
Parallel Accurate and Reproducible Summation

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Résumé

Floating-point arithmetic is prone to accuracy problem due to the round-off errors. The combination of the round-off errors and of the out of order execution of arithmetic operations due to the scheduling of parallel tasks, introduces additional numerical accuracy issues. We address the problem of improving the numerical accuracy and reproducibility of summation operators. We propose two efficient parallel algorithms for summing n floating-point numbers. The first objective of our algorithms is to obtain an accurate result, i.e. the computed result is similar or nearest to the one computed in double precision. The second objective is to improve the reproducibility of the summations compared to those computed by the naive algorithm and this regardless of the number of processors used during the computations.

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