ICAM 05

Proceedings of International Conference on Applied Mathematics 2005

22-26 AUGUST 2005
AULA TIMUR
ITB BANDUNG INDONESIA

Optimization Modeling Technology: Past, Present and Future

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Abstract: During the last fifty years the field of mathematical programming has evolved into a mature discipline of mathematics. Starting with the invention of the simplex method for linear programming in the late forties, a wealth of theory and algorithms has been developed since then. At the same time, a large number of planning and scheduling applications were developed for a variety of industries and government agencies that have led to improved decision making and better use of resources. Optimization technology in the form of advanced computer implementations of solution algorithms and modeling systems has played a major role in bridging the gap between theory and applications.

The presentation will give an overview of how optimization technology has evolved over time, and will sketch some of the accomplishments that have been reached using this technology. The major portion of the presentation will emphasize likely future developments. In particular, it will motivate the extension of modeling systems to provide new algorithmic capabilities in addition to the current modeling capabilities. One illustration will be the description of a decomposition algorithm that solves a job shop scheduling problem with the use of both mathematical programming and constraint logic programming. A second illustration will be the description of the new open framework in the modeling system AIMMS to solve mixed-integer nonlinear programming models using variants of the outer approximation method. The talk will conclude with a brief software demonstration.