

NOUR GHASSAN AL HASSANIEH

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EDUCATION

Rensselaer Polytechnic Institute, Troy NY, USA

May 20, 2023

PhD in Mathematics, GPA: 4.0

Notable courses: computational linear algebra, numerical solutions of PDEs, numerical methods of fluid and solid mechanics, perturbation methods, wave motion, finite element analysis.

American University of Beirut, Beirut Lebanon

May 27, 2016

MS in Mathematics, GPA: 3.89

Notable courses: measure theory, modules and rings, modular forms, algebraic topology, complex analysis.

Haigazian University, Beirut Lebanon

June 27, 2014

BS in Mathematics, GPA: 4.0

Received a full scholarship from the University Scholarship Program (USAID)

Notable courses: advanced computer programming and data structures, design and analysis of algorithms, numerical analysis, data base systems.

RESEARCH EXPERIENCE

Center of Computational Mathematics, Flatiron Institute

Sep 2023 - August 2026

Flatiron Research Fellow

New York NY, USA

- *Postdoctoral mentors:* Alex Barnett, Leslie Greengard
- Used integral equation and spectral methods to develop fast and accurate time-domain algorithms to solve wave equation problems in 1D, 2D, and 3D, for wave scattering applications.
- Applied algorithms to a million point sources in low-to-high frequency regimes.
- Demonstrated linear complexity of developed algorithms with respect to discrete points in space and time, in comparison to the quadratic complexity of direct implementations.
- Currently working on simulating surface acoustic waves (SAWs) in SAW devices using a finite-difference scheme coupled with a boundary integral elliptic solver.

Rensselaer Polytechnic Institute

Jan 2021 - May 2023

Research Assistant

Troy NY, USA

- *Research advisors:* Donald W. Schwendeman, William D. Henshaw, Jeffrey W. Banks
- Developed high-order accurate finite-difference schemes to solve second-order PDE initial-boundary-value problems (elliptic, parabolic, hyperbolic) on 1D, 2D, and 3D domains.
- Solved problems such as: the incompressible Navier Stokes equations on 2D Cartesian grids, conjugate heat transfer problems with solid-solid or solid-fluid interface, heat, wave, and Poisson equations on Cartesian and curvilinear 2D and 3D domains to high-order accuracy (orders 2, 4, 6, 8).
- Developed, implemented, and analyzed a high-order accurate finite difference numerical boundary conditions method (Local Compatibility Boundary Conditions (LCBC)) to support second-order PDE initial boundary value problems on Cartesian or curvilinear 2D and 3D domains.
- Incorporated the LCBC method in an object-oriented code framework (Overture framework) for solving PDEs on complex geometry using composite grids.
- Designed a hierarchical algorithm (FActored Modified Equation (FAME) scheme) to implement the Modified Equation scheme for the wave equation on composite grids to an arbitrary order of accuracy.
- Verified that FAME at least doubles the computational speed of standard Modified Equation algorithms.

TEACHING EXPERIENCE

New York University*Courant Instructor/Assistant Professor*

Sep 2023 - August 2025

New York NY, USA

- Taught Numerical Analysis for Fall 2023, Spring 2024, and Fall 2025 (35 students each) and Applied Complex Variables for Spring 2025 (60 students).
- Developed lesson plans, homework questions, quizzes and exams, and maintained a webpage for discussion and sharing course materials.
- Mentored two students in research projects on finite-difference methods for PDEs.

Rensselaer Polytechnic Institute*Teaching Assistant*

Sep 2018 - Dec 2020

Troy NY, USA

- Assisted Professors in the courses: linear algebra, introduction to ODEs, fundamentals of applied mathematics, numerical methods for ODEs, and PDEs in mathematical physics by holding office hours, problem solving sessions and grading.

American Creativity Academy*Mathematics Teacher*

Sep 2016 - June 2018

Hawally, Kuwait

- Taught 10th grade algebra 2 (~100 students, 4 sections, 2016-2017); Taught International Baccalaureate (IB) mathematics (standard and high levels), and trigonometry and analytic geometry for grades 11 and 12 (~96 students, 2017-2018).
- Instructed the elective classes: debate (2016-2017), business management, world issues and SAT prep (2017-2018).
- Developed lesson plans, projects, exams and homework assignments for each of the major and elective classes listed above; Tailored teaching methods and resources to support student progress.
- Participated in professional development conferences: “Moving from schooling to learning and responses to intervention” (Nov 20, 2016), “Strategies for improved classroom management” (March 9th, 2017), “Learning and working together - professional learning program” (March 18, 2017), “Expanding your toolbox” (13 hour workshop - December 2017) “Tribes TLC 24 hour basic course” (March 28, 2017).
- Certified Kaplan SAT instructor.

The American University of Beirut*Mathematics Graduate Assistant*

Sep 2014 - May 2016

Beirut, Lebanon

- Assisted in the courses calculus I, II, real analysis, complex analysis and measure theory by holding problem solving sessions and grading.
- Tutored students in undergraduate mathematics courses (calculus and linear algebra) as part of AUB’s “Math Clinic”.

