Posit NPB: Assessing the Precision Improvement in HPC Scientific Applications

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Floating-point operations can significantly impact the accuracy and performance of scientific applications on large-scale parallel systems. Recently, an emerging floating-point format called Posit has attracted attention as an alternative to the standard IEEE floating-point formats because it could enable higher precision than IEEE formats using the same number of bits. In this work, we first explored the feasibility of Posit encoding in representative HPC applications by providing a 32-bit Posit NAS Parallel Benchmark (NPB) suite. Then, we evaluate the accuracy improvement in different HPC kernels compared to the IEEE 754 format. Our results indicate that using Posit encoding achieves optimized precision, ranging from 0.6 to 1.4 decimal digit, for all tested kernels and proxy-applications. Also, we quantified the overhead of the current software implementation of Posit encoding as 4x-19x that of IEEE 754 hardware implementation. Our study highlights the potential of hardware implementations of Posit to benefit a broad range of HPC applications.

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