Mohammad Zandsalimy | PhD

Computational Scientist

The University of British Columbia, Vancouver, BC

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Introduction

Computational Scientist with Ph.D. in Mechanical Engineering and 10+ years of programming experience in C++, Python, and MATLAB. Proficient in computational methods in data science, optimization applications, and applied mathematics.

Experience

The University of British Columbia — *Vancouver, BC*

Research Assistant — *Sep 2019 – Present*

- Developed object-oriented software for stability analysis and improvement of different computational methods using C++, Python, and Jenkins.
- Created a framework for eigenanalysis of the solution Jacobian and mesh optimization using PETSc and SLEPc, enabling current solvers to achieve stable and more reliable results.

Teaching Assistant — *Sep 2019 – Present*

- Conducted tutorials, designed and graded assignments, and provided laboratory guidance for courses including Aerodynamics of Aircraft and Fluid Dynamics.

Sharif University of Technology — *Tehran, Iran*

Research Assistant — *Sep 2014 – Aug 2016*

- Implemented reconfigurable hardware programming using C++ and Vivado Design Suite for hardware design and acceleration of computational problems.

Teaching Assistant — *Sep 2014 – Aug 2016*

- Conducted tutorials, designed and graded assignments, and provided laboratory guidance for courses including Computer Programming, Computational Fluid Dynamics, Computer Aided Design, and Seminar.

Khajeh Nasir Toosi University of Technology — *Tehran, Iran*

Research Assistant — *Sep 2013 – Aug 2014*

- Developed MATLAB software for computational speed-up of fluid and heat transfer simulation.

Skills

Languages *C++*, *Python*, *MATLAB*/*Octave*

Tools *Scikit-learn*, *pandas*, *Surprise*, *lifelines*, *SHAP*, *ELI5*, *spaCy*, *XGBoost*, *LightGBM*, *PETSc/Tao*, *SLEPc*, *Linux*, *Git*, *Autotools*, *LaTeX*, *Project Jupyter*

Softwares *Tecplot*, *ParaView*, *SolidWorks*, *Maple*, *ANSYS Fluent*, *Adobe Photoshop*

Research Interests

- Development of novel, efficient and reliable methods in scientific computing
- Data mining and pattern recognition
- Recommendation systems and behavioral modeling
- Deep learning applications

Certificates

- Applied Machine Learning - CPSC 330 ..... The University of British Columbia
- Machine Learning - Stanford University ..... Coursera
- Introduction to Machine Learning ..... Kaggle

Education

The University of British Columbia *Vancouver, BC*
Doctor of Philosophy (Ph.D.) in Mechanical Engineering, GPA: 4.0/4.0 *Sep 2019 – Present*
- **Thesis**: Stability Analysis and Improvement of Finite Volume Methods
- **Supervisor**: Prof. Carl Ollivier-Gooch

Sharif University of Technology *Tehran, Iran*
Master of Science (M.Sc.) in Aerodynamics, GPA: 4.0/4.0 *Sep 2014 – Aug 2016*
- **Thesis**: Accelerating the Numerical Solution of Fluid Flows Using FPGA Hardware
- **Supervisor**: Dr. Abbas Ebrahimi

Khajeh Nasir Toosi University of Technology *Tehran, Iran*
Bachelor of Science (B.Sc.) in Aerospace Engineering, GPA: 3.9/4.0 *Sep 2010 – Aug 2014*
- **Thesis**: The Simulation of Fluid Flow and Heat Transfer Using a Network Method
- **Supervisor**: Dr. Reza Ebrahimi