ACHIEVEMENTS AND LEADERSHIP

Mini-symposium Co-organizer*ICOSAHOM2025 - Montreal*

July 2025

- On Recent advances in fast and accurate methods for wave problems, with Tristan Goodwill.

Recipient of the Joaquin B. Diaz Prize*Department of Mathematical Sciences - Rensselaer Polytechnic Institute*

May 2023

- Awarded to a graduate student who shows ability and enthusiasm for research in mathematics.
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Participant in Women at Rensselaer Mentor Program

Sep 2021

Rensselaer Polytechnic Institute

- Mentored three first-year undergraduate students by pointing them towards university resources, connecting them with key faculty members, and discussing emotional intelligence, early career preparation, self-awareness, stress management, time management and resilience.

Recipient of the Ralph Ernest Huston Prize

May 2020

Department of Mathematical Sciences - Rensselaer Polytechnic Institute

- Awarded to a first or second year graduate student who portrays exceptional ability as a teacher.

Participant in the University Scholarship Program's leadership activities

Sep 2011

USAID - Haigazian University

- Carried out a comprehensive feasibility study with a group of 9 people and designed a budget proposal and a business plan to potential investors.
- Tested the viability of the business plan through the implementation of a 3-month pilot project.
- Participated in a series of leadership, entrepreneurship lectures and training sessions at Haigazian University, Lebanon (2011-2012).
- Participated in a "Leadership through Social Entrepreneurship" two-day workshop delivered by Beyond Reform and Development as a first step towards the creation of a social project.
- Attended a series of lectures from prominent leaders including NGO founders, or key representatives on topics such as education inequality, refugees, and ethics of leadership.

Recipient of Youth Exchange and Study Scholarship (YES Program)

2009 - 2010

Amideast, Lebanon

- Completed my junior high school year in an American high school (Como Park Senior High School in St. Paul MN) where I served as a "youth ambassador" of my home country; Awarded "Certificate of Recognition for Exemplary Community Service" by Youth for Understanding USA.

RESEARCH PUBLICATIONS AND SOFTWARE IMPLEMENTATIONS

- N. G. Al Hassanieh, J. W. Banks, W. D. Henshaw, and D. W. Schwendeman. (2022). Local compatibility boundary conditions for high-order accurate finite-difference approximations of PDEs. *SIAM Journal on Scientific Computing*, 44(6), A3645-A3672. <https://doi.org/10.1137/21M1458454> (or *ArXiv*: 2111.02915v2, 58 pages).
- N. G. Al Hassanieh, A. H. Barnett, and L. Greengard. (2026). A fast algorithm for the wave equation using time-windowed Fourier projection. *Journal of Computational Physics*, 548, 114570. <https://doi.org/10.1016/j.jcp.2025.114570> (or *ArXiv*: 2507.07823.)
- N. G. Al Hassanieh, A. H. Barnett, L. Greengard, Truncated kernel windowed Fourier projection: a fast algorithm for the 3D free-space wave equation. *Preprint ArXiv*: 2511.20824. (in review, SINUM). <https://arxiv.org/abs/2511.20824>
- N. G. Al Hassanieh, A. H. Barnett, L. Greengard, Fast evaluation of 2D free-space hyperbolic potentials using windowed Fourier projection, Manuscript in preparation (2025).
- N. G. Al Hassanieh, A. H. Barnett, MATLAB implementation of windowed Fourier projection (2025). <https://github.com/nalhassanieh/windowedFourierProjection.git>
- N. G. Al Hassanieh, High-order accurate finite-difference methods for partial differential equations on complex geometry, Ph.D. thesis, Rensselaer Polytechnic Institute (2023). <https://hdl.handle.net/20.500.13015/6636>

CONFERENCE PRESENTATIONS

- Invited mini-symposium speaker at the Association of Women in Mathematics (AWM) Workshop on Numerical Analysis and Scientific Computing in conjunction with the 2026 SIAM Annual Meeting (Cleveland, OH - July 2026)
- Invited participant in the Women in Computational Methods for PDEs workshop at the Banff International Research Station for Mathematical Innovation and Discovery (BIRS) (Banff, Canada - March 2026)
- Invited speaker at the mini-symposium “Fast Algorithms for Modeling Waves in Complicated Media” at SIAM Conference on Computational Science and Engineering (CSE25) (Fort Worth, TX - March 2025)
- Poster presenter at the AWM Graduate Student Poster Session as part of AWM Workshop at SIAM Annual Meeting 2022 (Pittsburgh, PA - July 2022)
- Poster presenter at the 15th Symposium on Overset Composite Grids and Solution Technology (Suffolk, VA - Nov 2022)
- Invited participant in the Simons Collaboration on Wave Turbulence Annual Meeting (New York, NY - Dec 2022)

COMPUTER SKILLS

Java, C/C++, Fortran, Github, Matlab, Maple, GeoGebra.

LANGUAGES

Arabic (native language). English (fluent)