

SIGAL GOTTLIEB

MATHEMATICS DEPARTMENT  
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**Current Research Interests**

- Strong stability preserving high order time discretizations.
- Numerical methods for solution of hyperbolic PDEs and, in general, convection dominated problems, using finite difference WENO methods.
- Spectral methods and discontinuous Galerkin methods for time-dependent problems.
- Post-processing to recover order of accuracy lost in finite difference shock-wave computations.

**Professional Preparation**

Brown University Providence, RI	Applied Mathematics	Sc.B. 1993 Sc.M. 1995 Ph.D. 1998	Magna Cum Laude with Honors in Applied Math
Brown University Providence, RI	Applied Mathematics	Visiting Postdoctoral Research Associate June 1998- August 2002	

**Appointments**

9/1/2004 - Present	Associate Professor	Department of Mathematics University of Massachusetts Dartmouth North Dartmouth, Massachusetts
9/1/1999 8/31/2004	- Assistant Professor	Department of Mathematics University of Massachusetts Dartmouth North Dartmouth, Massachusetts
8/1/2005 - Present	Visiting Associate Professor (Courtesy position)	Division of Applied Mathematics Brown University, Providence, RI
9/1/2002 7/31/2005	- Visiting Assistant Professor (Courtesy position)	Division of Applied Mathematics Brown University, Providence, RI

## Peer Reviewed Journal Publications

- J.-H. Jung and S. Gottlieb, "On the Numerical Implementation of spectral Galerkin Penalty Methods." Submitted to *Communications in Computational Physics*
- D. Ketcheson, C. Macdonald, and S. Gottlieb, "Optimal implicit strong stability preserving Runge-Kutta methods." Submitted to *Applied Numerical Mathematics*
- C. Macdonald, S. Gottlieb, and S. J. Ruuth, "A numerical study of diagonally split Runge-Kutta methods for PDEs with discontinuities." Submitted to *Journal of Scientific Computing*
- R. Archibald, A. Gelb, S. Gottlieb and J. Ryan, "One-sided post-processing for the Discontinuous Galerkin Method Using ENO-type stencil choice and the Edge Detection Method." *Journal of Scientific Computing* **vol. 28** (2006), pp.167-190
- S. Gottlieb, D. Gottlieb and C.-W. Shu, "Recovering High Order Accuracy in WENO Computations of Steady State Hyperbolic Systems" *Journal of Scientific Computing* **vol. 28** (2006), pp.307-318.
- S. Gottlieb and S. J. Ruuth, "Optimal strong-stability-preserving time-stepping schemes with fast downwind spatial discretizations." *Journal of Scientific Computing* **vol. 27** (2006), pp. 289-304.
- S. Gottlieb, J. S. Mullen and S. J. Ruuth, "A fifth order flux-implicit WENO method." *Journal of Scientific Computing* **vol. 27** (2006), pp. 271-288.
- S. Gottlieb, "On High Order Strong Stability Preserving Runge-Kutta and Multi-Step Time Discretizations." *Journal of Scientific Computing* **vol. 25** (2005), pp. 105-128
- D. Gottlieb and S. Gottlieb, "Spectral Methods for Compressible Reactive Flows" *Comptes Rendus Mecanique* **333** (2005), pp. 3-16.
- D. Gottlieb and S. Gottlieb, "Spectral Methods for Discontinuous Problems." *Proceedings 20th biennial Conference on Numerical Analysis*, D.F. Griffiths and G. A. Watson, editors. University of Dundee Numerical Analysis Report NA/217 (2003)
- S. Gottlieb and L.-A. J. Gottlieb, "Strong Stability Preserving Properties of RungeKutta Time Discretization Methods for Linear Constant Coefficient Operators" *Journal of Scientific Computing* **18 (1)** (2003), pp. 89-109.
- S. Gottlieb, C.W. Shu and E. Tadmor, "Strong Stability Preserving High Order Time Discretization Methods." *SIAM review* **vol. 43 no. 1** (2001), pp. 89-112
- P.F. Fischer and S. Gottlieb, "Solving  $Ax = b$  using a modified conjugate gradient method based on the roots of  $A$ ." *Journal of Scientific Computing* **vol. 15 no. 4** (2000), pp.441-456.
- S. Gottlieb and C.W. Shu, "Total Variation Diminishing Runge-Kutta Schemes." *Mathematics of Computation* **vol. 67** (1998), pp.73-85.
- P. F. Fischer and S. Gottlieb "A Modified Conjugate Gradient Method for the Solution of  $A\underline{x} = \underline{b}$ ." *Journal of Scientific Computing* **vol. 13 no. 2** (1998), pp.173-183.

C.R. Johnson, I.M. Spitkovsky and S. Gottlieb “Inequalities Involving the Numerical Radius.” *Linear and Multilinear Algebra* **vol. 37** (1994), pp.13-24.

## Books

Jan S. Hesthaven, Sigal Gottlieb, David Gottlieb *Spectral Methods for Time Dependent Problems*. Cambridge Monographs on Applied and Computational Mathematics (No. 21) Cambridge University Press (2006). ISBN 0521792118

## Book Chapters

A. Gelb and S. Gottlieb, “The Resolution of the Gibbs Phenomenon for Fourier Spectral Methods.” Chapter 7 in *Advances in The Gibbs Phenomenon with Detailed Introduction*, Abdul J. Jerri, Editor,  $\Sigma$  Sampling Publishing, Potsdam, New York (2007), ISBN 0967301-0-8.

