Curriculum Vitae of
Vishal Vasan

Reader F
International Centre for Theoretical Sciences
Tata Institute of Fundamental Research
Bengaluru, India 560089

Date of Birth: December 19, 1983
Citizenship: India

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Professional Experience

International Centre for Theoretical Sciences, Tata Institute of Fundamental Research

Reader F	May 2019–present
Junior Faculty	July 2015–April 2019

Pennsylvania State University, Department of Mathematics

Position: S. Chowla Research Assistant Professor	Fall 2012–Spring 2015.

Education

Ph.D. Applied Mathematics, University of Washington, June 2012.

M.S. Applied Mathematics, University of Washington, March 2009.

M.S. Mechanical Engineering, Arizona State University, May 2007.

B.E. Mechanical Engineering, Anna University, India, April 2005.

Fields of Interest

Partial differential equations, dynamical systems and their applications. Inverse problems. Computational and Data-driven methods.

Academic Recognition

- 'Focus on Fluids' chose my paper *Accurate solution method for the Maxey-Riley equation, and the effects of Basset history* Journal of Fluid Mechanics (2019) for highlighting. Focus on Fluids is a feature of the Journal of Fluid Mechanics which highlights one publication every month that has made significant contributions to the field. The feature was written by G Haller: *Solving the inertial particle equation with memory*. Journal of Fluid Mechanics: Focus on Fluids, **874**, 1–4.

- Associate of Indian Academy of Sciences 2020–2023

- Member of National Academy of Sciences, India 2018

Refereed Publications

In preparation

4. M. Kulkarni, S. Jose, V. Vasan. *An emergent system of KdV equations for N fields*

3. S. Jose, V. Vasan. *Vorticity determines the state of the rotating shallow-water equations on a sphere*

2. V. Neeraje and V. Vasan. *Simultaneous state and parameter estimation using observers*

1. J. Watwani, S. Pahujani, V. Jemseena, K. Vijay Kumar, V. Vasan. *The influence of boundary geometry on active patterns*

Published articles

24. D. Jaganathan, R. Govindarajan, V. Vasan. *Explicit integrators for nonlocal equations: the case of the Maxey-Riley-Gatignol equation* arXiv:2308.09714 (2024) Published online in Quarterly of Appl. Math.

23. D. Jaganathan, S.G. Prasath, R. Govindarajan, V. Vasan. *The Basset–Boussinesq history force: its neglect, validity, and recent numerical developments.* Frontiers in Physics (2023) **11** 1167338

22. S. Krishnan, S. Bharadwaj and V. Vasan. *Impact of freely falling liquid containers and subsequent jetting* Experiments in Fluids (2022) **63** 108

21. V. Vasan, Manisha and D. Auroux. *Ocean-depth measurement using shallow-water wave models.* Studies in Applied Mathematics (2021) **147** 1481–1518.

20. R. Nimiwal, U. Satpathi, V. Vasan and M. Kulkarni. *Soliton-like behaviour in non-integrable systems.* Journal of Physics A: Mathematical and Theoretical (2021) **54** 425701.

19. A. Sharma, A. Mitra, R. Govindarajan and V. Vasan. *Spatio-temporal relationships between rainfall and convective clouds during Indian monsoon through a discrete lens.* International Journal of Climatology (2020) **41** 1351–1368.

18. S. Swarup, V. Vasan and M. Kulkarni. *Provable bounds for the Korteweg-de Vries reduction in multi-component Nonlinear Schrödinger Equation.* Journal of Physics A: Mathematical and Theoretical (2020) **53** 135206.

17. D. Smith, T. Trogdon and V. Vasan. *Linear dispersive shocks* arXiv:1908.08716 (2019).

16. S. Ganga Prasath, V. Vasan and R. Govindarajan. *Accurate solution method for the Maxey-Riley equation, and the effects of Basset history.* Journal of Fluid Mechanics (2019) **868** 428–460.

