DEBOJYOTI GHOSH

Curriculum Vitae

Center for Applied Scientific Computing
Lawrence Livermore National Laboratory
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http://debog.github.io/

RESEARCH INTERESTS

o *Numerical method for hyperbolic partial differential equations* – conservative finite-difference and finite-volume methods, high-order time integration methods (implicit, implicit-explicit, and multirate methods).

o *Domain discretization techniques* – overset meshes, mapped multi-block grids, immersed boundary methods.

o *Applications*: external compressible and incompressible flows, atmospheric flows, aerodynamic flows – rotorcraft and flapping wing aircraft, ideal magneto-hydrodynamics, tokomak edge plasma simulations.

o *High-performance computing* – design and implementation of scalable algorithms on HPC platforms, specifically DOE Leadership-class supercomputers.

PROFESSIONAL EXPERIENCE

o *POSTDOCTORAL RESEARCH STAFF MEMBER* – **LAWRENCE LIVERMORE NATIONAL LABORATORY** (Livermore, CA)
October 2015 – Present
Center for Applied Scientific Computing

Implicit-explicit time integration methods for continuum kinetic systems; High-order finite-volume algorithms for tokamak edge plasma simulations; Multirate time integration methods for AMR-based atmospheric flow solvers.

o *POSTDOCTORAL APPOINTEE* – **ARGONNE NATIONAL LABORATORY** (Lemont, IL)
February 2013 – October 2015
Mathematics and Computer Science Division

Implicit-explicit time integrators and their applications to atmospheric flows; Multirate time integration methods; Scalable implementation of nonlinear compact finite-difference schemes.

o *RESEARCH ASSISTANT* – **UNIVERSITY OF MARYLAND** (College Park, MD)
July 2008 – January 2013
Alfred Gessow Rotorcraft Center, Aerospace Engineering

High-resolution non-oscillatory schemes for turbulent flows; Application to DNS of turbulent flows, and flows around rotary and flapping wing aircraft; Simulation of incompressible, vortex-dominated flows; Immersed boundary methods and their applications.

o *RESEARCH ASSISTANT* – **INDIAN INSTITUTE OF TECHNOLOGY BOMBAY** (Mumbai, India)
June 2005 – June 2006
Department of Aerospace Engineering

Numerical methods for ideal magneto-hydrodynamics; Finite-volume time-domain algorithms for Maxwell's equations (electromagnetics); Radar cross-section analysis of low-observable aircraft.

o *SUMMER INTERN* – **INFOTECH ENTERPRISES** (Bangalore, India)
May 2004 – Aug 2004
Pratt & Whitney Center of Excellence

Computational analysis of effusion-cooled plate with commercial software.

EDUCATION

o *University of Maryland*, Department of Mathematics   Jan 2013

DOCTOR OF PHILOSOPHY in Applied Mathematics (Concentration: Scientific Computing)
Application Areas: Fluid Mechanics, Rotorcraft Aerodynamics

o *Indian Institute of Technology Bombay*, Aerospace Engineering   July 2006

MASTER OF TECHNOLOGY in Aerospace Engineering (Concentration: Computational Aerodynamics)
BACHELOR OF TECHNOLOGY in Aerospace Engineering

OTHER COURSES AND TRAINING PROGRAMS

o Argonne Training Program for Extreme Scale Computing (ATPESC) (St. Charles, IL, 2014)

PUBLICATIONS

JOURNAL ARTICLES

o Ghosh, D., Constantinescu, E. M., *Well-Balanced, Conservative Finite-Difference Algorithm for Atmospheric Flows*, AIAA Journal, 54 (4), 2016, 1370-1385, doi:10.2514/1.J054580.

o Wang, P., Barajas-Solano, D. A., Constantinescu, E. M., Abhyankar, S., Ghosh, D., Smith, B. F., Huang, Z., Tartakovsky, A. M., *Probabilistic Density Function Method for Stochastic ODEs of Power Systems with Uncertain Power Input*, SIAM/ASA Journal on Uncertainty Quantification, 3 (1), 2015, 873-896, doi:10.1137/130940050.

