Journal of Convex Analysis 31 (2024) 025–038

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Characterizing Optimality for a Class of Nonconvex Quadratic Robust Optimization Problems Bilaterally Quadratically Constrained Under Interval Uncertainty

This paper analyzes the following robust optimization problem:

$$\min\left\{\frac{1}{2}x^\top Ax + a^\top x : \ \alpha \leq \frac{1}{2}x^\top Bx + b^\top x + c \leq \beta, \ \forall\ (B,b) \in \mathcal{B}_0\right\},$$

where $\mathcal{B}_0 \doteq \{B_1 + \mu B_2 : \mu \in [\mu_1, \mu_2]\} \times \{b_1 + \delta b_2 : \delta \in [\delta_1, \delta_2]\}$, with all the matrices involved are real symmetric, $a, b \in \mathbb{R}^n$ and $\alpha, \beta, \delta_1, \delta_2, \mu_1, \mu_2$ are given real numbers. To be more precise, we establish characterizations of the fulfillment of: (i) the robust alternative result; (ii) the robust S-lemma, and (iii) the robust optimality, to the problem above. To that purpose, we apply the convexity result proved by one of the authors valid for nonhomogeneous quadratic functions, instead of the Dines convexity theorem.

Keywords: Nonconvex quadratic programming under uncertainty, robust optimization, S-lemma, global optimality.

MSC: 90C20, 90C30, 90C26, 90C46.