15. A. Mitra, A. Apte, R. Govindarajan, V. Vasan, S. Vadlamani. *Spatio-temporal patterns of the Indian Monsoon rainfall.* Accepted in Dynamics and Statistics of the Climate System (2018) **3**.

14. A. Mitra, A. Apte, R. Govindarajan, V. Vasan, S. Vadlamani. *A discrete view of the Indian Monsoon to identify spatial patterns of rainfall.* Accepted in Dynamics and Statistics of the Climate System (2018) **3**.

13. B. Deconinck, Q. Guo, E. Shlizerman and V. Vasan. *Fokas's Unified Transform Method for linear systems.* Quarterly of Applied Mathematics (2018) **76** 463–488.

12. V. Vasan, K. L. Oliveras, D. Henderson and B. Deconinck. *A method to recover water-wave profiles from pressure measurements.* Wave Motion (2017) **75** 25–35.

11. V. Vasan and K. L. Oliveras. *Water-wave profiles from pressure measurements: Extensions.* Applied Mathematics Letters (2017) **68** 175–180.

10. J. Wilkening and V. Vasan. *Comparison of five popular methods of computing the Dirichlet–Neumann operator for the water-wave problem*. Contemporary Mathematics (2015) **635** 175–210.

9. K. L. Oliveras and V. Vasan. *Relationships between the pressure and the free surface independent of the wave speed*. Contemporary Mathematics (2015) bf 635 157–173.

8. B. Deconinck, T. Trogdon and V. Vasan. *The method of Fokas for solving linear partial differential equations*. SIAM Review (2014) **56** 159–186.

7. V. Vasan and K. L. Oliveras. *Pressure beneath a traveling wave with constant vorticity*. Disc. & Cont. Dyn. Sys. Ser. A (2014) **34** 3219–3239.

6. V. Vasan and B. Deconinck. *The Bernoulli boundary condition for traveling water waves*. Appl. Math. Letters (2013) **26** 515–519.

5. K. L. Oliveras and V. Vasan. *A new equation describing traveling water-waves*. J. Fluid Mech. (2013) **717**, 514–522.

4. V. Vasan and B. Deconinck. *The inverse water wave problem of bathymetry detection*. J. Fluid Mech. (2013) **714**, 562–590.

3. V. Vasan and B. Deconinck. *Well-posedness of boundary-value problems for the linear Benjamin-Bona-Mahony equation*. Disc. & Cont. Dyn. Sys. Ser. A (2013) **33**, 3171–3188.

2. B. Deconinck, K. L. Oliveras and V. Vasan. *Relating the bottom pressure and surface elevation in the water wave problem*. J. Non. Math. Phys. (2012) **19**, Suppl. 1 1240014.

1. K. L. Oliveras, V. Vasan, B. Deconinck and D. Henderson. *Recovering the water-wave surface from pressure measurements*. SIAM J. Appl. Math. (2012) **72**, 897–918.

Peer reviewed conference proceedings

4. A. Mitra, A. Apte, R. Govindarajan, V. Vasan, S. Vadlamani (2017). *Finding active and break spells in the Indian Monsoon by Markov Random Fields.* 7th International Workshop on Climate Informatics, National Center for Atmospheric Research, Boulder Colorado USA

3. A. Mitra, A. Apte, R. Govindarajan, V. Vasan, S. Vadlamani (2017). *Tracking the propagation of planetary scale cloud zones over Indian Ocean and South Asia with Markov Random Fields.* 7th International Workshop on Climate Informatics, National Center for Atmospheric Research, Boulder Colorado USA

2. B. Deconinck, D. Henderson, K. L. Oliveras and V. Vasan (2011). *Recovering the water-wave surface from pressure measurements.* Proceedings of 10th International Conference on Mathematical and Numerical Aspects of Waves - WAVES 2011. 4 pages

1. J. Riley and V. Vasan (2009). *Spectral energy transfer in strongly stratified flows.* Proceedings of EUROMECH Colloquium 512: Small Scale Turbulence and Related Gradient Structures, $94 - 96$.

