

Ulrich W. Kulisch — Curriculum Vitae

Ulrich W. Kulisch studied Mathematics and Physics at the Universität and at the Technische Universität in Munich from 1953, gaining a doctorate in 1961 and a post doctoral qualification (Habilitation) in 1963. From 1964 until 1966 he was acting Professor for Numerical Mathematics at the Universität in Munich.

Ulrich Kulisch has been Professor of Mathematics and Director of the Institute of Applied Mathematics at the Universität Karlsruhe since 1966. At Universität Karlsruhe he was also the director of the Computing Center between 1966 and 1972. As head of a university commission he was responsible for the introduction of computer science teaching in 1968/69. This led to the foundation of the Faculty of Informatics. Ulrich Kulisch spent several sabbaticals abroad. He visited the Mathematics Research Center, The University of Wisconsin, Madison, in 1969/70, the IBM Research Center at Yorktown Heights, N.Y. in 1972/73 and in 1978/79, and the Electrotechnical Laboratory at Tsukuba, Japan in 1998 and in 1999/2000.



Ulrich Kulisch is a member of numerous professional societies among which are GAMM, DMV, GI, IMA, SIAM, AMS, and IMACS. He is a founding member of Gesellschaft für Informatik (GI), between 1982 and 2002 he was the chairman of the GAMM working group on *Computer Arithmetic and Scientific Computing* and of the IMACS technical committee on *Enhanced Computer Arithmetic*. Since 1979 Ulrich Kulisch has been a member of the IFIP-Working Group 2.5 on *Numerical Software*. He has been a member of the Board of Directors of IMACS since 1980. Under the auspices of Bibliographisches Institut Mannheim Ulrich Kulisch started the first German book series on Informatics in 1968. Until 1998 he was an editor of this series. Since 1975 until 1998 he has been an editor of the mathematics survey series, *Jahrbuch Überblicke Mathematik*.

Ulrich Kulisch is the author or co-author of about 120 scientific publications and of ten books among which are titles on Analog Computation, Fundamentals of Numerical Computation, Computer Arithmetic in Theory and Practice, the XSC-programming languages, and the Toolbox books on validated scientific computing. A mathematical theory of computer arithmetic was proposed and developed by him. This theory redefines all arithmetic operations for real and complex numbers, vectors and matrices as well as their interval extensions on the computer by the principle of semimorphism. He got several patents on the subject. He has supervised more than 50 graduates in mathematics, computer science, and engineering science to achieve doctoral or post-doctoral qualifications. 15 former collaborators of his research group have become professors themselves.

To put the new arithmetic into effect, Ulrich Kulisch and his research group have developed and implemented the programming language Pascal-XSC (eXtended Scientific Computation). The project was supported by Nixdorf. Use of Pascal-XSC allows the clear and elegant formulation of algorithms where the computer itself validates the correctness of the computed result within close bounds. A textbook on Pascal-XSC has been published in German, in English, and in Russian. The Toolbox book has also been translated into Russian. The development of Pascal-XSC served as a model for a long term Fortran based collaboration with IBM. Several IBM program products like ACRITH and ACRITH-XSC together with hardware support for the extended arithmetic on several IBM /370 processors have been the result of this cooperation. Another industrial cooperation with Siemens led to the programming environment ARITHMOS. To keep up with recent developments another programming environment C-XSC has been developed as a C++ class library and published.

The XSC-developments are based on an advanced and extended floating-point arithmetic. Software simulation on conventional processors gives slow speed results. A hardware chip, the XPA3233, therefore, has been developed and fabricated in CMOS VLSI technology as a coprocessor for the PC in 1993. For floating-point data the XPA3233 allows matrix, vector, and many other operations to be performed very fast and always mathematically correct, that is, without any rounding errors. This achievement has profound implications for numerical mathematics. Since he is an emeritus professor he published two books: *Advanced Arithmetic for the Digital Computer - Design of Arithmetic Units*, Springer-Verlag, 2002, and *Computer Arithmetic and Validity - Theory, Implementation, and Applications.*, de Gruyter 2008, second edition 2013. He is still an active member of the IFIP Working Group 2.5 on Numerical Software as well as of the standard committee IEEE P1788 on interval arithmetic of the IEEE Computer Society.