Dinkelbach's Algorithm

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Overview

Mixed-integer linear fractional program (MILFP) is a special type of non-convex mixed-integer nonlinear program (MINLP) that usually arises in cyclic process scheduling problems. An MILFP, including both continuous and discrete variables, has only linear constraints and an objective function given by the ratio of two linear functions. Due to the combinatorial nature and non-convexity in the objective function, solving MILFP problems is a non-trivial task.

Two types of approaches are employed for solving large-scale MILFP problems. The first approach is to use Dinkelbach's algorithm, which is able to globally optimize the MILFP problems by iteratively solving a sequence of mixed-integer linear programming (MILP) subproblems with superlinear convergence rate.[1] The second approach is to employ general MINLP methods and global optimization techniques for the solution of this type of problems. Extensive computational examples are presented to compare the performance of Dinkelbach's algorithm with a several MINLP solution methods. The results clearly show that using the Dinkelbach's algorithm with the MILP solver CPLEX is more efficient than commercial MINLP solvers including DICOPT, SBB, α-ECP, and the global optimization solver BARON, for solving large-scale MILFP problems.

Reference

1. Fengqi You, Pedro M. Castro, Ignacio E. Grossmann, "Dinkelbach's algorithm as an efficient method to solve a class of MINLP models for large-scale cyclic scheduling problems," Computers & Chemical Engineering, In press (2009).