the authors [1]. Then, for three case studies based on IEEE test cases, the most promising of these techniques are implemented and their effectiveness is compared. All test cases could save around 50% of solution time using simple and easy-to-implement techniques, showing that there is an interest in using these approaches in academic and practical TEP applications.

Index Terms- Energy Resources, Circuit Optimization, Power Systems Planning, Mathematical Programming

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