o Ghosh, D., Constantinescu, E.M., Brown, J., *Efficient Implementation of Nonlinear Compact Schemes on Massively Parallel Platforms*, SIAM Journal on Scientific Computing, 37 (3), 2015, C354–C383, doi: 10.1137/140989261.

o Ghosh, D., Baeder, J.D., *Weighted Non-Linear Compact Schemes for the Direct Numerical Simulation of Compressible, Turbulent Flows*, Journal of Scientific Computing, 61 (1), 2014, 61-89, doi: 10.1007/s10915-014-9818-0.

o Ghosh, D. Medida, S., Baeder, J.D., *Application of Compact-Reconstruction WENO Schemes to Compressible Aerodynamic Flows*, AIAA Journal, 52 (9), 2014, 1858-1870, doi: 10.2514/1.J052654.

o Ghosh, D., Baeder, J.D., *Compact Reconstruction Schemes with Weighted ENO Limiting for Hyperbolic Conservation Laws*, SIAM Journal on Scientific Computing, 34 (3), 2012, A1678–A1706, doi: 10.1137/110857659.

o Ghosh, D., Baeder, J.D., *A High-Order Accurate Incompressible Navier Stokes Algorithm for Vortex Ring Interactions with Solid Wall*, AIAA Journal, 50 (11), 2012, 2408-2422, doi: 10.2514/1.J051537.

PEER-REVIEWED CONFERENCE PAPERS

o Ghosh, D., Constantinescu, E. M., *Nonlinear Compact Finite-Difference Schemes with Semi-Implicit Time Stepping*, in Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2014, Springer Lecture Notes in Computational Science and Engineering, Volume 106, 2015, 237-245, doi:10.1007/978-3-319-19800-2_20.

o Ghosh, D., Constantinescu, E.M., *Well-Balanced Formulation of Gravitational Source Terms for Conservative Finite-Difference Atmospheric Flow Solvers*, AIAA Paper 2015-2889, 7th AIAA Atmospheric and Space Environments Conference, June 22-26, Dallas, TX, doi: 10.2514/6.2015-2889.

o Ghosh, D., Medida, S., Baeder, J.D., *Compact-Reconstruction Weighted Essentially Non-Oscillatory Schemes for Unsteady Navier-Stokes Equations*, AIAA Paper 2012-2832, 42nd AIAA Fluid Dynamics Conference and Exhibit, June 25-28, 2012, New Orleans, LA, doi: 10.2514/6.2012-2832.

o Ghosh, D., Baeder, J.D., *Numerical Simulation of Vortex Ring Interactions with Solid Wall*, AIAA Paper 2011-675, 49th AIAA Aerospace Sciences Meeting, Jan 4-7, 2011, Orlando, FL, doi: 10.2514/6.2011-675.

o Ghosh, D., Baeder, J.D., *A High Order Conservative Upwind Algorithm for the Incompressible Navier Stokes Equations*, AIAA Paper 2010-5030, 40th AIAA Fluid Dynamics Conference and Exhibit, June 28 – July 1, 2010, Chicago, IL, doi: 10.2514/6.2010-5030.

TECHNICAL REPORTS

o Ghosh, D., Constantinescu, E.M., Brown, J., *Scalable Nonlinear Compact Schemes*, Technical Memorandum ANL/MCS-TM-340, Argonne National Laboratory, April 2014

THESES

o *Compact-Reconstruction Weighted Essentially Non-Oscillatory Schemes for Hyperbolic Conservation Laws*, Ph. D. Thesis, University of Maryland, College Park, January 2013.

o *Higher Order Non-Oscillatory Schemes in Ideal Magnetohydrodynamics*, Masters Thesis, Indian Institute of Technology Bombay, July 2006.

INVITED AND MINI-SYMPOSIUM TALKS

o Ghosh, D., Constantinescu, E. M., *Characteristic-Based Flux Splitting for Implicit-Explicit Time Integration of Low-Mach Number Flows*, 13th U.S. National Congress on Computational Mechanics (USNCCM13), Mini-symposium on Advances in Implicit / Explicit (IMEX) Time integration of Multiphysics Systems, July 26 - 30, 2015, San Diego, CA.

