

# The Use of Grossone in Mathematical Programming

Renato De Leone

School of Science and Technology  
University of Camerino  
Via Madonna delle Carceri 9 62032 Camerino, Italy  
`renato.deleone@unicam.it`

**Keywords.** Mathematical programming; simplex method; anticycling method; data envelopment analysis; nonlinear programming.

In this talk we will discuss some applications of  $\textcircled{1}$  in Mathematical Programming. The aim is to show how the use of the new methodology that has been proposed by Sergeev for performing calculations with infinite and infinitesimal quantities could improve the efficiency of standard methods in nonlinear programming and will also clarify the role of penalty terms.

In particular, we will focus the attention on how new numeral system allows to define new differentiable penalty functions. Moreover, we will investigate the relationship between stationary points of this penalty function and KKT points for the original Nonlinear Programming problem.

Another application of  $\textcircled{1}$  that will be presented is related to the Data Envelopment Analysis (DEA) methodology, for evaluating the efficiency of Decision Making Units (DMU). The use of negative power of  $\textcircled{1}$  allows to define new linear programming problems with theoretical properties similar to those obtained using infinitesimal non-archimedean quantities.

## References

- [1] Cooper W. W., Seidorf L. M., Tone K. (2002) *Data Envelopment Analysis*. Kluwer Academic Publishers, Boston.
- [2] Bertsekas D. B. (1996) *Constrained Optimization and Lagrange Multiplier Methods*. Athena Scientific, USA.
- [3] De Cosmis S., De Leone R. (2012) The use of Grossone in Mathematical Programming and Operations Research. *Applied Mathematics and Computation*, Vol. 218, No. 16, pp. 8029–8038.