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HYDROTHERMAL COORDINATION VIA STOCHASTIC OPTIMIZATION WITH APPLICATION TO THE CHILEAN ELECTRICAL SYSTEM

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ABSTRACT: Hydropower constitutes approximately half of all energy sources in Chile. Its operation is driven by both electrical demands and water consumption demands. We consider the hydrothermal coordination problem in the context of medium term operation planning of an interconnected national electric system. The objective of this problem is to define hydro and complementary thermal generation targets that minimize the operational costs over the planning period, considering a set of constraints with respect to the power system and generating units satisfying an electric demand. In order to avoid reservoir depletion in the final years of the planning period, a future cost function is considered. One of the important details of this problem is that agricultural water contracts have to be satisfied, which imply irrigation constraints. Another important aspect of the problem is the uncertainty in future weather conditions, in turn dictating reservoir inflow conditions in future years of a planning horizon. An approximation of the hydrothermal coordination problem can be represented by a large linear stochastic optimization model. In this work, the Progressive Hedging (PH) method has been used for solving this problem. One of the challenges of achieving good convergence of the PH algorithm is to set penalty parameters. The “cost proportional rho method has been applied to set those parameters. PH is implemented in Sandia National Laboratories' open-source Coopr software library, offering parallelization tools that facilitate easy deployment on a cluster. Results of these experiments for the Chilean hydro system have been obtained on an IBM iDataplex, and comparison with the full scale linear programming problem (also known as the extensive form) will be presented.

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