

# Curriculum vitae

## (January 2012)

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**Personal statistics:** Danish Citizen, Born: April 29, 1939, in Aarhus, Denmark.

**Education:** Mag. Scient. (Mathematics), Aarhus University, Denmark. September, 1967.

### Employments:

**January 1988 - present:** Professor of Computer Science in the Department of Mathematics and Computer Science at University of Southern Denmark, Odense. Since July 1, 2009 emeritus.

**January - December 1991:** Chairman of the Department of Mathematics and Computer Science at Odense University

**April 1971 to Dec. 1987 (except for two periods of leave):** Chairman of the Computer Science Department, Aarhus University.

**February 1982 - January 1984:** Head of the Institute of Mathematical Sciences (Mathematics, Statistics and Computer Science), Aarhus University.

**January 1971 to December 1987:** Lektor (assoc. prof.) in the Computer Science Department, Aarhus University (DAIMI), engaged in research and teaching in numerical analysis, compiler construction, microprogramming, systems architecture, computer arithmetic and computer networks.

**January through March 1979, and July 1978:** Research Scientist, Computer Science Department, Southern Methodist University, Dallas, Texas. Research in the foundations of approximate rational arithmetic.

**August 1975 to May 1976:** Visiting Associate Professor, Computer Science Department, University of Southwestern Louisiana, Lafayette, Louisiana. Research and teaching in compiling and interpretation methods, computer arithmetic and its language support.

**September 1967 to January 1971:** "Amanuensis" at Aarhus University Computing Center, engaged in research in numerical analysis and consultant to users of the Computing Center.

**August 1963 to August 1967:** Teaching assistant at the Dept. of Mathematics, Aarhus University, engaged in teaching undergraduate courses in mathematics.

**September 1958 to April 1967:** Teacher at Aarhus Teknikum (Engineering College), engaged in teaching mathematics, chemistry, physics, and programming.

**Research Activities:** Foundations and implementation of computer arithmetic and number systems, in particular redundancy in representations and rational arithmetic, applications in DSP and cryptography. Machine architecture and microprogramming, firmware development tools.

### Book Publication:

with David W. Matula: "*Finite Precision Number Systems and Arithmetic*", Cambridge University Press, 700 pages, September 2010.

## **Publications in journals and peer reviewed conference proceedings:**

with Nicolas Louvet, Vincent Lefevre and Jean-Michel Muller: “On the Computation of Correctly-Rounded Sums”, *IEEE Transactions on Computers* To appear 2012, (extensively expanded version of conference presentation below).

with Nicolas Brisebarre, Mioara Joldes, Erik Martin-Dorel and Jean-Michel Muller: “Augmented precision square roots and 2-D norms, and discussion on correctly rounding  $\sqrt{x^2 + y^2}$ ”, Proceedings of the 20<sup>th</sup> IEEE Symposium on Computer Arithmetic (ARITH20), July 2011.

with Adrien Panhaleux and Jean-Michel Muller: “Performing Arithmetic Operations on Round-to-Nearest Representations”, *IEEE Transactions on Computers*, Vol. 60(2), 2011.

with Christoph Lauter, Nicolas Louvet, Vincent Lefevre and Jean-Michel Muller: “Computing Correctly Rounded Integer Powers in Floating-Point Arithmetic”, *ACM Transactions on Mathematical Software*, Vol. 37(1), January 2010 (extensively revised version of conference presentation below).

“Correcting the Normalization Shift of Redundant Binary Representations”, *IEEE Transactions on Computers*, Vol. 58(10), Oct. 2009.

with Vincent Lefevre, Nicolas Louvet and Jean-Michel Muller: “On the Computation of Correctly-Rounded Sums”, Proceedings of the 19<sup>th</sup> IEEE Symposium on Computer Arithmetic, June 2009.

with Vincent Lefevre and Jean-Michel Muller: “Computing Integer Powers in Floating-Point Arithmetic”, Proceedings of the 41<sup>st</sup> Asilomar Conference on Signals, Systems and Computers, November 2007.

with Jean-Michel Muller: “Leading Guard Digits in Finite Precision Redundant Representations”, *IEEE Transactions on Computers*, Vol. 55(5), May 2006.

with Jean-Michel Muller: “RN-Codings: : New Insights and Some Applications.” Proceedings of RNC7, Nancy, France, July 10-12 2006, pp. 115-124.

with Jean-Michel Muller: “Choosing Starting Values for Certain Newton-Raphson Iterations”, Extensively revised version of paper below. *Theoretical Computer Science*, Vol. 351, 2006, pp. 101-110.

with Jean-Michel Muller: “RN-coding: Definition and Some Properties”, Proc. IMACS’2005, July 2005.

with David W. Matula : “Single Precision Reciprocal by Multipartite Table Look-up”, Proc. of The 17<sup>th</sup> IEEE Symposium on Computer Arithmetic, IEEE, 2005.

