Presentation of pseudo-intervals arithmetic. Applications to linear algebra, optimization and set inversion problems

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In a first step, one introduces the Pseudo-Intervals Arithmetic (PIA) which is based on free algebra. This permits to build inclusion functions which are defined univocally and avoid data dependency. One exhibits some simple examples of applications to linear algebra (matrix inversion and diagonalisation) and to gradient-based optimization algorithms in order to show how PIA is well-suited for them. In a second step, one presents the Probabilist Set Inversion method (PSI), inspired from SI*v*IA (Set Inversion *via* Interval Arithmetic) and using PIA with conditional probability calculations . One ends with some relevant applications of the PSI-algorithm, combined with evolutionary programming[1].

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[1] A. Kenoufi, J.F. Osselin, B. Durand, "System adjustments for targeted performances combining symbolic regression and set inversion, in "Inverse Problems in Science and Engineering", 2013, http://dx.doi.org/10.1080/17415977.2013.790384 .