Nek Sharan

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EDUCATION

Ph.D., Aerospace Engineering   **December 2016**
University of Illinois at Urbana-Champaign, USA

- Dissertation Topic: "Time-stable high-order finite difference methods for overset grids"
- Advisors: Prof. Daniel J. Bodony & Prof. Carlos Pantano

M. Tech. & B. Tech., Aerospace Engineering   **August 2011**
Indian Institute of Technology Bombay, India

- Dissertation Topic: "Numerical Simulation of Axisymmetric Jets"
- Advisor: Prof. Avijit Chatterjee

PROFESSIONAL EXPERIENCE

Assistant Professor   **August 2021 - Present**
Department of Aerospace Engineering
Auburn University, Auburn, AL, USA

Postdoctoral Research Associate   **April 2019 - August 2021**
Computational Physics and Methods Group
Los Alamos National Laboratory, Los Alamos, NM, USA

Postdoctoral Scholar   **October 2016 - April 2019**
Graduate Aerospace Laboratories & Department of Mechanical and Civil Engineering
California Institute of Technology, Pasadena, CA, USA

Graduate Research Assistant   **August 2012 - September 2016**
Department of Aerospace Engineering
University of Illinois at Urbana-Champaign, Urbana, IL, USA

Analyst   **August 2011 - July 2012**
Modeling & Simulation Group
Procter & Gamble Co., Bengaluru, India

Research Assistant   **July 2010 - June 2011**
Department of Aerospace Engineering
Indian Institute of Technology Bombay, Mumbai, India

Assistant Engineer   **May 2009 - July 2009**
Thermodynamics and Combustion Technology
FH Aachen - Aachen University of Applied Sciences, Aachen, Germany

PUBLICATIONS

N. Sharan, P. T. Brady and D. Livescu. High-order dimensionally-split Cartesian cut-cell method for non-dissipative schemes. *Journal of Computational Physics*, 464 (2022): 111341.

N. Sharan, P. T. Brady and D. Livescu. Time stability of strong boundary conditions in finite-difference schemes for hyperbolic systems. *SIAM Journal on Numerical Analysis*, 60(3) (2022): 1331-1362.

N. Sharan and J. Bellan. Investigation of high-pressure turbulent jets using direct numerical

simulation. *Journal of Fluid Mechanics*, 922 (2021): A24.

N. Sharan, G. Matheou and P. E. Dimotakis. Turbulent shear-layer mixing: initial conditions, and direct-numerical and large-eddy simulations. *Journal of Fluid Mechanics*, 877 (2019): 35-81.

N. Sharan, G. Matheou and P. E. Dimotakis. Mixing, scalar boundedness, and numerical dissipation in large-eddy simulations. *Journal of Computational Physics*, 369 (2018): 148-172.

N. Sharan, C. Pantano and D. J. Bodony. Time-stable overset grid method for hyperbolic problems using summation-by-parts operator. *Journal of Computational Physics*, 361 (2018): 199-230.

N. Sharan. Time-stable high-order finite difference methods for overset grids. *Doctoral Dissertation*, University of Illinois at Urbana-Champaign, 2016.

CONFERENCE PROCEEDINGS

U. Saetti and **N. Sharan**. Harmonic Decomposition Models of Periodically-Forced Fluid Flows, AIAA Paper 2022-3841, *AIAA Aviation 2022 Forum*.

N. Sharan and J. R. Bellan. High-pressure two-species mixing in turbulent free jets, AIAA Paper 2022-0482, *AIAA Scitech 2022 Forum*.

N. Sharan, M. Natarajan, P. T. Brady and D. Livescu. A deep learning framework for derivation of time-stable difference schemes, AIAA Paper 2021-2727, *AIAA Aviation 2021 Forum*.

N. Sharan and J. R. Bellan. Direct numerical simulation of high-pressure free jets, AIAA Paper 2021-0550, *AIAA Scitech 2021 Forum*.

N. Sharan, P. T. Brady and D. Livescu. Finite-difference Cartesian cut-cell method for hyperbolic systems, AIAA Paper 2021-0746, *AIAA Scitech 2021 Forum*.

