Grossone Infinity Computing: Foundations and Computations with Floating-Point Infinities and Infinitesimals

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In this tutorial – designed for a broad audience and requiring no special mathematical background – we present a recent computational methodology (see [2, 3, 4]) that makes it possible to work with infinities and infinitesimals numerically within a unified computational framework. This is fundamentally different from traditional approaches, which treat infinite and infinitesimal quantities only symbolically and rely on different notions of infinity in different contexts admitting numerous paradoxes (see [1]).

The methodology is proposed to be implemented on a new type of supercomputer, the *Infinity Computer*, which employs a patented floating-point representation with the infinite radix ①, called *grossone*. One of its major strengths lies in its computational effectiveness in practical applications, as extensively discussed at NUMTA conferences by numerous colleagues (see, e.g., [5]).

Through a series of engaging examples, we show that the ①-based methodology is useful from both computational and theoretical perspectives. In particular, we demonstrate that several classical paradoxes involving infinity and infinitesimals can be avoided within this framework (see [4]).

A lot of additional information can be found at the following web pages: https://www.theinfinitycomputer.com & http://www.numericalinfinities.com

References

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[5] Sergeyev, Ya. D. and De Leone, R. (Eds.) (2022). *Numerical Infinities and Infinitesimals in Optimization.* Springer, Cham.