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On solving bilevel optimization problems and optimization problems with equilibrium constraints

In many applied optimization and optimal control problems, the constraints are determined through another optimization or equilibrium problem. Such a problem is called a bilevel optimization problem or an optimization problem with equilibrium constraints. They are a class of important and difficult problems in science, engineering and economics. To solve a bilevel problem, a reformulation to one level problem is usually required. Due to the bilevel structure, the reformulation of the problem is usually nonsmooth/nonconvex even when all functions of the original problem are smooth. Moreover the classical necessary optimality conditions may not hold any more and classical numerical algorithms may not be applicable. There has been significant progresses in solving these types of problems in recent years. In this talk, I will introduce various bilevel problems and explain how we cope with difficulties and present some applicable necessary optimality conditions for various bilevel problems. Moreover a smoothing technique will be introduced to solve a simple bilevel program.