Power Scheduling in a Hydro-Thermal Generation System under Uncertainty

Matthias P. Nowak and Werner Römisch

Institute of Mathematics
Humboldt University Berlin
10099 Berlin, Germany
www-iam.mathematik.hu-berlin.de/~romisch

We consider a power generation system comprising thermal and pumped-storage hydro plants, and introduce a model for its weekly cost-optimal operation. Due to the uncertainty of the load, the mathematical model represents a dynamic (multi-stage) stochastic program. The model involves a large number of mixed-integer (stochastic) decisions, but its constraints are loosely coupled across operating power units ([?]). The coupling structure is used to design a stochastic lagrangian relaxation method, which leads to a decomposition into stochastic single unit subproblems ([?], [?]). Extending our earlier work in [?] we develop an algorithm for solving the mixed-integer dynamic stochastic program which consists of the following parts: approximation of the uncertain load by a scenario tree, a bundle method for solving the nondifferentiable concave lagrangian dual problem ([?]), efficient algorithms for solving the stochastic single unit subproblems (a network flow algorithm and stochastic dynamic programming, respectively) and a lagrangian heuristics for finding a "good" primal solution. We present numerical results for the operation of a real power generation system.

References

[1] D. Dentcheva and W. Römisch, Optimal power generation under uncertainty via stochastic programming, in: *Stochastic Optimization* (K. Marti Ed.), Lecture Notes in Economics and Mathematical Systems, Springer 1997 (to appear).

[2] K.C. Kiwiel, Proximity control in bundle methods for convex nondifferentiable minimization, Mathematical Programming 46 (1990), 105-122.

[3] M.P. Nowak and W. Römisch. Optimal power dispatch via multistage stochastic programming, in: *Progress in Industrial Mathematics at ECMI96* (M. Brøns, M.P. Bendsøe and M.P. Sørensen Eds.), Teubner, Stuttgart 1997, 324-331.

[4] W. Römisch and R. Schultz, Decomposition of a multi-stage stochastic program for power dispatch, ZAMM - Zeitschrift für Angewandte Mathematik und Mechanik 76 (1996) Suppl. 3, 29-32.