A characterization of cone-convex vector-valued functions

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Abstract.

An interesting result in convex analysis, established by J.-P. Crouzeix in 1977, states that a real-valued function defined on a linear space is convex if and only if each function obtained from it by adding a linear functional is quasiconvex. The aim of this paper is to extend this result for vector-valued functions taking values in a partially ordered linear space.

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REFERENCES

- [1] Arens, R., Operational calculus of linear relations, Pacific J. Math., 11 (1961), 9-3
- [2] Aubin, J.-P. and Frankowska, H., Set-Valued Analysis, Birhäuser, Boston, 1990
- [3] Benoist, J., Borwein, J. M. and Popovici, N., A characterization of quasiconvex vector-valued functions, Proc. Amer. Math. Soc., 131 (2003), 1109–1113
- [4] Crouzeix, J.-P. Contribution to the Study of Quasi-convex Functions (in French), Doctoral Thesis, University of Clermont-Ferrand II, 1977
- [5] Jeyakumar, V., Oettli, W. and Natividad, M., A solvability theorem for a class of quasiconvex mappings with applications to optimization, J. Math. Anal. Appl., 179 (1993), 537–546
- [6] La Torre, D., Popovici, N. and Rocca, M., Scalar characterizations of weakly cone-convex and weakly conequasiconvex functions, Nonlinear Anal., 72 (2010), 1909–1915
- [7] Luc, D. T., Theory of Vector Optimization, Lecture Notes in Economics and Mathematical Systems 319, Springer-Verlag, Berlin, 1989
- [8] Popovici, N., A characterization of cone-convex functions, Ann. Tiberiu Popoviciu Semin. Funct. Equ. Approx. Convexity, 1 (2003), 123–131
- Sach, P. H., Characterization of scalar quasiconvexity and convexity of locally Lipschitz vector-valued maps, Optimization, 46 (1999), 283–310
- [10] Száz, Á., Linear extensions of relations between vector spaces, Comment. Math. Univ. Carolinae, 44 (2003), 367–385
- [11] Zălinescu, C., Convex Analysis in General Vector Spaces, World Scientific, River Edge, 2002

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