

Nek Sharan

CONTACT INFORMATION

3200 Canyon Rd, Apt 4102
Los Alamos, NM 87544 USA

Phone: (217) 419-1197
E-mail: nsharan@lanl.gov
Web: <https://neksharan.github.io>

RESEARCH INTERESTS

Numerical methods, Computational fluid dynamics, Turbulent mixing, Large-eddy simulations, Combustion, High-performance computing, Scientific machine learning

EDUCATION

University of Illinois at Urbana-Champaign, USA

Ph.D., Aerospace Engineering, December 2016

- Dissertation Topic: “Time-stable high-order finite difference methods for overset grids”
- Advisors: Daniel J. Bodony & Carlos Pantano
- GPA: 4.0/4.0

Indian Institute of Technology Bombay, India

M. Tech & B. Tech (Dual Degree), Aerospace Engineering, August 2011

- Dissertation Topic: “Numerical Simulation of Axisymmetric Jets”
- Advisor: Avijit Chatterjee
- GPA: 8.9/10.0

RESEARCH EXPERIENCE

Los Alamos National Laboratory, USA

April 2019 - Present

Postdoctoral Research Associate, working with Peter Brady and Daniel Livescu

California Institute of Technology, USA

October 2016 - April 2019

Postdoctoral Scholar, worked with Paul Dimotakis and Josette Bellan

University of Illinois at Urbana-Champaign, USA

August 2012 - September 2016

Graduate Research Assistant, advised by Daniel Bodony and Carlos Pantano

Indian Institute of Technology Bombay, India

July 2010 - July 2011

Research Assistant, advised by Avijit Chatterjee

FH Aachen - Aachen University of Applied Sciences, Germany

May 2009 - July 2009

Assistant Engineer, supervised by Thomas Esch

TEACHING EXPERIENCE

California Institute of Technology, USA

Spring 2018

Guest Lecturer (Ae239b Turbulence)

- Delivered multiple lectures on turbulence modeling for practical applications

University of Illinois at Urbana-Champaign, USA

Spring 2016

Teaching Assistant (AE410 Computational Aerodynamics)

- Duties included holding weekly office hours, conducting tutorials on scientific programming, preparing homeworks, and grading

Indian Institute of Technology Bombay, India

Fall 2010 & Spring 2011

Teaching Assistant (AE310 Engineering Design Optimization & AE207 Intro to Engineering Design)

- Organized classroom lessons, activities and presentations; Assigned and graded homeworks & projects

National Social Service at IIT Bombay, India

Fall 2006 – Spring 2008

Teaching Associate

- Taught Mathematics, Science, and English classes to disadvantaged school children
- Visited rural areas to conduct computer literacy sessions

HONORS AND AWARDS

Laboratory Directed Research and Development–Exploratory Research (LDRD-ER) Award 2020 (with D. Livescu & P. T. Brady): \$330k/year for 3 years

CTO Pathfinder Award for exceptional innovation leadership at Procter & Gamble Co. (P&G), 2012

IIT Bombay Heritage Fund Scholarship for exemplary academic performance in years 2006-07, 2008-09 and 2009-10

Undergraduate Research Opportunity (UROP) for academic excellence and research skills (awarded to 5 out of 600 students) in 2008

Certificate of Merit (national top 1%) in Indian National Physics Olympiad (INPhO) 2006

Science & Technology Merit Certificate (national top 0.1%) in All India Secondary School Examination (AISSE) 2004

PUBLICATIONS

N. Sharan and J. R. Bellan. Investigation of high-pressure turbulent jets using direct numerical simulation. *Journal of Fluid Mechanics* (Submitted). [Click here for preprint]

N. Sharan, P. T. Brady and D. Livescu. High-order time-stable strong boundary conditions in finite-difference schemes solving hyperbolic systems. *Computers & Fluids* (Submitted). [Click here for preprint]

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

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

“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.

SERVICES AND LEADERSHIP ROLES

- **Reviewer** for AIAA Journal (AIAA), Journal of Computational Physics (Elsevier), Journal of Applied Acoustics (Elsevier), Journal of Hydro-environment Research (Elsevier), Sensors (Open Access), Energies (Open Access)
- **Organizer** for Caltech K-12 Outreach Activities (2016–2019)
 - Conducted introductory workshops on Linux at Southern California Linux Expo (SCaLE-16x) 2018, Pasadena, CA
 - Engaged K-12 students in STEM research through events like Caltech Science for March, TeachWeek etc.
- **Work-Culture Team Lead** at Procter & Gamble Co. (P&G), India (2011–2012)

- Partnered with local NGOs to conduct classes and trips for less-privileged children
- **Institute Student Mentor** at IIT Bombay, India (2009–2011)
 - Advised 5 students overcome multiple backlogs through comprehensive course planning
 - Guided 24 freshmen to ensure their smooth transition into campus life

INDUSTRY
EXPERIENCE

Procter & Gamble Co. (P&G), Bengaluru, India

August 2011 - July 2012

Analyst, Modeling & Simulation Group

Jet Airways (India) Ltd., Mumbai, India

December 2008 - January 2009

Management Trainee, Engineering Materials Department