Acceleration of an Accurate Summation Algorithm

Takeshi Ogita*
Division of Mathematical Sciences
Tokyo Woman's Christian University
2–6–1 Zempukuji, Suginami-ku, Tokyo 167–8585, Japan

March 15, 2015

Abstract

In 2008, Rump et al. [Rump et al. (2008)] developed algorithms for accurate floating-point summation. In particular, the algorithm `AccSum`, which provides a faithfully rounded result in working precision of the exact sum of given floating-point numbers, is known to be a very fast algorithm for this purpose. In this talk an acceleration method for `AccSum` is proposed. The method utilizes a simple technique of grouping given data with the algorithm `FastTwoSum` [Dekker (1971)] for summation of two floating-point numbers as the accumulator. The computational cost for the proposed method can be much smaller than that for `AccSum`, though it strongly depends on given data. Numerical results are presented for illustrating the effectiveness of the proposed algorithm.

Keyword: Summation; floating-point arithmetic; accurate numerical algorithm.

T. J. Dekker, A floating-point technique for extending the available precision, Numer. Math., 18 (1971), 224–242.

S. M. Rump, T. Ogita, S. Oishi: Accurate floating-point summation part I: Faithful rounding, SIAM J. Sci. Comput., 31:1 (2008), 189–224.

*ogita@lab.twcu.ac.jp