

Dhairya Malhotra

CONTACT INFORMATION

Tel: (512) 577-2680

E-mail: contact@dhairyamalhotra.com

Website: <https://cims.nyu.edu/~malhotra>

RESEARCH INTERESTS

- **Parallel and distributed computing:** parallel algorithms, high performance computing, performance optimization, OpenMP, MPI, CUDA, Intel Xeon Phi co-processor.
- **Scientific computing:** integral and differential equations, elliptic partial differential equations, boundary and volume integral equations, advection-diffusion equation, octrees, high-order methods, fast algorithms, Fast Multipole Method, Fast Fourier Transform.
- **Applications:** N-body problems, electrostatics, electromagnetic and acoustic scattering, incompressible Stokes equations, porous media flow, complex fluids, blood flow.

EDUCATION

University of Texas at Austin, Austin, Texas USA

- *Ph.D. in Computational and Applied Mathematics* **December 2017**
Fast integral equation solver for variable coefficient elliptic PDEs in complex geometries
Thesis advisor: George Biros
- *M.S. in Computational and Applied Mathematics* **Dec 2014**

Indian Institute of Technology Delhi, New Delhi, India

- *Integrated M.Tech. in Mathematics and Computing* **July 2011**

RESEARCH EXPERIENCE

University of Texas at Austin, Austin, Texas USA

- *Graduate Research Assistant, Advisor: Prof. George Biros* **Sep 2011 – Dec 2017**
Developed a highly optimized, parallel FMM library for evaluating volume potentials and applied it to solve variable coefficient elliptic BVP. Developed parallel algorithms for efficient simulation of concentrated vesicle suspensions.

Georgia Institute of Technology, Atlanta, Georgia USA

- *Student Summer Intern, Advisor: Prof. George Biros* **Summer 2010**
- *Student Summer Intern, Advisor: Prof. George Biros* **Summer 2009**

Risoe National Laboratory, Denmark

- *Student Summer Intern, Advisor: Dr. Andreas Alpers* **Summer 2008**

AWARDS AND HONORS

- ACM/IEEE-CS George Michael Memorial HPC Fellowship 2015
- NIMS Graduate Research Fellowship (academic year 2014-2015)
- Third place at TACC-BP Parallel Programming Contest (2014)
- Bronze medal at ACM Student Research Competition. (ACM/IEEE Supercomputing, 2013)
- Association for Computing Machinery, Gordon Bell Prize (2010)

SOFTWARE

- **PVFMM** Parallel fast multipole method for particle and volume potentials
- **TbSLAS** Tree-based Semi-Lagrangian Advection-Diffusion Solver
- **HykSort** New variant of hypercube quicksort on distributed memory architectures
- **AccFFT** GPU accelerated parallel FFT library

