

# Steven Byram Roberts | Curriculum Vitae

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## Education

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### Virginia Tech

*Ph.D. candidate in Computer Science, 3.97 GPA*

*Fall 2016–Spring 2021*

Member of Computational Science Laboratory and advised by Dr. Adrian Sandu

### Virginia Tech

*B.S. in Computer Science and B.S. in Mathematics, 3.98 GPA*

*Fall 2012–Spring 2016*

Highest GPA in both graduating classes

## Skills and Qualifications

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**Programming Languages:** Proficient in MATLAB and Mathematica, experienced with C (including OpenMP and MPI), C++, Python, CUDA, C#, and Java

**Mathematics:** Strong background in linear algebra, numerical analysis, and differential equations

**Web Development:** Experienced in HTML, JavaScript, Node.js, CSS, and creating Chrome Extensions

**Databases:** Experienced with SQL databases and basic querying

## Work History

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### Virginia Tech Computational Science Laboratory

*Research Assistant*

*Spring 2015–present*

- Designing, analyzing, and testing new multirate time integrators for numerically solving multiscale differential equations
- Developing new implicit-explicit (IMEX) methods suitable for stiff problems and differential algebraic equations.
- Creating a new framework for multimethods based on partitioned general linear methods

### CS 4234/5234: Parallel Computation

*Graduate Teaching Assistant*

*Fall 2019–Spring 2020*

- Held weekly office hours to help students with assignments
- Taught ten of the classes on topics including OpenMP, parallel performance metrics, and GPU computing with CUDA

### Lawrence Livermore National Laboratory

*Intern*

*Summer 2019*

- Developed new implicit multirate Runge–Kutta methods for solving stiff, multiscale systems of ordinary differential equations
- Compared and implemented variants of multirate backward differentiation formula methods

### Lawrence Livermore National Laboratory

*Intern*

*Summer 2018*

- Implemented and optimized finite element operators for GPUs using CUDA
- Achieved 10 to 100 times speedup over other CPU and GPU implementations
- Contributed to the open-source project libCEED

### NASA Glenn Research Center

*Intern*

*Summer 2017*

- Created 1D hybrid direct kinetic simulation of a Hall thruster
- Developed software in C++ from the ground up
- Modeled time-dependent velocity distribution functions of various species in plasma
- Gained experience solving hyperbolic partial differential equations with the finite volume method and using visualization tools

### **Insurance Institute for Highway Safety (IIHS)**

*Intern*

*Summer 2013–2016*

- Worked on C# applications for managing vehicle records stored in SQL databases
- Redesigned and updated mobile website
- Set up an OAuth server
- Worked with several frontend web frameworks
- Gained firsthand experience in software development life cycle

### **Web Developer**

*Freelance*

*2015–present*

- Developing and maintaining the website for the Computational Science Laboratory
- Designed and created websites for two Virginia Tech Materials Science and Engineering professors' research groups
- Created four Chrome Extensions used by more than 60,000 users

## **Volunteer Work and Involvement**

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**Spring 2019–present:** Treasurer of Chess Club at Virginia Tech

**Fall 2017–Fall 2019:** Volunteer for Virginia Tech CSRC Career Fair

**2016:** Volunteer Math Tutor for Teacher Praxis Preparation

**2013–2015:** Galipatia Academic Committee Member

## **Recognitions and Accomplishments**

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**Fall 2018–Spring 2020:** Virginia Space Grant Consortium Graduate STEM Research Fellowship Recipient

**2017:** Recipient of Virginia Tech Davenport Fellowship for “research performance and promise”

**2016–present:** Member of Phi Beta Kappa Honor Society

**2016:** Winner of Virginia Tech David Heilman Memorial Award for Outstanding Undergraduate Research

**2016:** Winner of Virginia Tech Math Outstanding Senior, Applied Computational Option

**2016:** Pivot Point Hackathon - Third place

**2014–2016:** Winner of Virginia Tech CS Sophomore, Junior, and Senior Scholar Awards

**2012–2016:** Virginia Tech Dean's List with Distinction

## **Publications**

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- [1] Arash Sarshar, Steven Roberts, and Adrian Sandu. “Alternating directions implicit integration in a general linear method framework”. In: *Journal of Computational and Applied Mathematics* 387 (2021), p. 112619. DOI: 10.1016/j.cam.2019.112619.
- [2] Steven Roberts, Andrey A Popov, Arash Sarshar, and Adrian Sandu. “A fast time-stepping strategy for ODE systems equipped with a surrogate model”. In: *arXiv preprint arXiv:2011.03688* (submitted to *SIAM Journal on Scientific Computing* 2020).
- [3] Steven Roberts, John Loffeld, Arash Sarshar, Carol S Woodward, and Adrian Sandu. “Implicit multirate GARK methods”. In: *arXiv preprint arXiv:1910.14079* (accepted in *Journal of Scientific Computing* 2020).

- [4] Adrian Sandu, Michael Günther, and Steven Roberts. “Linearly implicit GARK schemes”. In: *Applied Numerical Mathematics* 161 (2020), pp. 286–310. DOI: 10.1016/j.apnum.2020.11.014.
- [5] Steven Roberts, Arash Sarshar, and Adrian Sandu. “Parallel Implicit-Explicit General Linear Methods”. In: *Communications on Applied Mathematics and Computation* (2020). DOI: 10.1007/s42967-020-00083-5.
- [6] Steven Roberts, Arash Sarshar, and Adrian Sandu. “Coupled Multirate Infinitesimal GARK Schemes for Stiff Systems with Multiple Time Scales”. In: *SIAM Journal on Scientific Computing* 42.3 (2020), A1609–A1638. DOI: 10.1137/19M1266952.
- [7] Arash Sarshar, Steven Roberts, and Adrian Sandu. “Design of High-Order Decoupled Multirate GARK Schemes”. In: *SIAM Journal on Scientific Computing* 41.2 (2019), A816–A847. DOI: 10.1137/18M1182875.

## Presentations

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<b>Sayas Numerics Seminar</b>	<b>Online</b>
<i>Parallel implicit-explicit general linear methods</i>	<i>October 20, 2020</i>
Steven Roberts, Arash Sarshar, and Adrian Sandu	
<b>International Conference on Scientific Computation and Diff Eqs</b>	<b>Innsbruck, Austria</b>
<i>Implicit Multirate GARK Methods</i>	<i>July 23, 2019</i>
Steven Roberts, John Loffeld, Arash Sarshar, Adrian Sandu, and Carol Woodward	
<b>Virginia Space Grant Consortium Student Research Conference</b>	<b>Hampton, VA</b>
<i>Practical Multirate Time Integration Methods</i>	<i>April 8, 2019</i>
Steven Roberts and Adrian Sandu	
<b>SIAM Conference on Computational Science and Engineering</b>	<b>Spokane, WA</b>
<i>Implicit Multirate Generalized Additive Runge–Kutta Methods</i>	<i>March 1, 2019</i>
Steven Roberts, John Loffeld, Arash Sarshar, Adrian Sandu, and Carol Woodward	

## Software

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<b>ODE Test Problems</b>	<b>0.0.1</b>
<i>A MATLAB suite of initial value problems</i>	
Steven Roberts, Andrey Popov, and Adrian Sandu	
<a href="https://github.com/ComputationalScienceLaboratory/ODE-Test-Problems">https://github.com/ComputationalScienceLaboratory/ODE-Test-Problems</a>	