“Reviewing 4-to-2 Adders for Multi-Operand Addition”, Proc. Conf. Application-Specific Systems, Architectures and Processors (ASAP 2002), IEEE, July 2002. Awarded “Best Paper”. Published in *Journal of VLSI Signal Processing*, Vol. 40(1), May 2005, pp. 143-152.

“Digit Selection for SRT Division and Square Root”, Significantly extended version of ARITH-paper below. *IEEE Transactions on Computers*, Vol. 54(3), March 2005.

with N. Brisebarre, D. Defour, J-M. Muller and N. Revol: “A New Range Reduction Algorithm”, October 2004, Extensively revised version of the Asilomar paper below, *IEEE Transactions on Computers*, Vol. 54(3), March 2005.

with Jean-Michel Muller: “Choosing Starting Values for Newton-Raphson Computation of Reciprocals, Square-Roots and Square-Root Reciprocals”. Proc. of RNC5, Lyon, Sept. 3-5, 2003.

“Revisiting SRT Quotient Digit Selection”, Proc. of The 16<sup>th</sup> IEEE Symposium on Computer Arithmetic, IEEE, 2003.

with David Defour, Jean-Michel Muller and Natalie Revol: “A new Range Reduction Algorithm”, in Proc. 35<sup>th</sup> Asilomar Conference on Signals, Systems, and Computers, Nov. 2001.

with Jean-Claude Bajard and Laurent-Stephane Didier: “RNS Modular Multiplication and Base Conversions”, Proc. 15<sup>th</sup> IEEE Symposium on Computer Arithmetic, IEEE, 2001.

with Feng Zhou: “Computing Moments by Prefix Sums”, *Journal of VLSI Signal Processing*, Vol. 25, 2000.

with Asger M. Nielsen: “Redundant Radix Representation of Rings”, *IEEE Transactions on Computers*, Vol. 48(11), November 1999.

“Necessary and Sufficient Conditions for Parallel, Constant Time Conversion and Addition”, August 1998. in Proc. 14th IEEE Symposium on Computer Arithmetic, Adelaide, 1999.

with Feng Zhou: “A New Fast Discrete Fourier Transform”, *Journal of VLSI Signal Processing*, Vol. 20, 1998.

with Jean-Claude Bajard and Laurent-Stephane Didier: “An RNS Montgomery Modular Multiplication Algorithm”, in Proc. 13th IEEE Symposium on Computer Arithmetic, IEEE, 1997. Revised version published in *IEEE Transactions on Computers*, Vol. 46(7), July 1998.

with Asger M. Nielsen: “On Radix Representation of Rings”, in Proc. 13th IEEE Symposium on Computer Arithmetic, IEEE, 1997.

with Feng Zhou: “Computing Moments by Prefix Sums”, in Proc. IEEE Intl. Conf. on Image Processing, Lausanne, extended abstract 1996.

with D. W. Matula: “LCF: A Lexicographic Binary Representation of the Rationals”, *Journal of Universal Computer Science*, Vol 1(7), July 1995.

with Asger M. Nielsen: “MSB-First Digit Serial Arithmetic”, *Journal of Universal Computer Science*, Vol 1(7), July 1995.

with Feng Zhou: “High Speed DCT/IDCT Using a Pipelined CORDIC Algorithm”, in Proc. 12th IEEE Symposium on Computer Arithmetic, IEEE, 1995.

“A Systolic, Linear-Array Multiplier for a Class of Right-Shift Algorithms”, *IEEE Transactions on Computers*, C-43, no. 8, August 1994.

“Digit Set Conversions: Generalizations and Applications”, *IEEE Transactions on Computers*, C-43, no. 5, May 1994.

