Contribution ID: **13** Type: **Tutorial or Skill-Up**

How to compute a special function with near machine-precision accuracy

Wednesday 26 February 2025 16:00 (45 minutes)

Based on my experience as developer and maintainer of some numerical open-source libraries (libcerf, libkww, libformfactor), I will explain key concepts for writing code that computes a special function or integral with high accuracy and high speed.

- Choose different numerical algorithms for different argument regions.
- Don't be afraid of divergent series or ill-conditioned recursions.
- Confine Chebyshev fits to small subregions.
- Use code instrumentation and bisection to ensure continuity where the algorithm changes.
- Beware of literature that is only concerned with truncation. Near machine precision, cancellation is the bigger problem. Visualization may reveal the difference.
- Never rely on non-standard facilities. "Long double" makes no sense if it is not longer than "double"? Tell Apple.
- Generate test references and hard-coded coefficients with high-precision scripts (e.g. mpmath based).
- Be graceful with relative accuracy measures near zeros and for real or imaginary parts of complex numbers.
- Don't trust any performance measure you haven't tweaked yourself. Take caching into account.

I want to participate in the youngRSE prize

no

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