

Mifflin, Robert; Sagastizábal, Claudia

**Primal-dual gradient structured functions: second-order results; links to epi-derivatives and partly smooth functions.** (English) [Zbl 1036.90067](#)

SIAM J. Optim. 13, No. 4, 1174-1194 (2003).

The paper studies second order expansions for the recently introduced class of nonsmooth functions with primal-dual gradient structure. For this class of lower semi-continuous and not necessarily convex functions it is possible to explicitly give a basis for the subspace  $\mathcal{V}$  parallel to the Clarke subdifferential at some point. Relative to its orthogonal subspace  $\mathcal{U} = \mathcal{V}^\perp$  the function appears to be smooth, and it is actually possible to find smooth trajectories tangent to  $\mathcal{U}$  along which the function is  $C^2$ . Along with this smooth restriction a smooth multiplier function can be defined. Having these two smooth objects at hand, a  $C^2$  Lagrangian is defined which leads to a second order expansion of the nonsmooth function along the subspace  $\mathcal{U}$ . Explicit expressions for the first and second order derivatives are given. Connections between second order epi-derivatives and  $\mathcal{U}$ -Hessians are made, and expressions for manifold restricted Hessians are given for partly smooth functions. A number of illuminating examples accompany the results of the article.

Reviewer: [Oliver Stein \(Aachen\)](#)

**MSC:**

[90C31](#) Sensitivity, stability, parametric optimization

[49J52](#) Nonsmooth analysis

[90C46](#) Optimality conditions and duality in mathematical programming

Cited in **19** Documents

**Keywords:**

second order derivatives;  $\mathcal{V}\mathcal{U}$ -decomposition; nonsmooth analysis; subdifferential

**Full Text:** [DOI](#)