

Anastasia Volkova

Associate Professor in Computer Science

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Research Interests

- Computer Arithmetic
- Digital filters
- Optimization
- Digital circuit design
- Code generators
- Reliable algorithms

Professional experience

- Sep 2019 - current **Associate professor**, University of Nantes, Department of Computer Science, Nantes, France.
- Apr - Aug 2019 **AI Research resident**, Intel Corporation – AI Research Group, San Diego, USA.
- Mar 2019 **Invited researcher**, Max Planck Institute for software systems, Kaiserslautern, Germany.
- 2017 - 2019 **Postdoctoral researcher**, Inria – ENS Lyon – LIP, Lyon, France.
- 2014 - 2017 **PhD candidate & Teaching Instructor**, Sorbonne University – UPMC – LIP6, Paris, France.
- 2012-2013 **Software Engineer**, IT Department of Odessa National University, Odessa, Ukraine.

Education

- 2014 - 2017 **PhD in Computer Science**, Sorbonne University – UPMC, Paris, France.
Thesis: "Towards reliable implementation of digital filters"
Advisors: Christoph Lauter, Thibault Hilaire
- 2012-2014 **Master of Applied Mathematics**, Odessa National I.I. Mechnikov University, Ukraine.
Memoir: "Averaging methods for fuzzy differential systems"
- 2008-2012 **Bachelor of Applied Mathematics**, Odessa National I.I. Mechnikov University, Ukraine.
Memoir: "Linguistic models of large-scale fuzzy expert systems"

Selected publications

- [VIDH'19] A. Volkova, M. Istoan, f. de Dinechin and T. Hilaire, Towards Hardware IIR Filters Computing Just Right: Direct Form I Case Study, *IEEE Transactions on Computers*, 68(4), 597–608, 2019, doi:10.1109/TC.2018.2879432
- [VHL'19] A. Volkova, T. Hilaire, C. Lauter, Arithmetic approaches for rigorous design of reliable fixed-point LTI filters, Accepted to *IEEE Transactions on Computers*, 2019, early access version available at doi:10.1109/TC.2019.2950658
- [VM'19] A. Volkova, J.-M. Muller. Semi-automatic implementation of the complementary error function. In *IEEE 26th Symposium on Computer Arithmetic (ARITH)*, Kyoto, Japan, 2019.
- [DV'19] E. Darulova, A. Volkova. "Sound approximation of programs with elementary functions". In *31st International Conference on Computer-Aided Verification (CAV)*, New-York, USA, 2019
- [VCH'17] A. Volkova, C. Lauter et T. Hilaire. Reliable verification of digital implemented filters against frequency specifications. In *IEEE 24th Symposium on Computer Arithmetic (ARITH)*, pp. 180-187, London, UK, 2017. doi: 10.1109/ARITH.2017.9
- [QVTH'17] F. Qureshi, A. Volkova, J. Takala et T. Hilaire. Multiplierless Unified Architecture for Mixed Radix-2/3/4 FFTs. In *25th European Signal Processing Conference (EUSIPCO)*, pp. 1334-1338, Kos, Greece, 2017. doi: 10.23919/EUSIPCO.2017.8081425
- [HV'17] T. Hilaire et A. Volkova. Error analysis methods for the fixed-point implementation of linear systems. In *IEEE Workshop on Signal Processing Systems (SiPS)*, pp. 1-6, Lorient, France, 2017. doi: 10.1109/SiPS.2017.8109991
- [VHL'15b] A. Volkova, T. Hilaire et C. Lauter. Reliable evaluation of the worst-case peak gain matrix in multiple precision. In *IEEE 22nd Symposium on Computer Arithmetic (ARITH)*, pp. 96-103, Lyon, France, 2015. doi: 10.1109/ARITH.2015.14

- [VHL'15a] A. Volkova, T. Hilaire et C. Lauter. Determining fixed-point formats for a digital filter implementation using the worst-case peak gain measure. In *49th Asilomar Conference on Signals, Systems and Computers (ASILOMAR)*, pp. 737-741, Pacific Grove, CA, USA, 2015. doi: 10.1109/ACSSC.2015.7421231
- [VH'15] A. Volkova and T. Hilaire. Fixed-point implementation of lattice wave digital filter: Comparison and error analysis. In *23rd European Signal Processing Conference (EUSIPCO)*, pp. 1118-1122, Nice, France, 2015. doi: 10.1109/EUSIPCO.2015.7362557

Software projects

- FIRopt A tool for optimal design of digital filters for finite-precision multiplierless FPGA implementations. License GNU GPL v3.0. In development, my contribution is ≈ 7000 lines of C++ code (total amount $\approx 10\,000$). Available at <https://gitlab.com/filteropt/firopt>
- FiXiF toolbox Code generation tool for LTI filters for software fixed-point arithmetic. License GNU GPL v3.0. In development, my contribution is ≈ 2000 lines of Python and C code (total amount ≈ 8000). Available at <https://github.com/fixif/FiXiF.git>
- Daisy+Metalibm A tool for approximation of generic numerical kernels, copyright MPI-SWS. My contribution is ≈ 1000 lines of Scala code. Branch metalibm in the Daisy tool is available at <https://github.com/malyzajko/daisy>
- ERFCgenerator A semi-automatic code generation tool for evaluation of the `erfc` function, licence CeCILL-B. I am the only developer, ≈ 3000 lines of C and Sollya code. Available at <https://gforge.inria.fr/projects/erfcgenerator>
- WCPGLib Implementation of the algorithm for evaluation of Worst Case Peak gain of digital filters, licence CeCILL-B. I am the only developer, ≈ 6000 lines of C code. Available at <https://scm.gforge.inria.fr/anonscm/git/metalibm/wcpg.git>
- FxPFLib A mathematical library for a reliable determination of the Fixed-Point formats for a linear digital filter implementation, licence CeCILL-B. I am the only developer, ≈ 4000 lines of C code. Available at <https://scm.gforge.inria.fr/anonscm/git/fxpf/fxpf.git>

Students

- 2020 Killian Freteaud, Master 2 intern, working on error analysis for AI
- 2020 Rémi Garcis, Master 2 intern, working on optimization for IIR filters
- 2018 Youcef Merah, Master 2 intern, worked on code generation for numerical kernels
- 2016 Maminionja Ravoson, Master 2 intern, worked on automatic implementation of lattice digital filters

Fellowships

- 2019 Intel Corporation fellowship for a research residency in the area of hardware for AI
- 2017 Inria fellowship for a postdoctoral residency in the area of computer arithmetic
- 2013 Ukrainian Ministry of Education fellowship for a 6-months scientific internship

Activities

- 2016-now Reviewer for IEEE Transactions on Computers, ARITH, AICAS
- 2015-2016 Member of Organizing Committee for doctoral seminars at LIP6.

Languages

- Ukrainian Native
- Russian Native
- English Full proficiency
- French Full proficiency
- German Basic notions

Interests

Trail running, hiking, climbing