Full Nesterov-Todd Step Primal-Dual Interior-Point Methods for Second-Order Cone Optimization*

M. Zangiabadi[†‡] G. Gu[‡] C. Roos[‡]

[†] *Department of Mathematical Science, Shahrekord University, P.O. Box 115, Shahrekord, Iran*

[‡] *Department of Electrical Engineering, Mathematics and Computer Science, Delft University of Technology, P.O. Box 5031, 2600 GA Delft, The Netherlands*
e-mail: [M.Zangiabadi, G.Gu, C.Roos]@tudelft.nl

Abstract

After a brief introduction to Jordan algebras, we present a primal-dual interior-point algorithm for second-order conic optimization that uses full Nesterov-Todd-steps; no line searches are required. The number of iterations of the algorithm is $O(\sqrt{N}\log(N/\varepsilon)$, where N stands for the number of second-order cones in the problem formulation and ε is the desired accuracy. The bound coincides with the currently best iteration bound for second-order conic optimization. We also generalize an infeasible interior-point method for linear optimization [C. Roos, A full-Newton step $O(n)$ infeasible interior-point algorithm for linear optimization, 16(4) 2006, 1110-1136.] to second-order conic optimization. As usual for infeasible interior-point methods the starting point depends on a positive number ζ. The algorithm either finds an ε-solution in at most $O\left(N\log(N/\varepsilon)\right)$ steps or determines that the primal-dual problem pair has no optimal solution with vanishing duality gap satisfying a condition in terms of ζ.

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