“High Radix Modular Multiplication for Cryptosystems”, in Proc. 11th IEEE Symposium on Computer Arithmetic, IEEE, 1993.

with H. Orup: “A High-Radix Hardware Algorithm for Calculating the Exponential  $M^E$  Modulo  $N$ ”, in Proc. 10th Symposium on Computer Arithmetic, IEEE, June 1991.

with G. Bohlender, W. Walter and D.W. Matula: “A Semantics for Exact Floating Point Operations”, in Proc. 10th Symposium on Computer Arithmetic, IEEE, June 1991.

with D.W. Matula: “An Algorithm for Bit-Pipelined Rational Arithmetic”, *IEEE Transactions on Computers*, C-39, no 8, Aug. 1990

with D.W. Matula: “Exploiting Redundancy in Bit-Pipelined Rational Arithmetic”, in Proc. 9th Symposium on Computer Arithmetic, IEEE, Sept. 1989.

with D.W. Matula: “An On-Line Arithmetic unit for Bit-Pipelined Rational Arithmetic”, *Journal of Parallel and Distributed Computing*, vol. 5, 1988.

with D.W. Matula: “A Bit-Serial Arithmetic Unit for Rational Arithmetic”, in Proc. 8th Symposium on Computer Arithmetic, IEEE, May 1987.

with D.W. Matula: “Finite Precision Lexicographic Continued Fraction Number Systems”, in Proc. 7th Symposium on Computer Arithmetic, IEEE, June 1985.

with D.W. Matula: “Finite Precision Rational Arithmetic: Slash Number Systems”, *IEEE Transactions on Computers*, C-34, no 1, Jan. 1985.

with D.W. Matula: “Finite Precision Rational Arithmetic: An Arithmetic Unit”, *IEEE Transactions on Computers*, vol C-32, no 4, April 1983.

with D.W. Matula: “An Order Preserving Binary Encoding of the Rationals”, Proc. 6th Symposium on Computer Arithmetic, IEEE, June 1983.

with R.T.Gregory: "Mapping Integers and Hensel Codes onto Farey Fractions", DAIMI-PB 149, July 1982 and *BIT*, vol 23, no 1, 1983.

with D.W. Matula: "An Integrated Rational Arithmetic Unit", Proc. 5th Symposium on Computer Arithmetic, IEEE, May 1981.

with D.W. Matula: "Foundations of Finite Precision Arithmetic", in "Fundamentals of Numerical Computation", *Computing*, Suppl.2, 1980

with D.W. Matula: "Approximate Rational Arithmetic Systems: Analysis of Recovery of simple Fractions During Expression Evaluation", in Proc. EUROSAM '79, Springer Lecture Notes Series, vol.72, 1979.

with D.W. Matula: "A Feasibility Analysis of Fixed-Slash Rational Arithmetic", Proc. 4th Symposium on Computer Arithmetic, IEEE, Nov. 1978.

with D.W. Matula: "A Feasibility Analysis of Fixed-Slash and Floating-Slash Number Systems", Proc. 4th Symposium on Computer Arithmetic, IEEE, Nov. 1978.

with Ole L. Madsen, Bent B. Kristensen: "Interpretation and Code Generation Based on Intermediate Languages", DAIMI PB-88, April 1978, also in *Software Practice and Experience*, vol 10, 1980.

with B.D. Shriver: "A Unified Numeric Representation Arithmetic Unit and Its Language Support", *IEEE Transactions on Computers*, C-26, 7 July 1977.

"A Unified Numeric Data-type in Pascal", Proc. 3rd Symposium on Computer Arithmetic, IEEE, Nov. 1975.

with B.D. Shriver: "The UNRAU - a Unified Numeric Representation Arithmetic Unit", Proc. 3rd Symposium on Computer Arithmetic, IEEE, Nov. 1975.

"Concepts of the MATHILDA System", Proc. Second Annual Symposium on Computer Architecture, IEEE, January 1975.

#### **Non refereed publications (selected):**

with Feng Zhou: "Bit Serial Structure for Full-Search, Block Matching Algorithm", In Proceedings of the IS&T/SPIE Symposium on Electronic Imaging, January, 1996

with Feng Zhou: "A High-Speed Hough Transform Using CORDIC", in Proc. Intn. Conf. on Digital Signal Processing, DSP-95, Limasol, Cyprus, June 1995.

with D.W. Matula: "A Precision Demand-Driven Computation Cell", Extended Abstract, Invited talk at SCAN-90, Albena, Bulgaria, Sept. 1990.

with D.W. Matula: "On Minimum Weight Binary Representations of Integers and Continued Fractions", DAIMI PB-130, Jan. 1981.

