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# Computer Arithmetic: Continuing a Long and Steady Emergence

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## Computer Arithmetic: continuing a long and steady emergence

Computer Arithmetic is the art of representing and manipulating numbers in a computing device. Having been one of the pillars of computer engineering since its early beginning, a legitimate question is “How can Computer Arithmetic contribute to emerging trends and topics?”. As written in 2016 in a column of Computer [1], “*after all, multiplication and addition haven’t changed. Nevertheless, new architectures, processors, problems, application domains, and so forth, all require computations and are open to new challenges for computer arithmetic.*”

In 2016, so “only” 6 years ago, blockchain, artificial intelligence, machine learning, in memory computing (to pick a few) were just starting to walk their successful climbing trail to reach the top positions among today’s most impactful technologies. Computer Arithmetic has always been at the core of the digital age, and it is currently driving every single innovation on a widespread range of domains such as those mentioned above, as well as many more, like high-performance computing, signal processing, or security, just to mention a few.

How about the future? Few predictions have been made today, but by living day-by-day new “research&technology” advances will show new and emerging challenges. Today we look and think at the implementation of quantum computing, sustainable computing, DNA computing, ... and tomorrow will show us what is round the corner. A certainty is that no matter the new impacting trends, Computer Arithmetic will be at their service.

Since 1969, the IEEE ARITH symposia have served as the most important venue for presenting the latest research in computer arithmetic and related areas, originating from both academia and industry.

The topics of ARITH include number systems, algorithms for operations and mathematical functions, implementations, validation, hardware and software designs, and applications of computer arithmetic, including cryptography or machine learning.

ARITH symposia have taken place in several places around the world: from Kyoto to London, Lyon, Austin, Portland, Cape Cod, Santiago de Compostela, Adelaide, Asilomar, Grenoble, Santa Monica, Como, and many more other locations. Due to the recent pandemic, the decision was taken in 2021 to organize the 2022 IEEE Symposium on Computer Arithmetic (ARITH 2022) <https://arith2022.arithsymposium.org/index.html> as a virtual conference from September 12 to 14.

In partnership with the conference, TETC has launched at the end of 2021 a call for papers for a Special Section on Emerging and Impacting Trends on Computer Arithmetic <https://www.computer.org/digital-library/journals/ec/cfp-trends-computer-arithmetic> TETC has received 28 submissions from researchers from all the world, 7 of which [2-8] were accepted and appeared in the first available issue of TETC. These papers were also invited for presentation at the Symposium. ARITH 2022 also received 32 submissions for conference papers, out of which 16 were selected for publication and presentation at the conference.

As reported in its [webpages](#), TETC is a [special sections](#)-based journal. Our authors have the option to submit papers to a current [special section](#) or to the continuous call for papers on some specific emerging topics of interest to the journal, called “[technical tracks](#)”. To stay up-to-date with the most recent research advances and to possibly contribute to the domain of Computer Arithmetic as well as to other topics of interest of TETC, please visit regularly our webpages as well as the TETC’s [gateway](#) to IEEE Xplore.

## Bibliography

1. P. Montuschi and J. Muller, "Modern Computer Arithmetic" in *Computer*, vol. 49, no. 09, pp. 12-12, 2016, doi: 10.1109/MC.2016.277.
2. D. Mallasén, R. Murillo, A. A. D. Barrio, G. Botella, L. Piñuel and M. Prieto-Matias, "PERCIVAL: Open-Source Posit RISC-V Core With Quire Capability," in *IEEE Transactions on Emerging Topics in Computing*, 2022, doi: 10.1109/TETC.2022.3187199.
3. S. Boldo, L. Ben Salem-Knapp, W. Weens, "Bounding the Round-Off Error of the Upwind Scheme for Advection", in *IEEE Transactions on Emerging Topics in Computing*, 2022, doi:
4. F. Y. Dosso, J. -M. Robert and P. Véron, "PMNS for efficient arithmetic and small memory cost," in *IEEE Transactions on Emerging Topics in Computing*, 2022, doi: 10.1109/TETC.2022.3187786.
5. J. C. Bajard, K. Fukushima, T. Plantard and A. Sipasseuth, "Generating Very Large RNS Bases," in *IEEE Transactions on Emerging Topics in Computing*, 2022, doi: 10.1109/TETC.2022.3187072.
6. Meloni, Nicolas, "An Alternative Approach to Polynomial Modular Number System Internal Reduction," in *IEEE Transactions on Emerging Topics in Computing*, 2022, doi:
7. J. Osorio, A. Armejach, E. Petit, G. Henry and M. Casas, "A BF16 FMA is All You Need for DNN Training," in *IEEE Transactions on Emerging Topics in Computing*, 2022, doi: 10.1109/TETC.2022.3187770.
8. E. Zacharelos, I. Nunziata, G. Saggese, A. G. M. Stollo and E. Napoli, "Approximate Recursive Multipliers Using Low Power Building Blocks," in *IEEE Transactions on Emerging Topics in Computing*, 2022, doi: 10.1109/TETC.2022.3186240.

## Links cited in the text

- <https://www.computer.org/csdl/journals/ec/about/14393?title=About&periodical=IEEE%20Transactions%20on%20Emerging%20Topics%20in%20Computing>
- <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245516>
- <https://www.computer.org/csdl/journals/ec/write-for-us/15071?title=Author%20Information&periodical=IEEE%20Transactions%20on%20Emerging%20Topics%20in%20Computing>

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