## Refereed Conference Proceedings

S. Gottlieb and J. S. Mullen, “ An Implicit WENO Scheme for Steady-State Computation of Scalar Hyperbolic Equations” in **Computational Fluid and Solid Mechanics 2003** (ed. **K.J. Bathe**) (2003)

U. Qidwai and S. Gottlieb, “An efficient hole-filling algorithm for c-scan enhancement.” Review of the progress in Quantitative Nondestructive Evaluation (RQNDE), Maine, 2001.

## Other Publications

S. Gottlieb and D. Gottlieb, Review of “Spectral Methods for Incompressible Viscous Flow” by Roger Payret, *SIAM Review* **vol. 45** (2003), pp.147-148

D. Gottlieb and S. Gottlieb, Review of “High-Order Methods for Incompressible Fluid Flow” by M.O. Deville, P.F. Fischer and E.H. Mund., *Mathematics of Computation* **vol. 73** (2003), pp. 1039-1040

## Honors and Awards

- Co-PI on NSF grant DMS-0608844 “RUI: Adaptive High Order Method for Solution of PDEs.” August 2006 - July 2009 for a total of \$197,713.
- PI on AFOSR grant FA9550-0610255 “Implicit High Order Strong Stability Preserving Runge-Kutta Time Discretizations.” March 2006-December 2008, for a total of \$98,005.
- PI on NSF grant DMS-0106743 “Development of Numerical Methods for Semiconductor Device Simulation and Electron Microscopy.” August 2001- August 2003 for a total of \$50,000.

## Professional Activities

- Associate editor of *Journal of Scientific Computing*.
- Refereed papers for:
  - SIAM Journal on Numerical Analysis
  - SIAM Journal on Scientific Computing
  - Proceedings of the Royal Society: Mathematical, Physical and Engineering Sciences
  - Journal of Scientific Computing
  - Electronic Journal of Linear Algebra
  - Mathematics of Computation
  - Journal of Computational Physics.
- Refereed two grant proposals for NSERC
- External reviewer for doctoral thesis of Dennis Cates at Arizona State University.
- Organized mini-symposium on *High Order Methods for Discontinuous Problems* at SIAM 2006 annual meeting, July 10-14, 2006. Boston, MA.
- Organized mini-symposium on *Strong Stability Preserving Time-Discretizations* at SIAM 2006 annual meeting July 10-14, 2006. Boston, MA.
- Gave lecture on “High Order Limiting for Discontinuous Galerkin Methods” as part of a minisymposium on *Recent Advances in High-Order/Spectral Methods* at SIAM 2006 annual meeting on July 10-14, 2006. Boston, MA.
- Gave lecture on “An implicit multi-domain WENO finite-difference method” at the 7th International Conference on Mathematical and Numerical Aspects of Waves (WAVES’05). June 20-24, 2005, Brown University.
- Gave lecture at ICOSAHOM 2004 meeting on “Recovering high-order accuracy in WENO computations of steady state hyperbolic systems” at a minisymposium on *Recent Advances in Spectral Methods and High Order Finite Difference Schemes*. June 2004.
- Organized mini-symposium and gave lecture at ICOSAHOM 2004 meeting on *High Order Time Discretization Methods*. June 2004.
- Invited lecture: “SSP Runge-Kutta Time Discretizations” at the 2003 AFOSR workshop on *Advances and Challenges in Time Integration of PDEs* August 18-20, 2003. Brown University.
- “An implicit WENO scheme for steady state computation of scalar hyperbolic equations” at the second MIT conference on computational fluid and solid mechanics. July 2003.

- Organized minisymposium and gave lecture at SIAM 50<sup>th</sup> annual meeting on *SSP Time discretizations* July 2002.
- EDC electronic mentor field test and program 20002001. The aim of this project is to expose high-school students to research and to investigate the feasibility of online mentoring.
- Numerical Methods consultant to the Fire Spread Team at the Center for the Simulation of Accidental Fires and Explosions (C-SAFE) which is funded by the DOE Accelerated Strategic Computing Initiative (ASCI). (2002-2005)

### Teaching

I have been teaching full time since September 1999 at UMASS-Dartmouth. To date, I have taught:

1. MTH101: Elements of College Mathematics, 3 credits.
2. MTH107: Elements of College Mathematics Enhanced, 3 credits.
3. MTH111: (Honors section) Calculus and Analytic Geometry I, 4 credits.
4. MTH112: (Honors section) Calculus and Analytic Geometry I, 4 credits.
5. MTH119: Math and Music, 3 credits.
6. MTH121: Women in Mathematics, 3 credits. I designed this course.
7. MTH181: Introduction to Discrete Structures I, 3 credits.
8. MTH182: Introduction to Discrete Structures II, 3 credits.
9. MTH212: Differential Equations, 3 credits.
10. MTH361: Numerical Analysis I, 3 credits.
11. MTH362: Numerical Analysis II, 3 credits.

### Recent Collaborators

Paul Fischer, Argonne National Lab.

Anne Gelb, Arizona State University.

David Gottlieb, Brown University.

Jae-Hun Jung, UMass-Dartmouth

Julia S. Mullen, Worcester Polytechnic Institute.

Steven Ruuth, Simon Fraser University.

Jennifer Ryan, Virginia Tech.

Chi-Wang Shu, Brown University. (Doctoral Advisor)