"Firmware Development and Test Systems", in *Informatik Fachberichte*, Vol.31, 1980.

with D.W. Matula: "On the Average Value of the Greatest Common Divisor", CSE7901 Report, Southern Methodist University, Dallas, 1979.

with B.D. Shriver: "A Description of the MATHILDA Processor", Computer Science Department Report, DAIMI PB-52, September 1975.

"Current Research Activities in microprogramming at Aarhus University", in *EUROMICRO Newsletter*, April 1975.

with B.D. Shriver: "An Overview of the MATHILDA System", Computer Science Department Report, DAIMI PB-34, August 1974, also in *SIGMICRO Newsletter*, January 1975.

"Calculation of Certain Infinite Sums and Products", Aarhus University Computing Center Report, 1968.

"Convergence of the QR Algorithm for Hessenberg Matrices", Mag. Scient. Thesis, Mathematics Department, Aarhus University, 1967.

**Thesis and dissertation supervision:** Computer arithmetic and number systems, computer networks, computer architecture and -description tools, speech recognition, compiler writing systems, firmware development tools and programming support environments.

**Other Activities:**

Program Co-Chairman for the 10th IEEE Symposium on Computer Arithmetic (ARITH-10), Grenoble, 1991; for ARITH-14, Adelaide, 1999 and ARITH-18, Montpellier 2007. Program Chairman and Co-General chairman of ARITH-6, Aarhus, 1983.

Member of program committee - IEEE Symposia on Computer Arithmetic, Los Angeles 1978, Ann Arbor 1981, Aarhus 1983, Urbana 1985, Como 1987, Santa Monica 1989, Grenoble 1991, Windsor 1993, Bath 1995, Asilomar 1997, Adelaide 1999, Vail 2001, Santiago de Compostella 2003, Cape Cod 2005, Montpellier 2007, Oregon, 2009 and Tübingen 2011.

Chairman of the Steering Committee for the conferences “Real Numbers and Computers” since 2002, and member of the program committees for RNC1 to RNC8. General and PC-Chair of RNC4, Dagstuhl, April 17–19, 2000.

Co-Guest-Editor of Special Issues of the IEEE Transactions on Computers, August 1992, July 2000 and February 2009.

Guest editor of special issue of the journal “Theoretical Computer Science”, vol. 291, 2003.

Member of NATO Scientific Panel, PST, 2000–2004.

Co-organizer of Dagstuhl Seminar “Architectural and Arithmetic Support of Multimedia”, Aug. 31–Sept. 4, 1998.

Member of advisory board (Fagligt Forum) to the Danish Technical Research Council, 1997–2004.

Associate Editor, member of the Editorial Board, IEEE Transactions on Computers, 1991–95.

Chairman of an international panel for the evaluation of Latvian research in computer science, 1992, appointed by the Danish Natural Science Research Council.

Member of program committee - Workshop on Cryptographic Hardware and Embedded Systems (CHES), 2000 – 2005.

Program Chairman - Ninth Annual Workshop on Microprogramming, New Orleans, 1976.

Member of the Board of the Mathematics and Computer Science Department Executive Committee, Odense University, 1990-1991. Chairman of the department 1991.

Member of the Board of the School of Natural Sciences, Odense University, 1989- .

Member and Chairman of the Computer Science Department Executive Committee, Aarhus University, 1971-87.

Member of the Board of Natural Sciences, Aarhus University, 1980-85, and on the executive board 1982-85.

Member of the Executive Committee for Mathematical Sciences (Mathematics, Statistics and Computer Science), Aarhus University, 1973-87. Chairman 1982 - 84.

Member of the Executive Board of the Regional Computing Center at Aarhus University (RECAU) 1977-85.

Member of technical advisory board to Danish Datamatics Center, 1979-83.

Consultant to Danish Datamatics Center Ada compiler project, 1981-83.

Consultant to Cyrix Corporation, Dallas, 1992-94.

Reviewer to CACM, BIT, IEEE Transactions on Computers, IEEE Transactions on Circuits and Systems I, Information Processing Letters, Discrete Mathematics, Journal of Parallel and Distributed Computing, IEEE Software, IEEE Computer and numerous conferences.