Maksims Abaļenkovs, PhD

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Main Areas of Interest

Computational electromagnetics, Numerical linear algebra, High-performance computing, Linux/Unix

Skills Profile

- Specialist in developing and implementing computational electromagnetics techniques (Finite-Difference Method, frequency dependence, subgridding and Fast Multipole Method).
- High-performance computing engineer with focus on shared-, distributed- and GPU-memory development.
- Technical leader on cross-functional projects guiding junior developers.
- Expert in numerical approximation methods and parallel programming runtimes obtained during industrial and academic projects.
- Professional in designing, profiling and optimising computational workflows aimed at solution of specific challenges.
- Numerical linear algebra advocate.

Research and Development Work Experience

04/2022–present **Senior High Performance Software Engineer, STFC, Didcot, UK**

- Extending Integrated Flood Modelling for distributed-memory and GPU-enabled operation (C, StarPU, OpenMP, MPI, Perl).
- Designing and implementing an energy saving xApp for a practical OpenRAN deployment in Liverpool (Python, Perl, Docker).
- Profiled and optimised Markov Chain Monte Carlo method for shared-, distributed- and GPU-memory execution (C++, OpenMP, MPI, CUDA, Intel {Advisor, VTune Profiler}).
- Planned and delivered a hands-on one-day course on Rust for experienced developers (Rust).

09/2019–03/2022 **Research Software Engineer, STFC, Warrington, UK**

- Applied custom arbitrary float number formats for QR decomposition on CPU and FPGA architectures (C, C++, Perl, GNU Octave).
- Integrated parallel data format support for a computational chemistry suite. This work produced a sixfold reduction in output file size and twofold reduction in average memory utilisation (Fortran, MPI, NetCDF, HDF5).
- Trained machine learning algorithm to detect earthworm casts (Python, TensorFlow 2).
- Created a novel method for validation and verification of an industrial artificial intelligence system (Python, Docker).
- Conducted performance tests of implicit-factorisation preconditioners on a range of system matrices (BOUT++, Nektar++, C++, PETSc).
- Prototyped graph-based algorithm to model power, sewage and mobile network outage due to flooding (Python, Podman, Docker).
- Containerised molecular dynamics and neutron reflectometry workflow (Perl, C++, MATLAB, Apptainer, Nextflow).

05/2015–10/2018 **Research Associate, The University of Manchester, Manchester, UK**

- Parallelised iterative refinement algorithms for linear systems solution in mixed precision (C, Fortran, Python, OpenMP, StarPU, LAPACK, BLAS). Please see PLASMA 24.8.7 distribution.
- Developed *Rightsizer*—an open-source software package to detect an optimal tile size and a number of OpenMP threads for parallel matrix factorisations (C, OpenMP, PLASMA).
- Expanded 2DRMP package to apply PLASMA routines for matrix multiplication, eigenvalue decomposition, LU-factorisation and linear systems solution (Fortran, PLASMA).
- Derived a generic algorithm for calculation of finite-difference expressions of any order n. Developing *X-Stencil*—an open-source package to validate theoretical results in an FDTD-based method up to the 10th order (Fortran, MATLAB).
- Developed a matrix casting approach to re-formulate the update equations of stencil-based methods in {1, 2, 3}D and speed-up the computation (Fortran).

03/2013–05/2015 **Research Engineer, Télécom Bretagne, Brest, France**

- Prototyped the Fast Multipole Method with Fast Fourier Transform software to speed-up solution of the forward problem in Electroencephalography applications. This project included the study of efficient convolution of circulant and block Toeplitz tensors (Fortran, C++, FFTW, MATLAB, GNU Octave).
- Provided computational expertise to a team developing an automotive radar simulation platform in collaboration with Renault. Major contributions to the project included development and application of beamforming and Multiple Signal Classification algorithms for Angle-of-Arrival estimation in realistic scenarios (MATLAB).

Education

09/2007–12/2011 **PhD in Electrical and Electronic Engineering**
The University of Manchester, UK

Huygens Subgridding for the Frequency-Dependent–Finite-Difference Time-Domain Method

- Developed various Frequency-Dependent Finite-Difference Time-Domain algorithms with the Huygens Subgridding technique (Fortran, OpenMP, MPI, MATLAB).
- New solver allowed efficient simulation of electromagnetic wave propagation in multilayered media, *e.g.* human body.
- Proposed the solver application to optimise defibrillators by simulating defibrillation current in a human torso.

09/2006–09/2007 **MSc in Advanced Computer Science**
The University of Manchester, UK

Large-Scale Finite-Difference Time-Domain Data Processing Using High Performance Systems

- Adapted the HDF5 library for a parallel in-house FDTD solver. The HDF5 enabled logical data storage and efficient data processing (Fortran, HDF5).

10/2004–09/2006 **BSc in Computer Science with minor in Physics**
Heinrich-Heine-Universität Düsseldorf, Germany

Programming Skills

C (5 years), Fortran (5y), Python (2y), C++ (2y), Java (2y), Perl (1y), Rust (6 months), Julia (6m),
OpenMP (5y), MPI (2y), StarPU (1y), CUDA (6m), oneAPI SYCL (6m),
MATLAB (2y), GNU Octave (2y).

Extra Positions of Responsibility

08/2013–present **Scientific Journal Reviewer**

Active reviewer for the IEEE Transactions on Antennas and Propagation, and Antennas and Wireless Propagation Letters journals.

Professional Affiliations

Member of

- the Institute of Electrical and Electronics Engineers (IEEE) [since 2010],
- the Society for Industrial and Applied Mathematics (SIAM) [since 2010] and
- the Applied Computational Electromagnetics Society (ACES) [since 2013].

Languages

Speak four European languages fluently: English, German, Russian, Latvian and know French at an intermediate level.