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 team of 15 people, participated in code reviewing and team leading
- Developed numerical methods for fully implicit reservoir simulation and surface network modeling
- Implemented various graph algorithms for surface network modeling
- Participated in development of solver for Sequential Quadratic Programming optimization problem
- Worked with large code base, optimized critical code sections

2016-2019 **R&D intern**, *Schlumberger*.
- Simulated multiphase flow using OpenFoam and fast extension hydraulic fractures
- Developed the simulator FastRadialHF for the initiation and propagation hydraulic fractures
- Implemented an efficient nonlinear solver for the fully coupled multiphysics matrix
- 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 separating the physics-related code from features of parallel implementation
- Implemented various hybrid parallel programming patterns using MPI, OpenMP, CUDA
- Developed parallel algorithms for the ocean model
- Evaluated scaling performances on modern supercomputers
- Literature review of climate change problems

Programming Skills

Programming Languages	C++ (98/11/17), C, Fortran, Python, Wolfram Mathematica	Parallel Computing	Threads, MPI, OpenMP, CUDA
Development tools	git, bash, gdb, valgring, vim, VS, ect.	Build systems	CMake, Ninja, Jenkins
Computer Graphics	OpenSceneGraph, OpenGL, GSL	Libraries	STL, Qt, PETSc, OpenFoam, Lapack, BLAS, etc.
General	LaTeX, OOP, test driven development, agile methodology, etc.		

Languages

Russian	Fluent
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