Second-Oder Variational Analysis in Second-Order Cone Programming

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Abstract: The paper conducts a second-order variational analysis for an important class of nonpolyhedral conic programs generated by the so-called second-order/Lorentz/ice-cream cone $\mathbb{Q}$. From one hand, we prove that the indicator function of $\mathbb{Q}$ is always twice epi-differentiable and apply this result to characterizing the uniqueness of Lagrange multipliers at stationary points together with an error bound estimate in the general second-order cone setting involving $\mathcal{C}^2$-smooth data. On the other hand, we precisely calculate the graphical derivative of the normal cone mapping to$\mathbb{Q}$ under the weakest metric subregularity constraint qualification and then give an application of the latter result to a complete characterization of isolated calmness for perturbed variational systems associated with second-order cone programs. The obtained results seem to be the first in the literature in these directions for nonpolyhedral problems without imposing any nondegeneracy assumptions.

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