- Ghosh, D., Constantinescu, E. M., *A Finite-Difference Algorithm with Characteristic-Based Semi-Implicit Time-Integration for the Euler Equations with Gravitational Forcing*, SIAM Conference on Mathematical & Computational Issues in the Geosciences, Mini-symposium on Modeling and Simulation of Multiscale and Coupled Processes in Atmospheric Physics, June 29 - July 2, 2015, Stanford, CA.

- Ghosh, D., Constantinescu, E.M., *A Compact-Reconstruction WENO Scheme with Semi-Implicit Time Integration*, SIAM Conference on Computational Science and Engineering, Mini-symposium on Recent Advances in High Order Spatial Discretization Methods for PDEs, March 14 – 18, 2014, Salt Lake City, UT.

- Ketcheson, D., Ghosh, D., *Stability-Optimized Time Integrators for WENO Discretizations*, SIAM Conference on Computational Science and Engineering, Mini-symposium on Advances in Time-stepping Methods, March 14 – 18, 2014, Salt Lake City, UT.

- Barajas-Solano, D.A., Tartakovsky, A., Ghosh, D., Constantinescu, E.M., Abhyankar, S., *Probability Density Methods for the Analysis of Power Grids Under Uncertainty*, SIAM Conference on Computational Science and Engineering, Mini-symposium on Distributed Cyber-Physical Systems: Modelling and Controlling the Power Grid, March 14 – 18, 2014, Salt Lake City, UT.

- Ghosh, D., Constantinescu, E.M., Brown, J., *Scalable Non-Linear Compact Schemes*, International Conference on Spectral and High Order Methods (ICOSAHOM), Mini-symposium on Aspects of Time Stepping, June 23 – 27, 2014, Salt Lake City, UT.

- Ghosh, D., *Compact-Reconstruction WENO Schemes - Theory, Implementation and Applications*, NIA CFD Seminar, National Institute of Aerospace, Hampton, VA, June 2014

OTHER CONFERENCES/TALKS/MEETINGS

- Dorf, M., Dorr, M., Cohen, R. H., Lee, W., Ghosh, D., Hittinger, J., Rognlien, T., *Continuum Kinetic Modeling of the Tokamak Plasma Edge with the COGENT code*, International Sherwood Fusion Theory Conference, April 4 - 6, 2016, Madison, WI.

- Cohen, R. H., Dorf, M., Dorr, M., Lee, W., Ghosh, D., Hittinger, J., Rognlien, T., *Continuum Kinetic Modeling of the Tokamak Plasma Edge with the COGENT*, US Transport Task Force Workshop, March 29 - April 1, 2016, Denver, CO.

- Ghosh, D., Constantinescu, E.M., Brown, J., *A Scalable, Parallel Implementation of Weighted, Non-Linear Compact Schemes*, SIAM Annual Meeting, July 7 – 11, 2014, Chicago, IL.

- Brown, J., Ghosh, D., *Fast Solvers for Implicit Runge-Kutta*, Thirteenth Copper Mountain Conference on Iterative Methods, April 6 – 11, 2014, Copper Mountain, CO.

- Brown, J., Ghosh, D., *Fast solvers for implicit Runge-Kutta systems*, Tenth Workshop of the INRIA-Illinois-ANL Joint Laboratory on Petascale Computing, November 25 - 27, 2013, Urbana, IL.

- Brown, J., Constantinescu, E.M., Ghosh, D., McInnes, L.C., *BOUT++ and PETSc: Time integration and solver composition*, BOUT++ Workshop, September 3 - 6, 2013, Livermore, CA.

- Constantinescu, E.M., Brown, J., Smith, B., McInnes, L.C., Ghosh, D., Balay, S., *Robust Implicit-Explicit Time Stepping*, DOE Applied Math PI Meeting, August 6, 2013, Albuquerque, NM.

