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Stochastic long-term hydrothermal scheduling with parameter uncertainty in autoregressive streamflow models

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Abstract— The optimal scheduling of hydrothermal systems requires the representation of uncertainties in future streamflows to devise a cost-effective operations policy. Stochastic optimization has been widely used as a powerful tool to solve this problem but results will necessarily depend on the stochastic model used to generate future scenarios for streamflows. Periodic autoregressive (PAR) models have been widely used in this task. However, its parameters are typically unknown and must be estimated from historical data, incorporating a natural estimation error. Furthermore, the model is just a linear approximation of the real stochastic process. The consequence is that the operator will be uncertain about the correct linear model that should be used at each period. The objective of this work is to assess the impacts of incorporating the uncertainty of the parameters of the PAR models into a stochastic hydrothermal scheduling model. The proposed methodology is tested with case studies based on data from the Brazilian hydroelectric system. It is shown that when the uncertainty of the parameters is ignored, the policies given by the stochastic optimization tend to be too optimistic.

Index Terms— stochastic dynamic programming, parameter uncertainty, uncertainty assessment, hydro scheduling, bootstrap.

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