

# Majid Rasouli

## PERSONAL DATA

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## EDUCATION

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*2015 - Jan 2021*: PhD Candidate in **Computer Science**, University of Utah, GPA: 3.90/4  
*2011 - 2013*: Masters in **Mathematics**, Sharif University, GPA: 16.31/20  
*2006 - 2011*: Bachelors in **Mathematics**, Amirkabir University, GPA: 15.03/20  
Was awarded certificate for graduating among **top 3** GPAs in my class

## TECHNICAL SKILLS

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*Main*: **C++ (5 years' experience)**, git, Linux, CMake, L<sup>A</sup>T<sub>E</sub>X, Distributed and Parallel Programming (MPI (cluster), OpenMP (multithread, GPU)), Object-Oriented Programming (OOP), Data Structure and Algorithm  
*Prototyping*: Julia, MATLAB  
*Visualization*: Paraview, Javascript, CSS, D3  
*Familiar*: Python, GPU Programming, Machine Learning (ML), Deep Learning (DL), R Studio, Shell Scripting (Bash), Slurm, Software Design  
*Personal*: Problem-Solver, Good Written and Oral Communication, Great at Teamwork

## EXPERIENCE

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*2020 - Present*: **Contributor** for [Nektar++](#) (Spectral/HP Element Framework)  
Implementing a new solver in Nektar++ which can outperform the current solvers in the library when solving a range of challenging projects.

*2016 - Present*: **Software Developer**: I have been developing a Math library, more specifically a linear system solver, in C++ parallelized with MPI and OpenMP. I have implemented low-level optimizations on kernel linear algebra operations. Also, I have devised and implemented multiple highly scalable parallel algorithms. My responsibilities for this role: programming (C++, MATLAB), version control (git), profiling (Intel's VTune, Advisor, Inspector), testing (Google Test) and documentation (Doxygen).

*2015 - Present*: **Research Assistant** in [Dr. Hari Sundar's](#) research team. The research areas include scientific computing and high performance computing (HPC).

## SELECTED COURSES

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### Undergraduate:

Basic Programming, Advanced Programming, Linear Algebra, Numerical Linear Algebra, Logic, Probability and Stat 1 & 2, Numerical Analysis

### Graduate:

Big Data Computer Systems, Parallel Computing HPC, Advanced Scientific Computing 1 & 2, Advanced Algorithms, Algorithms and Approximation, Inverse Problems, Visualization

### Coursera (Online):

Deep Learning (DL)

## RESEARCH AND PROJECTS

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### **Saena (Jan 2016 - Present; Developer and First Author; Paper in Progress)**

Saena is a highly scalable linear system solver (based on algebraic multigrid) written in C++. It is parallelized with MPI and OpenMP. It outperforms other state-of-the-art linear algebra libraries performing different linear algebra operations in many cases.

### **Matrix-Vector Product Optimizations (First Author)**

Matrix-vector product is the dominant operation in algebraic multigrid. We have presented four different ideas to improve matrix-vector product in both shared memory (OpenMP) and distributed memory (MPI) approaches. It is implemented in Saena (C++). The paper is published in *IEEE HPEC18: Improving Performance and Scalability of Algebraic Multigrid through a Specialized MATVEC*.

### **A Compressed, Divide and Conquer Algorithm for Scalable Distributed Matrix-Matrix Multiplication (First Author)**

Matrix-matrix product is a fundamental operation in many applications, and in general in scientific computing. We have implemented a recursive matrix-matrix product. We keep splitting the matrices until reaching a threshold, then we perform a combination of dense and sparse matrix multiplication to speedup the process. We have implemented it in Saena (C++, MPI, OpenMP). The paper is accepted in *HPC ASIA 2021*.

### **Scalable Lazy-update Multigrid Preconditioners (First Author)**

Algebraic multigrid is especially attractive due to its black-box nature. This however comes at the cost of increased setup costs that can be significant in case of systems where the system matrix changes frequently making it difficult to amortize the setup cost. In this work, we investigate several strategies for performing lazy updates to the multigrid hierarchy corresponding to changes in the system matrix. The paper is published in *IEEE HPEC19: Scalable Lazy-update Multigrid Preconditioners*.

### **USA Demographic Analysis**

We have implemented an interactive map of USA, using Javascript, CSS and D3.

<https://majidrp.github.io/DemographicAnalysis/>

## HONORS

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- Ranked in **Top 1 Percent** in The National University Entrance Exam for Masters Degree, 2011, Iran.
- Scholarship for International HPC Summer School 2017, University of Colorado, Boulder
- Scholarship for SDSC Summer Institute 2018, San Diego Supercomputer Center, UCSD
- Certificate for Graduating as One of Top 3 GPAs in My Class, Bachelors in Mathematics

## WORKSHOPS

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### **International HPC Summer School 2017, University of Colorado-Boulder**

Attendee of multiple workshops including:

Scientific Visualization with Paraview, Performance Analysis And Optimization (Tau),

Workflow Tools, Hybrid Programming: MPI+OpenMP, Spark

<https://confluence.xsede.org/display/IH17/International+HPC+Summer+School+2017>

### **SDSC Summer Institute 2018, San Diego Supercomputer Center (SDSC)**

Attendee of multiple workshops including: Advanced git, GPU Computing and Programming, Performance Tuning, Information Visualization, Globus

<https://si18.sdsc.edu>