ABSTRACT

The need to solve real-life optimization problems poses frequently a severe challenge, as the underlying mathematical programs threaten to be intractable. The intractability can be attributed to any of the following properties: large dimensionality of the design dimension; lack of convexity; parameters affected by uncertainty. In problems of designing optimal mechanical structures (truss topology design, shape design, free material optimization), the mathematical programs typically has a large dimensional Semi Definite Program. Some Signal Processing and Estimation problems may result in nonconvex formulations. In the wide area of optimization under uncertainty, some classical approaches, such as chance (probabilistic) constraints, give rise to nonconvex NP-hard problems.

In all the above applications we explain how the difficulties were resolved. In some cases this was achieved by mathematical analysis (notoriously duality theory) which converted the problems (or its dual) to a tractable convex program. In the Robust Control example, a reparameterization scheme is developed under which the problem is converted to a tractable deterministic convex program.

BIO

Aharon Ben-Tal is a Professor of Operations Research and former Head of the MINERVA Optimization Center at the Faculty of Industrial Engineering and Management at the Technion – Israel Institute of Technology, and holder of the Dresner Chair. He received his Ph.D. in Applied Mathematics from Northwestern University in 1973. He has been a Visiting Professor at the University of Michigan, University of Copenhagen, Delft University of Technology, MIT, CWI Amsterdam, Columbia and NYU. His interests are in Continuous Optimization, particularly nonsmooth and large-scale problems, conic and robust optimization, as well as convex and nonsmooth analysis. Recently the focus of his research is on optimization problems affected by uncertainty. In the last 15 years, he has devoted much effort to engineering applications of optimization methodology and computational schemes. Some of the algorithms developed in the