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High-Precision Arithmetic and Mathematical Physics

Monday, 3 November 2008 11:20 (40 minutes)

For the vast majority of computations done both in pure and applied physics, ordinary 64-bit floating-point arithmetic (about 16 decimal digits) is sufficient. But for a growing body of applications, this level is not sufficient. For applications such as supernova simulations, climate modeling, n-body atomic structure calculations, "double-double" (approx. 32 digits) or even "quad-double" (approx. 64 digits) is required. For yet other applications, notably arising in quantum field theory and statistical mechanics, much higher precision (hundreds or even thousands of digits) is required. Armed with software for performing computation to these high levels of precision, the tools of "experimental mathematics" can be brought to bear, such as in recognizing the values of definite integrals that arise in the theory via their decimal values. Numerous recent studies, including some rather remarkable results in quantum field theory, will be mentioned.

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