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# The AURORA Financial Management System: Model and Parallel Implementation Design

Published: December 2000

Volume 99, pages 189–206, (2000) [Cite this article](#)



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## Abstract

The AURORA financial management system under development at the University of Vienna is a modular decision support tool for portfolio and asset-liability management. It is based on a multivariate Markovian birth-and-death factor model for the economic environment, a pricing model for the financial instruments and an objective function which is flexible enough to express risk aversion.

The core of the system is a large scale linear or convex program, which due to its size and structure is well suited for parallel optimization methods.

As the system is still at an early stage of development, the results are preliminary in nature. Only a few types of financial instruments are handled and just two types

of objectives are considered. The parallel optimization modules are still in the development phase.

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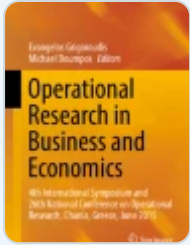
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## References

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- [1] Ph. Artzner, F. Delbaen, J.-M. Eber and D. Heath, Coherent measures of risk, *Mathematical Finance* 9 (1999) 203–228.

[Google Scholar](#)

- [2] D.P. Bertsekas, *Constrained Optimization and Lagrange Multiplier Methods* (Academic Press, 1982).

- [3] J.R. Birge, Decomposition and partitioning methods for multistage stochastic linear programs, *Operations Research* 33 (1985) 989–1007.

[Google Scholar](#)

- [4] J.R. Birge and L. Qi, Computing block-angular Karmarkar projections with applications to stochastic programming, *Management Science* 34(12) (1990).

- [5] R.E. Bixby, Progress in linear programming, *ORSA J. on Computing* 6(1) (1994) 15–22.

[Google Scholar](#)

[6] F. Black, E. Derman and W. Toy, A one-factor model of interest rates and its application to treasury bond options, *Financial Analysts Journal* 3 (January/February 1990) 33-39.

[Google Scholar](#)

[7] M.J. Brennan, E.S. Schwartz and R. Lagnado, Strategic asset allocation, *Journal of Economic Dynamics and Control* 21 (1997) 1377-1403.

[Google Scholar](#)

[8] D.R. Cariño, T. Kent, D.H. Myers, C. Stacy, M. Sylvanus, A.L. Turner, K. Watanabe and W.T. Ziemba, The Russell-Yasuda Kasai model: an asset/liability model for a Japanese insurance company using multistage stochastic programming, *Interfaces* 24 (1994) 29-49.

[Google Scholar](#)

[9] J.C. Cox, J.E. Ingersoll and S.A. Ross, A theory of terms of interest rates, *Econometrica* 53 (1985) 385-407.

[Google Scholar](#)

[10] G.B. Dantzig and P. Wolfe, Decomposition principle for linear programs, *Operations Research* 8 (1960) 101-111.

[Google Scholar](#)

[11] M.A.H. Dempster and R.T. Thompson, Parallelization and aggregation of nested Benders decomposition, Working paper WP 01/95, The Judge Institute of Management Studies, Cambridge University (1995).

[12] J. Dupacova, Stochastic programming models in banking, Working paper, International Institute for Applied Systems Analysis (1991).

[13] A. Gupta, G. Karypis and V. Kumar, Highly scalable parallel algorithms for sparse matrix factorization, *IEEE Transactions on Parallel and Distributed Systems* 8(5) (1997).

[14] P. Hoel, S. Port and Ch. Stone, *Introduction to Stochastic Processes* (Houghton-Mifflin, Boston, 1972).

[Google Scholar](#)

[15] P. Kall and S.W.Wallace, *Stochastic Programming* (Wiley, Chichester, 1994).

[Google Scholar](#)

[16] S. Karlin and H. Taylor, *A Second Course in Stochastic Processes* (Academic Press, Boston, 1993).

[Google Scholar](#)

[17] H. Konno and H. Yamazaki, Mean absolute deviation portfolio optimization model and its applications to Tokyo stock market, *Management Science* 37 (1991) 519-531.

[Google Scholar](#)

[18] M.I. Kusy and W.T. Ziemba, A bank asset and liability management model, *Operations Research* 34 (1986) 356-376.

