

Asymptotic functions of vector functions and their application to multiobjective optimization problems*

Rubén López[†]

Abstract

We introduce two notions of asymptotic function for vector functions when the image space is ordered by the first orthant. To do this, we choose a suitable extended-valued framework. We establish properties and formulas for these asymptotic functions and use them to study multiobjective optimization problems. We obtain bounds for the asymptotic cones of level, colevel and weakly efficient solution sets. With this information, we obtain coercivity properties, coercive and noncoercive existence results.

Coauthors: Cristian Vera (Universidad Arturo Prat, Iquique, Chile) and Fabián Flores-Bazán (Universidad de Concepción, Chile)

This talk is dedicated to Professor Juan Enrique Martínez-Legaz on the occasion of his 70th birthday

References

- [1] AUSLENDER A. & TEBoulLE M., *Asymptotic Cones and Functions in Optimization and Variational Inequalities*, Springer, Berlin, 2003.
- [2] DOVZHENKO A.V., KOGUT P.I. & MANZO R., Epi and coepi-analysis of one class of vector-valued mappings, *Optimization* **63** 535–557, 2014.
- [3] FLORES-BAZÁN F., Ideal, weakly efficient solutions for vector optimization problems, *Math. Program.* **3** 453–475, 2002.
- [4] FLORES-BAZÁN F. & VERA C., Characterization of the nonemptiness and compactness of solution sets in convex and nonconvex vector optimization, *J. Optim. Theory Appl.* **130** 185–207, 2006.

*This work has been supported by project FONDECYT 1220687 through ANID-Chile

[†]Departamento de Matemática, Universidad de Tarapacá, Arica, Chile
rlopezm@academicos.uta.cl

- [5] FLORES-BAZÁN F., FLORES-BAZÁN F. & VERA C., Maximizing and minimizing quasiconvex functions: related properties, existence and optimality conditions via radial epiderivatives, *J. Global Optim.* **63** 99–123, 2015.
- [6] FLORES-BAZÁN F., LÓPEZ R. & VERA C., Asymptotic functions of vector functions and their application to multiobjective optimization problems, In progress, 2023.
- [7] GUTIÉRREZ C., LÓPEZ R. & NOVO V., Existence and boundedness of solutions in infinite dimensional vector optimization problems, *J. Optim. Theory Appl.* **162** 515–547, 2014.
- [8] GUTIÉRREZ C., LÓPEZ R. & NOVO V., On the existence of weak efficient solutions of nonconvex vector optimization problems, *J. Optim. Theory Appl.* **185** 880–902, 2020.
- [9] HADJISAVVAS N., LARA L. & LUC D.T., A general asymptotic function with applications in nonconvex optimization, *J. Global Optim.* **78** 49–68, 2020.
- [10] IUSEM A. & LARA F., Quasiconvex optimization problems and asymptotic analysis in Banach spaces, *Optimization* **69** 2453–2470, 2020.
- [11] LARA F. & LÓPEZ R., Formulas for asymptotic functions via conjugates, directional derivatives and subdifferentials, *J. Optim. Theory Appl.* **173** 793–811, 2017.
- [12] LARA F., LÓPEZ R. & SVAITER B.F., A further study on asymptotic functions via variational analysis, *J. Optim. Theory Appl.* **182** 366–382, 2019.
- [13] LI G., LI S. & YOU M., Recession function and its applications in optimization, *Optimization* **70** 2559–2578, 2021.
- [14] LÓPEZ R. & VERA C., On the set of weakly efficient minimizers for convex multiobjective programming, *Oper. Res. Lett.* **36** 651–655, 2008.
- [15] LÓPEZ R., Variational convergence for vector valued-functions and its applications to convex multiobjective programming, *Math. Meth. Oper. Res.* **78** 1–34, 2013.
- [16] ROCKAFELLAR R.T. & WETS R.J., Variational Analysis, Springer, New York, 1998.
- [17] SOLTAN V., Asymptotic planes and closedness conditions for linear images and vector sums of sets, *J. Convex Anal.* **25** 1183–1196, 2018.
- [18] SOLTAN V., Lectures on Convex Sets, 2nd edition, 2020.