A logarithmic barrier approach and its regularization applied to convex semi-infinite programming problems

Dissertation

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Abstract

The goal of this thesis is to transfer the logarithmic barrier approach, which led to very efficient interior-point methods for convex optimization problems in recent years, to convex semi-infinite programming problems. Based on a reformulation of the constraints into a nondifferentiable form this can be directly done for convex semi-infinite programming problems with nonempty compact sets of optimal solutions. But, by means of an involved max-term this reformulation leads to nondifferentiable barrier problems which can be solved with an extension of a bundle method of Kiwiel. This extension allows to deal with inexact objective values and subgradient information which occur due to the inexact evaluation of the maxima. Nevertheless we are able to prove similar convergence results as for the logarithmic barrier approach in the finite optimization.

In the further course of the thesis the logarithmic barrier approach is coupled with the proximal point regularization technique in order to solve ill-posed convex semi-infinite programming problems too. Moreover this coupled algorithm generates sequences converging to an optimal solution of the given semi-infinite problem whereas the pure logarithmic barrier only produces sequences whose accumulation points are such optimal solutions. If there are certain additional conditions fulfilled we are further able to prove convergence rate results up to linear convergence of the iterates.

Finally, besides hints for the implementation of the methods we present numerous numerical results for model examples as well as applications in finance and digital filter design.