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W. Kahan

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Professor Kahan pursued research to provide improved subroutines for common arithmetic functions for scientific computations. He produced an algorithm for the accurate implementation of rational arithmetic operations without resorting to multi-precision arithmetic. This was described in a paper entitled "Rational arithmetic in floating point". He has also made a careful study of how to make branch cuts in the complex plane so as to allow evaluation of the elementary functions without any anomalies. This was presented in a talk at the conference on "State-of-the-Art in Numerical Analysis" held in Birmingham, England, April 14-18, 1986.

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CENTER FOR PURE AND APPLIED MATHEMATICS

BERKELEY, CALIFORNIA 94720

Final Technical Report
for
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AFOSR-TR. 87-1767

PI: W. Kahan

The work done with the support of this, and other grants, is concerned with providing users with reliable, accurate, fast support for their scientific computations. There has been widespread adoption of the IEEE standards, p. 754 and p. 854, for floating point arithmetic and it is natural to exploit their virtues in providing improved library subroutines.

Professor Kahan has supervised several graduate students (Stuart McDonald, K. C. Ng, Peter Tang, Z-S Liu, and Robert Corbett) on a project to provide elementary functions for the C-language Math library that runs on VAX's and on any other machines conforming to the standard. Detailed documentation is still not complete, the anticipated delivery date is September 1, 1987.

However, some other tasks that acknowledge AFOSR support have been put into the public domain.

1. Professor Kahan has produced an algorithm for the accurate implementation of rational arithmetic operations without resorting to multi-precision arithmetic. This is described in "Rational Arithmetic in Floating Point", PAM 343, Center for Pure and Applied Mathematics.
2. Professor Kahan has completed a careful study of how to make branch cuts in the complex plane so as to allow evaluation of the elementary functions without any anomalies. It proposes a novel idea that one needs not only

principal parts of these functions but "principal expressions" for them.
Kahan gave an invited talk on this topic at the conference on "State-of-the-Art in Numerical Analysis", held in Birmingham, England, April 14-18, 1986. The paper will appear in the proceedings and acknowledges AFOSR support. A preliminary shorter version appeared, before this grant was proposed, as "Branch Cuts for Complex Elementary Functions", PAM 105, Center for Pure and Applied Mathematics, UC, Berkeley, October 1982.

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