

Dixièmes Journées Franco-Chiliennes d’Optimisation
INSA Rouen Normandie, Rouen, France
8-11 July 2025

**DIFFERENTIABILITY OF PROBABILITY FUNCTIONS INVOLVING
STAR-SHAPED VALUED SET-VALUED MAPS.**

WIM VAN ACKOOIJ, PEDRO PÉREZ-AROS, AND CLAUDIA SOTO

Motivated by a control-theoretic example in which system dynamics are influenced by uncertainty and a predetermined “here-and-now” control input, we define a feasible trajectory as one that reaches the target with high probability. This leads to a probability function that quantifies the likelihood associated with a random vector belonging to a star-shaped set. Consequently, we are motivated to explore the properties of probability functions acting on parameter-dependent star-shaped sets.

In this talk, we illustrate through examples that, although star-shapedness closely resembles convexity, it is not sufficient to guarantee locally Lipschitz continuity of the associated probability functions. To address this limitation, we propose an intuitive regularization of the star-shapedness concept. Under this regularization, and with additional reasonable assumptions, we derive “computable” expressions for the generalized subdifferentials of the resulting probability functions.

REFERENCES

- [1] W. van Ackooij, P. Pérez-Aros, C. Soto: *Differentiability of probability functions involving star-shaped valued set-valued maps*, SIAM Journal on Optimization, number, 1–27, 2025.

OSIRIS, EDF-LAB PARIS-SACLAY, FRANCE, EMAIL: wim.van-ackooij@edf.fr.