

Majid Rasouli

Curriculum Vitae

PERSONAL DATA

FULL FIRST NAME: Seyed Majid
FULL LAST NAME: Rasouli Pichahi
DATE OF BIRTH: 1988
EMAIL: maj.rasouli@gmail.com
HOMEPAGE: <https://www.cs.utah.edu/~rasouli/>

EDUCATION

2015 - PRESENT PhD Candidate in **Computer Science**, University of Utah
Advisor: [Dr. Hari Sundar](#), 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

Main: **C++ (5 years experience)**, git, Linux, L^AT_EX, CMake
Parallel Programming (MPI (cluster), OpenMP (multithread, GPU))
Prototyping: Julia, MATLAB
Visualization: Paraview, Javascript, CSS, D3
Familiar: Python, GPU Programming, Machine Learning, R Studio, Bash, Slurm

EXPERIENCE

2020 – Present: **Developer** of [Nektar++](#) (Spectral/HP Element Framework)
My responsibility is to implement an algebraic multigrid 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 Saena, 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. Some of the achievements are explained in the Projects section.
My responsibilities for this role: programming (C++, MATLAB), profiling (Intel tools: VTune, Advisor, Inspector), testing (Google Test), version control (git) 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

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

RESEARCH AND PROJECTS

Matrix-Vector Product Optimization (Published; 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 Divide and Conquer Distributed Matrix-Matrix Multiplication (First Author)

Matrix-matrix product is a fundamental operation in the setup phase of algebraic multigrid, 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) and it is at its final stage.

Scalable Lazy-update Multigrid Preconditioners (Published; 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](#).

Randomized Sparsification for Algebraic Multigrid (Middle Stage; First Author)

Algebraic Multigrid's scalability and performance suffers from loss of sparsity in coarser levels of multigrid due to filling-in. We use randomized sparsification to increase sparsity of coarse matrices at different levels of the Multigrid hierarchy, but still keeping the important information of the matrices. The randomness feature of our method guarantees the whole range of information from the matrix being preserved.

USA Demographic Analysis

We have implemented an interactive map of USA, using Javascript, CSS and D3.
<https://majidrp.github.io/DemographicAnalysis/>

HONORS

- 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

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>