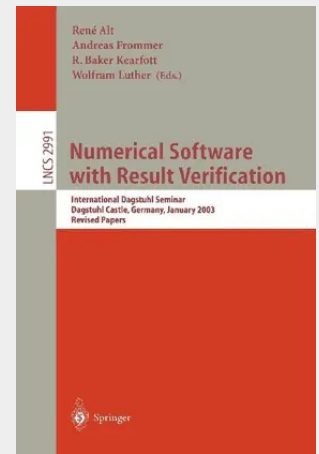


Numerical Software with Result Verification

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Reliable computing techniques are essential if the validity of the output of a numerical algorithm is to be guaranteed to be correct. Our society relies more and more on computer systems. Usually, our systems appear to work successfully, but there are sometimes serious, and often minor, errors. Validated computing is one essential technology to achieve increased software reliability. Formal logic in the definition of data types, the computer arithmetic, in algorithm design, and in program execution allows us to guarantee that the stated problem has (or does not have) a solution in an enclosing interval we compute. If the enclosure is narrow, we are certain that the result can be used. Otherwise, we have a clear warning that the uncertainty of input values might be large and the algorithm and the model have to be improved. The use of interval data types and algorithms with controlled rounding and result verification capture uncertainty in modeling and problem formulation, in model parameter estimation, in algorithm truncation, in operation round-off, and in model interpretation. The techniques of validated computing have proven their merits in many scientific and engineering applications. They are based on solid and interesting theoretical studies in mathematics and computer science. Contributions from fields including real, complex and functional analysis, semigroups, probability, statistics, fuzzy interval analysis, fuzzy logic, automatic differentiation, computer hardware, operating systems, compiler construction, programming languages, object-oriented modeling, parallel processing, and software engineering are all essential.

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