Andrei Chaplygin

Software developer

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Work Experience

2019-present **C++ Senior Software Developer**, *Rock Flow Dynamics*.
tNavigator - high-performance tool for integrated static and dynamic modelling from reservoir to surface networks:
- Worked with a team of 15 people, participated in code reviewing and team-leading
- Developed robust numerical methods for reservoir simulation and surface network modeling
- Improved stability and calculation time for 50+ models of real oil-gas fields
- Developed optimization methods to satisfy constraints and maximize oil-gas production in fields
- Implemented features increasing modeling functionality (4 releases per year)

2016-2019 **R&D Scientist**, *Schlumberger*.
- Developed and validated model of hydraulic fractures driven by wellbore pressure
- Studied multiphase flow in a tube and fast extension hydraulic fractures
- Implemented an efficient nonlinear solver for the fully coupled multiphysics problem
- Wrote article with research results in Q1 scientific journal

2015-2016 **C++ Software Developer**, *Geometric Modeling and Interactive Systems Research Group*.
- Developed the software for visualization of satellites navigation
- Implemented numerical methods of orbital dynamics and computer graphic algorithms
- Worked with Qt, OpenSceneGraph, OpenGL shaders

Education

2019-present **PhD in Applied Mathematics and Computer Science**, *Marchuk Institute of Numerical Mathematics*.
Thesis: Improvement of the general ocean circulation model for efficient use on massively parallel and heterogeneous computing systems

2017-2019 **Master degree in Applied Mathematics and Computer Science**, *Lomonosov Moscow State University*.
Thesis: Load balancing method using Hilbert space-filling curves for INMOM (Institute of Numerical Mathematics Ocean Model)

2013-2017 **Bachelor degree in Applied Mathematics and Computer Science**, *Lomonosov Moscow State University*.
Thesis: Implementation of parallel INMOM (Institute of Numerical Mathematics Ocean Model) ocean circulation model

Research Experience

2015-present **Multi-scale mathematical modeling of the atmosphere and ocean**.
INMOM - general ocean circulation model which has been used as the oceanic block of the climate model INMCM. This coupled model is representative at various stages of the international project for comparing climate models CMIP, conducted under the auspices of IPCC.
- Developed the software architecture that allows flexibly configuring the ocean model for various computing systems without changing physics-related parts of the program.
- Implemented various hybrid parallel programming patterns (MPI + OpenMP + CUDA) demonstrating close to linear performance scaling on modern supercomputers
- Developed load-balancing methods increasing twice the performance
- Worked closely with geophysicists and other specialists on a new ocean model kernel

Programming Skills

Programming Languages	C++ (98/11/17), C, Fortran, Python, Wolfram Mathematica
Development tools	git, bash, gdb, ssh, sanitizers (asan, tsan), valgring, Qt Creator, Visual Studio, vim, ect.
Build systems	CMake, Ninja, Jenkins
Parallel Computing	Threads, MPI, OpenMP, CUDA, Slurm, TAU Performance System
Libraries	STL, Qt, PETSc, Intel MKL (Lapack, BLAS), GSL, OpenFoam, OpenGL, OpenSceneGraph, etc.
General	LaTeX, OOP, test driven development, agile methodology, etc.

Languages

Russian	Native
English	Upper-Intermediate

Publications

- Chaplygin, A. V., Gusev, A. V., Diansky, N. A. High-performance Shallow Water Model for Use on Massively Parallel and Heterogeneous Computing Systems. Supercomputing Frontiers and Innovations, 8(4), 2022
- Fomin, V. V., Panasenkova, I. I., Gusev A. V., Chaplygin, A. V., Diansky, N. A. Operational forecasting system for Arctic Ocean using the Russian marine circulation model INMOM-Arctic. Arctic: Ecology and Economy, vol. 11, no. 2, 2021
- Chaplygin, A.V., Gusev, A.V. Shallow Water Model Using a Hybrid MPI/OpenMP Parallel Programming. Problems of Informatics 1, 2021
- Maxim Chertov, Andrey Chaplygin. Evaluating characteristics of high-rate hydraulic fractures driven by wellbore energy source. Engineering Fracture Mechanics, Volume 222, 2019
- Chaplygin A.V., Diansky N.A., and Gusev A.V. Load balancing using Hilbert space-filling curves for parallel shallow water simulations. Numerical methods and programming. Vol. 20, 2019
- Diansky N.A, Fomin V.V., Grigoriev A.V., Chaplygin A.V., Zatsepin A.G. Spatial-Temporal Variability of Inertial Currents in the Eastern Part of the Black Sea in a Storm Period. Physical Oceanography. Vol. 26, Iss. 2, 2019

Presentations

- Shallow water model using a hybrid MPI/OpenMP parallel programming. Mathematical modeling and supercomputer technologies, Nizhny Novgorod, Russia, 2020
- A full free surface ocean general circulation model in sigma-coordinates for simulation of the World Ocean circulation and its variability. EGU General Assembly, Vienna, Austria, 2019
- Parallel modeling of nonlinear shallow water equations. 60th MIPT Scientific Conference, Moscow, Russia, 2017
- Calculation of extreme surge in the Taganrog Bay and the use of atmospheric and ocean circulation models of different spatial resolution. International Scientific Conference Marine Research and Education, Moscow, Russia, 2017

Activities

- Rome-Moscow school of Matrix Methods and Applied Linear Algebra 2018 (participation)
- Rome-Moscow school of Matrix Methods and Applied Linear Algebra 2016 (participation)

Links

https://github.com/Andrcraft9

https://www.linkedin.com/in/andrey-chaplygin-1917a4193

https://www.researchgate.net/profile/Andrey-Chaplygin