[Google Scholar](#)

[19] H. Markowitz, Portfolio selection, *Journal of Finance* 7 (1952) 77-91.

[Google Scholar](#)

[20] J.M. Mulvey, Nonlinear network models in finance, in: *Advances in*

[21] J.M. Mulvey, An asset-liability investment system, *Interfaces* 24 (1994) 22–33.

[Google Scholar](#)

[22] J.M. Mulvey, Multi-stage financial planning systems, in: *Operations Research Models in Quantitative Finance*, eds. R.L. D'Ecclesia and S.A. Zenios (Physica-Verlag, 1994) pp. 18–35.

[23] J.M. Mulvey and A. Ruszczyński, A diagonal quadratic approximation method for large-scale linear programs, *Operations Research Letters* 12 (1992) 205–215.

[Google Scholar](#)

[24] J.M. Mulvey and A. Ruszczyński, A new scenario decomposition method for large-scale stochastic optimization, *Operations Research* 43 (1995) 477–490.

[Google Scholar](#)

[25] J.M. Mulvey and W.T. Ziemba, *Worldwide Asset and Liability Modeling* (Cambridge University Press, 1998).

[26] J.M. Mulvey and H. Vladimirou, Stochastic network programming for financial planning problems, *Management Science* 38 (1992) 1642–1664.

[Google Scholar](#)

[27] V. Norkin, G.Ch. Pflug and A. Ruszczyński, A branch and bound method for stochastic global optimization, *Mathematical Programming* 83 (1998) 425–450.

[Google Scholar](#)

[28] W. Ogryczak and A. Ruszczyński, From stochastic dominance to mean-risk models: Semideviations as risk measures, *European Journal of Operations Research* 116 (1999) 33–50.

[Google Scholar](#)

[29] G.Ch. Pflug, Risk-resaping contracts and stochastic optimization, *Central European Journal of Operations Research* 5(3–4) (1998) 205–230.

[Google Scholar](#)

[30] G.Ch. Pflug, *How to Measure Risk?* Festschrift to F. Ferschl (Physica-Verlag, 1999).

[31] G.Ch. Pflug and A. Świętanowski, Dynamic asset allocation under uncertainty for pension fund management, *Control and Cybernetics* 28(4) (1999).

[32] A. Ruszczyński and A. Świętanowski, Accelerating the regularized decomposition method for two stage stochastic linear problems, *European Journal of Operations Research* 101(2) (1997) 328–342.

[Google Scholar](#)

[33] A. Ruszczyński, An augmented Lagrangian decomposition method for block diagonal linear programming problems, *Operations Research Letters* 8 (1989) 287–294.

[Google Scholar](#)

[34] A. Ruszczyński, Interior point methods in stochastic programming, Technical Report WP-93-8, International Institute for Applied Systems

Analysis, Laxenburg, Austria (1993).

- [35] A. Ruszczyński, Parallel decomposition of multistage stochastic programming problems, *Mathematical Programming* 58 (1993) 201–228.

[Google Scholar](#)

- [36] A. Ruszczyński, On convergence of an augmented Lagrangian decomposition method for sparse convex optimization, *Mathematics of Operations Research* 20(3) (1995) 634–656.

[Google Scholar](#)

- [37] O.A. Vasicek, An equilibrium characterization of the term structure, *J. Financial Economics* 5 (1977) 177–18.

[Google Scholar](#)

- [38] H. Vladimirou and S.A. Zenios, Scalable parallel computations for large-scale stochastic programming, *Annals of Operations Research* 90 (1999) 87–129.

[Google Scholar](#)

- [39] S.A. Zenios, *Financial Optimization* (Cambridge University Press, 1993).

- [40] S.A. Zenios and R.L. D'Ecclesia, eds., *Operations Research Models in Quantitative Finance* (Springer, 1994).

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### Cite this article

Pflug, G., Świętanowski, A., Dockner, E. *et al.* The AURORA Financial Management System: Model and Parallel Implementation Design. *Annals of Operations Research* **99**, 189–206 (2000).

<https://doi.org/10.1023/A:1019297118383>

Issue Date

December 2000

DOI

<https://doi.org/10.1023/A:1019297118383>

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