N. Sharan and J. R. Bellan. Turbulent mixing in supercritical jets: effect of compressibility factor and inflow condition, AIAA Paper 2020-1156, *AIAA Scitech 2020 Forum*.

N. Sharan, P. T. Brady and D. Livescu. Stable and conservative boundary treatment for difference methods, with application to cut-cell discretizations, AIAA Paper 2020-0807, *AIAA Scitech 2020 Forum*.

N. Sharan and J. R. Bellan. Numerical aspects for physically accurate Direct Numerical Simulations of turbulent jets, AIAA Paper 2019-2011, *AIAA Scitech 2019 Forum*.

N. Sharan, C. Pantano and D. J. Bodony. Energy stable overset grid methods for hyperbolic problems. AIAA Paper 2014-2924, *7th AIAA Theoretical Fluid Mechanics Conference*.

N. Sharan and D. J. Bodony. High-order provably stable overset grid methods for block-structured adaptive mesh refinement. AIAA Paper 2013-2872, *21st AIAA Computational Fluid Dynamics Conference*.

N. Sharan and A. Chatterjee. Parallel Computation of Axisymmetric Jets. *Proceedings of the Python for Education and Scientific Computing (SciPy.in) 2010*.

TALKS

"Construction of stable difference schemes using a generative model", *74th American Physical Society Division of Fluid Dynamics (APS DFD) Annual Meeting*, Phoenix, November 2021

"High Order Cut-Cell Method for Direct Numerical Simulations", *74th American Physical Society*

Division of Fluid Dynamics (APS DFD) Annual Meeting, Phoenix, November 2021

"High-pressure turbulent jet flows and non-dissipative methods for complex domains", *Mechanical Engineering Graduate Seminar*, University of New Mexico, Albuquerque, February 2021 **(Invited)**

"Dimensionally-split provably stable cut-cell approach for flow calculations", *73rd American Physical Society Division of Fluid Dynamics (APS DFD) Annual Meeting*, Chicago, November 2020

"Free-shear flow mixing computations: initial conditions, scalar boundedness and subgrid-scale effects", *GALCIT Colloquium*, California Institute of Technology, Pasadena, May 2020 **(Invited)**

"High-order energy-stable boundary treatment for finite-difference cut-cell method", *72nd American Physical Society Division of Fluid Dynamics (APS DFD) Annual Meeting*, Seattle, November 2019

"Direct numerical simulation of high-pressure mixing in turbulent jets", *11th US National Combustion Meeting*, Pasadena, March 2019

"Stable, high-order methods for overset grids and turbulent mixing in large-eddy simulations", Computational Physics and Methods (CCS-2), Los Alamos National Laboratory, Los Alamos, November 2018 **(Invited)**

"Low-dissipation methods for overset/AMR grids and scalar boundedness in turbulent mixing simulations", Computational Engineering Division, Lawrence Livermore National Laboratory, Livermore, October 2018 **(Invited)**

"Effects of numerical dissipation and unphysical excursions on scalar-mixing estimates in large-eddy simulations", *70th American Physical Society Division of Fluid Dynamics (APS DFD) Annual Meeting*, Denver, November 2017

"Time-stable and conservative high-order finite difference methods for overset grids", *UIUC AE Department Seminar*, Urbana, April 2016.

"High-order provably stable overset grid methods for hyperbolic problems, with application to the Euler equations", *68th American Physical Society Division of Fluid Dynamics (APS DFD) Annual Meeting*, Boston, November 2015

"Stable interface treatment in overset grid methods", *67th American Physical Society Division of Fluid Dynamics (APS DFD) Annual Meeting*, San Francisco, November 2014.

"Intermittent Communication in Parallel Computation", *23rd International Conference on Parallel Computational Fluid Dynamics*, Barcelona, May 2011.

"Axisymmetric Navier Stokes solver using Python and Cython", *12th Annual CFD Symposium*, IISc Bangalore, August 2010.