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“Cone-Free” Primal-Dual Path-Following and Potential Reduction Polynomial Time Interior-Point Methods

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Abstract We present a framework for designing and analyzing primal-dual interior-point methods for convex optimization. We assume that a self-concordant barrier for the convex domain of interest and the Legendre transformation of the barrier are both available to us. We directly apply the theory and techniques of interior-point methods to the given good formulation of the problem (as is, without a conic reformulation) using the very usual primal central path concept and a less usual version of a dual path concept. We show that many of the advantages of the primal-dual interior-point techniques are available to us in this framework and therefore, they are not intrinsically tied to the conic reformulation and the logarithmic homogeneity of the underlying barrier function.

Keywords convex optimization, interior-point methods, primal-dual algorithms, self-concordant barriers