PUBLICATIONS

- *Dhairya Malhotra*, Abtin Rahimian, Denis Zorin, George Biros. A parallel algorithm for long time-scale simulation of concentrated vesicle suspensions in three dimensions. ([preprint](#))
- Amir Gholami, Judith Hill, *Dhairya Malhotra*, George Biros. AccFFT: A library for distributed-memory FFT on CPU and GPU architectures, [arXiv:1506.07933](#). ([preprint](#))
- Arash Bakhtiari, *Dhairya Malhotra*, Amir Raoofy, Miriam Mehl, Hans-Joachim Bungartz, George Biros. [A Parallel Arbitrary-Order Accurate AMR Algorithm for the Scalar Advection-Diffusion Equation](#), Proc. ACM/IEEE Supercomputing, Salt Lake City, UT. 2016.
- *Dhairya Malhotra*, George Biros. Algorithm 967: A Distributed-Memory Fast Multipole Method for Volume Potentials, ACM Transactions on Mathematical Software (TOMS), 2016. [DOI:10.1145/2898349](#)
- Amir Gholami, *Dhairya Malhotra*, Hari Sundar, George Biros. FFT, FMM, or Multigrid? A comparative Study of State-Of-the-Art Poisson Solvers for Uniform and Nonuniform Grids in the Unit Cube, SIAM Journal on Scientific Computing, 2016. [DOI:10.1137/15M1010798](#)
- *Dhairya Malhotra*, George Biros. PVFMM: A parallel kernel independent FMM for particle and volume potentials, Communications in Computational Physics, 2015. [DOI:10.4208/CICP.020215.150515SW](#)
- Ahmed Khawaja, Jiajun Wang, *Dhairya Malhotra*, Andreas Gerstlauer, George Biros and Lizy John. Performance Analysis of HPC Applications with Irregular Tree Data Structures Proc. IEEE International Conference on Parallel and Distributed Systems, Hsinchu, Taiwan. 2014. [DOI:10.1109/PADSW.2014.7097837](#)
- *Dhairya Malhotra*, Amir Gholami, George Biros. A Volume Integral Equation Stokes Solver for Problems with Variable Coefficients, Proc. ACM/IEEE Supercomputing, New Orleans, LA. 2014. [DOI:10.1109/SC.2014.13](#) (**Finalist for Best Student Paper**)
- Hari Sundar, *Dhairya Malhotra*, Karl W. Schulz. Algorithms for High-Throughput Disk-to-Disk Sorting, Proc. ACM/IEEE Supercomputing, Denver, CO. 2013. [DOI:10.1145/2503210.2503259](#)
- Hari Sundar, *Dhairya Malhotra*, George Biros. HykSort: a new variant of hypercube quicksort on distributed memory architectures, Proc. 27th International Conference on Supercomputing, Eugene, OR. 2013. [DOI:10.1145/2464996.2465442](#)
- Abtin Rahimian, Ilya Lashuk, Aparna Chandramowlishwaran, *Dhairya Malhotra*, Logan Moon, Rahul Sampath, Aashay Shringarpure, Shravan Veerapaneni, Jeffrey Vetter, Richard Vuduc, Denis Zorin, and George Biros. Petascale direct numerical simulation of blood flow on 200k cores and heterogeneous architectures, Proc. ACM/IEEE Conf. Supercomputing (SC), New Orleans, LA. 2010. [DOI:10.1109/SC.2010.42](#) (**Winner, Gordon Bell Prize**)

PRESENTATIONS

- “Parallel Simulation of Concentrated Vesicle Suspensions in 3D”. BIRS-CMO Workshop on Complex Creeping Fluids: Numerical Methods and Theory, October 2017.

- “Fast Integral Equation Solver for Elliptic PDEs in Complex Geometries”. SIAM CSE, February 2017.
- “A Parallel Arbitrary-Order Accurate AMR Algorithm for the Scalar Advection-Diffusion Equation”. ACM/IEEE Supercomputing, November 2016.
- “Fast Solvers for Complex Fluids”. SIAM Parallel Processing for Scientific Computing, April 2016.
- “A Volume Integral Equation Solver for Elliptic PDEs in Complex Geometries”. SIAM Conference on Parallel Processing for Scientific Computing, April 2016.
- “PVFMM: A Parallel Fast Multipole Method for Volume Potentials”. SIAM CSE, March 2015.
- “A Parallel Volume Integral Equation Stokes Solver for Flows in Complex Geometries”. SIAM CSE, March 2015. (**Finalist for BGCE Best Student Paper**)
- “A Volume Integral Equation Stokes Solver for Problems with Variable Coefficients”. ACM/IEEE Supercomputing, 2014. (**Finalist for Best Student Paper**)
- “A Volume Integral Equation Solver for Boundary Value Problems with Highly Heterogeneous Coefficients”. SIAM Conference on Parallel Processing for Scientific Computing, February 2014.
- “A Petascale Fast Multipole Method for Volume Potentials”. SIAM Annual Meeting, July 2013.
- “A Parallel Fast Summation Algorithm for Volume Potentials”. SIAM CSE, February 2013.

POSTER PRESENTATIONS

- “A Distributed-Memory Fast Multipole Method for Volume Potentials”. ACM/IEEE Supercomputing, 2013. (**Bronze Award, ACM Student Research Competition**)
- “A Massively Parallel Adaptive Fast Multipole Method for Volume Potentials”. SIAM Annual Meeting, 2012.