

REAL Computing
Made
REAL

Preventing Errors in Scientific and
Engineering Calculations

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AN EXHORTATION XI

Make fewer errors! (Errors are hard to find.) We need help — but much software obscures! — A kind of *Kyrie*.

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TOOLS OF THE TRADE

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A brief collection of those useful numerical aids that may by now have faded slightly in your memory.

A WORKSHOP FOR PRACTICE IN
SKETCHING FUNCTIONS

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.... to refresh your skills at getting realistic pictures of your equations (and their parts). Sketching an equation before an algorithm is chosen will prevent more computational disasters than any other effort. Try some! (We give our own at the end of this chapter.)

GLOOMY MUSINGS

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Correctness, Efficiency and Responsibility
How can we get into the habit of thinking carefully about our computations *before* writing our programs? How can we be sensitized to *preventing* errors without becoming paralyzed into inaction? Can we ever learn to distrust software even while using it? — a *Dies Irae!*

Chapter 1

NONLINEAR EQUATIONS

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We seek rearrangements of the equation to permit iterations that approach roots from one side. A picture will usually lead to an algorithm that does not degenerate into futile repetitions. (It may also show that you are about to seek a solution that you really don't want!)

Chapter 2
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When significant digits disappear, pay heed — for your algorithm is often about to break down! Searching for these places will lead you to trouble spots and allow you to fix them before they rise to bite you. This error-prevention dividend is far more important than the digits that could be lost. We illustrate various techniques, and include a real-life problem.

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A field where it often pays to alter the problem to fit the algorithm: How to remove singularities that can spawn monumental algorithmic inefficiencies.

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 — *Dona Nobis Pacem!*

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