- Ghosh, D., Medida, S., Baeder, J.D., *Direct Numerical Simulation of Compressible Turbulent Flows with Weighted Non-Linear Compact Schemes*, 65th Annual Meeting of the APS Division of Fluid Dynamics, November 18 – 20, 2012, San Diego, CA

- Ghosh, D., Medida, S., Baeder, J.D., *High-Order Non-Oscillatory Compact Reconstruction Scheme for Overset Grids*, 11th Symposium on Overset Composite Grids and Solution Technology, October 15 – 18, 2012, Dayton, OH

- Ghosh, D., Baeder, J.D., *Application of Compact-Reconstruction WENO Schemes to the Navier-Stokes Equations*, SIAM Annual Meeting, July 9 – 13, 2012, Minneapolis, MN

- Ghosh, D., Baeder, J.D., *High Order Compact Reconstruction Scheme with Weighted Essentially Non-Oscillatory Limiting*, AMS-MAA Joint Mathematics Meetings, Jan 4-7, 2012, Boston, MA

- Ghosh, D., *Application of Weighted Essentially Non-Oscillatory Limiting to Compact Interpolation Schemes*, AIAA Region I Young Prof., Student & Education Conference, Nov 4, 2011, Laurel, MD

- Ghosh, D., Chatterjee, A., *Higher-Order Non-Oscillatory Schemes in 2D Ideal Magneto-hydrodynamics*, 9th Annual CFD Symposium, August 2006, Bangalore, India

- Ghosh, D., Chatterjee, A., *Higher-Order Non-Oscillatory Schemes in Ideal Magneto-hydrodynamics*, 8th Annual CFD symposium, August 2005, Bangalore, India

- Ghosh, D., Vaghela, M.B., Chatterjee, A., *Radar Cross Section Computations for Low Observable Configurations*, 18th National Conference for Aerospace Engineers, Institution of Engineers (I), November, 2004, IIT Kharagpur, India

o   Ghosh, D., Vaghela, M.B., Chatterjee, A., *Characteristic Based FVTD Computations for Low Observable Configuration*, 7th Annual CFD symposium, August 2004, Bangalore, India

PROFESSIONAL ACTIVITIES

o   Reviewer
  o   Computers & Mathematics with Applications
  o   Journal of Scientific Computing
  o   Journal of Computational Physics
o   Member of the AIAA Atmospheric and Space Environments Technical Committee (2016 - Present).
o   Conference Session Chair/Co-Chair:
  o   7th AIAA Atmospheric and Space Environments Conference (Numerical Weather Prediction) (with Dr. Nashat Ahmad, NASA LaRC)
  o   SIAM Annual Meeting 2014 (Numerical Methods in PDE VII)
o   Visiting researcher at the Scientific Computing Group in the Department of Applied Mathematics, Naval Postgraduate School, Monterey, CA (Host: Frank Giraldo), September 2015.
o   Visiting researcher at the Numerical Mathematics Group in Computer, Electrical and Mathematical Sciences & Engineering, King Abdullah University of Science and Technology (Host: David Ketcheson), June 2015.
o   Organizer of the LANS Informal Seminar Series at the MCS Division, Argonne National Laboratory (2013 – 2015).

SCIENTIFIC SOFTWARE CONTRIBUTIONS

o   *PETSc* (Contributor) – Portable, extensible toolkit for scientific computing.
o   *NUMA* (Contributor) – A massively parallel numerical weather prediction code.
o   *COGENT* (Contributor) – A high-order finite-volume solver for tokamak edge simulations.
o   *HyPar* (Developer) – A conservative finite-difference solver for n-dimensional hyperbolic-parabolic PDEs

HONORS AND AWARDS

o   Travel Award to attend the International Conference on Spectral and High Order Methods 2014
o   Graduate Research Assistantship (2008 – 2013) from the Alfred Gessow Rotorcraft Center, Department of Aerospace Engineering, University of Maryland, College Park
o   Block Grant Fellowship (2006 – 2008) from the Dept. of Mathematics, Univ. of Maryland
o   Research Assistantship (2005 – 2006) from Aerospace Engineering, Indian Inst. of Tech. Bombay

TECHNICAL SKILLS

o   Programming Languages: C/C++, FORTRAN, MATLAB
o   High Performance Computing: MPI, OpenMP, HPCToolkit, Alinea DDT
o   Scientific Visualization Software: Tecplot, LLNL Visit
o   Authoring and Publishing Software: Latex, Microsoft Office