András Prékopa

Rutgers University
USA

András Prékopa is one of the founders of the area of stochastic programming and one of the most prolific contributors to its theory and applications. His achievements have implications ranging from pure mathematics to very applied operations research problems.

His main achievement is the introduction and the analysis of optimization models with probability constraints involving dependent random variables. In his seminal paper "Logarithmic Concave Measures with Applications to Stochastic Programming" he developed the theory of logarithmic concave probability distributions. He has shown that linear probability constraints, in which the right hand side vectors have logarithmic concave probability density functions, define a convex set. Together with his students and collaborators, Prékopa developed very efficient numerical methods for solving linear probabilistic programming problems. His theory inspired other mathematicians to develop the theory of r-concave measures. He also applied his methodology to water systems and power networks in Hungary. In the latter application, he was able to dramatically increase the reliability level of the Hungarian power network without any cost increase.

Another illustration of Prékopa's unique ability to see connections of abstract theory and applied models is his so-called "Hungarian inventory model." He creatively adapted the famous Smirnov's theorem about the distance between the true and the empirical distribution functions, to analyze the reliability of an inventory system. The result is described in the paper "Generalization of the Theorems of Smirnov with Application to a Reliability-Type Inventory Problem" (*Mathematische Operationsforschung und Statistik* 4 (1972), pp. 283—297). This theory allowed his team to develop re-ordering rules that lead to a substantial decrease of inventory levels in Hungary's economy.

Recently, András Prékopa has worked on bounding and approximation of expectations and probabilities in higher dimensional spaces. He discovered that many classical probability bounds are optimum values of linear programming problems formulated in connection with discrete moment problems. He also developed a variety of new bounds for probabilities of Boolean functions of events and expectations. The applications of this theory include communication and transportation network reliability, the probability distribution function of the length of the critical path in PERT, approximate solutions of probabilistic constrained stochastic programming problems, calculation of multivariate integrals etc.

His landmark monograph *Stochastic Programming* (Kluwer, 1995) describes many of his results, and provides a comprehensive presentation of the field of stochastic programming. Prékopa wrote and edited more than 10 other books, published about 140 scientific papers and numerous research reports.

Selected Contributions

- "Logarithmic Concave Measures with Applications to Stochastic Programming," *Acta Scientiaarium Mathematicarum (Szeged)*, 32, (1971)
- "Contributions to the theory of Stochastic Programming," *Math. Programming* (1973)
- "Serially linked reservoir system design using stochastic programming,"(with T. Rapcsak and I. Zsuffa) *Water Res. Research* (1978)
- "Boole-Bonferroni inequalities and linear programming," *Operations Research,* (1988)
- *Stochastic Programming*, Kluwer, (1995)
- "Probability bounds with cherry trees, " (with Madi-Nagy), *Math. of Oper. Res*. (2001)
- "On the Hungarian inventory control problem," to appear in *EJOR* (2004)