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Conjugate Convex Functions without Infinity

Let $B_r(E)$ be the closed ball of radius r around the origin in a real Banach space E and $\mathcal{F}_r(E)$ be the set of all r -Lipschitz continuous convex functions defined on $B_r(E)$. Suppose f is a real-valued and bounded below function on $B_r(E)$. We define the I -conjugate function f^I of f to improve the Fenchel inequality and investigate the properties of f^I . In particular, $(f^I)^I$ coincides with f on $B_r(E)$ if and only if f is in $\mathcal{F}_r(E)$. Excluding the value $+\infty$, the transformation from f to f^I enlarges the potentiality of the contribution to numerical computation for convex analysis.

Keywords: Conjugate function, convex function, Legendre-Fenchel transform, Lipschitz continuity, Fenchel inequality, subdifferential.

MSC: 46N10.