Selected Publications

- **M. Zandsalimy** and C. Ollivier-Gooch, A Novel Approach of Mesh Optimization to Stabilize Unstructured Finite Volume Simulations, Journal of Computational Physics 453 (2022) 110959, doi: https://doi.org/10.1016/j.jcp.2022.110959.
- A. Ebrahimi and **M. Zandsalimy**, Modeling and Simulation Speed-Up of Plasma Actuators Implementing Reconfigurable Hardware, AIAA Journal 56 (8) (2018) 3035-3046, doi: https://doi.org/10.2514/1.J056382.
- A. Ebrahimi and **M. Zandsalimy**, A new approach for the speed up of numerical solution of steady and unsteady flows using FPGA hardware, Sharif Mechanical Engineering 34 (3) (2018) 97-104, doi: https://doi.org/10.24200/J40.2018.6391.
- A. Ebrahimi and **M. Zandsalimy**, Evaluation of FPGA hardware as a new approach for accelerating the numerical solution of CFD problems, IEEE Access 5 (2017) 9717-9727, doi: https://doi.org/10.1109/ACCESS.2017.2705434.
- A. Ebrahimi and **M. Zandsalimy**, Evaluation of FPGA hardware as a new approach for accelerating the numerical solution of the Laplace problem, Modares Mechanical Engineering 17 (1) (2017) 67-74.

Honors and Awards

- President's Academic Excellence Initiative PhD Award, UBC ..... May 2020 & 2021
- Jaya-Jayant Prize in Mechanical Engineering, UBC ..... Nov 2020

- Department Scholar Award in Mechanical Engineering, UBC ..... Oct 2019
- The 4 Year Fellowship Award, UBC ..... Sep 2019
- Faculty of Applied Science Graduate Award, UBC ..... Sep 2019
- International Tuition Award, UBC ..... Sep 2019
- The German Academic Exchange Service (DAAD) scholarship ..... Apr 2019
- Iranian National Elites Foundation Scholarship Award ..... Feb 2018 & 2019
- Top National Thesis Award, SUT ..... Feb 2017

Language Skills

- English ..... TOEFL score 107
- Kurdish ..... Native
- Persian ..... Native

Course Development

Scientific Writing

Graduate course, Sharif University of Technology *Sep 2017*

- This course teaches students to become more effective writers. Participants are trained on principles of effective writing, formatting and presentation, peer review, grant writing, ethical issues in scientific publication, and writing for general audiences.
- I was leading the team designing and teaching this graduate-level course.

Presentations

21st Annual International Conference on Mechanical Engineering *Tehran, Iran*

A Novel Urban Waste Management Device *Apr 2013*

Theses

Accelerating the Numerical Solution of Fluid Flow Using FPGA Hardware

Master's Thesis, Sharif University of Technology *Aug 2016*

- The main goal of the present study is to investigate the feasibility of using FPGA (Field Programmable Gate Arrays) to accelerate the solution to fluid dynamics problems. The internal architecture of an FPGA can be reprogrammed and reconfigured after manufacturing. As a result, it is possible to design and implement complex circuits for different applications on such hardware. In the present study, the structure and configuration methods of an FPGA is presented. Then, various computational fluid dynamics (CFD) problems such as the unsteady 1D Couette problem, 2D potential flow (Laplace equation), incompressible viscous fluid flow, and compressible inviscid flow are implemented and solved numerically. The computational time and accuracy of the computations are compared to the results from a microprocessor. The results show that the computations on FPGA are up to 20 times faster than a conventional CPU, with the same data precision. Several numerical and analytical solutions are used to validate the results.

The Simulation of Fluid Flow and Heat Transfer Using a Network Method

Bachelor's Thesis, Khajeh Nasir Toosi University of Technology *Aug 2014*

- The 3D simulation of fluid flow and heat transfer in a combustion chamber is highly time consuming. A 1D flow analyzer is used to compute the flow parameters at any given point inside the Allison T56 engine combustion chamber. The main goal is to reduce the solution time and memory requirements of the problem. The input to the 1D solver is a network of the flow inside the combustion chamber. Empirical and analytical correlations in mass and heat transfer are used for the design of the network. The geometry of the combustion chamber and the types of holes and film cooling devices used in this geometry are important parameters for the study. The results are validated with experimental data and CFD results.