Teaching Experience

Faculty, ICTS-TIFR

Numerical Linear Algebra	Jan-Apr 2025
Reproducing Kernel Hilbert Spaces	Jan-Apr 2024
Topics in Nonlinear PDEs	Aug-Dec 2021, 2022, 2023
Summer workshop in applied mathematics (Numerical methods and algorithms)	Aug 2021
Experimental Lab course	2015,2016,2018,2019,2021
Introduction to Mechanics	Jan-Apr 2019
Introduction to Partial Differential Equations	Aug-Nov 2017

Semester projects

Estimating Individual Species and Resource Dynamics from Aggregate Observations, Sanjay Dey, **Summer 2024**

Stochastic processes and connections to partial differential equations, Priyadharshini V, **January 2024**

Observers and Control for PDEs, Vishal Neeraje, **Summer 2022**

Numerical methods for PDEs, Anup Kumar, **Summer 2021**

Adaptive time stepping methods, Sudeep Shaw, **Summer 2021**

Spectral Methods, Mukesh Kumar Singh, **August 2020**

Graphical approach to Krein Signature and Evans-Krein Function, Saumav Kapoor, **January 2020**

Analysis of Transient Stokes Flow using Unified Transform Method, Divya Jaganathan, **August 2019**

Instructor, Penn State University

MATH 251	Ordinary and Partial Differential Equations	Spring 2014
MATH 251	Ordinary and Partial Differential Equations	Fall 2013
MATH 250	Ordinary Differential Equations	Fall 2012

Instructor, University of Washington

AMATH 351	Ordinary Differential Equations	Autumn 2011

Teaching Assistant, University of Washington

MATH 498B	Undergraduate Mathematical Sciences Seminar Coordinator	Spring 2012
MATH 498B	Undergraduate Mathematical Sciences Seminar Coordinator	Winter 2012
AMATH 403/503	Methods for Partial Differential Equations	Spring 2011
AMATH 507	Calculus of Variations	Winter 2011
AMATH 403/503	Methods for Partial Differential Equations	Spring 2010
MATH 126	Calculus with Analytic Geometry III	Spring 2010
MATH 126	Calculus with Analytic Geometry III	Autumn 2009
AMATH 352	Applied Linear Algebra and Numerical Analysis	Summer 2009
MATH 126	Calculus with Analytic Geometry III	Spring 2009
MATH 124	Calculus with Analytic Geometry I	Winter 2009
MATH 120	Precalculus	Winter 2008
MATH 124	Calculus with Analytic Geometry I	Autumn 2007

Invited workshops

Semester Program on "Singularities and Waves In Incompressible Fluids"
ICERM, Providence, Rhode Island
January 30 - May 5, 2017 Organized by Bernard Deconinck, Yan Guo, Diane Henderson, Helena
Nussenzveig Lopes, Govind Menon, Paul Milewski, Walter Strauss and Jon Wilkening

Nonhomogeneous boundary-value problems for nonlinear waves
American Institute of Mathematics, Palo Alto, California
May 13 to May 17, 2013
Organized by Jerry Bona, Min Chen, Shuming Sun, and Bingyu Zhang

Conference presentations and invited talks

The inverted world of inverse problems: state and parameter estimation
IIT Bombay Dept of Chemical Engineering Colloquium
17 April 2024 Mumbai

Simultaneous state and parameter estimation using observers
Data Dynamics Summit
March 2024 IISER Pune

Ocean-depth measurement: an application of observers to parameter estimation
ICTS Program on Recent advances on control theory of PDE systems
February 2024 ICTS, Bengaluru

Introduction to sparse reconstruction
Seminar Series at Micron Technology
15 November 2023 Hyderabad

State estimation via nudging for evolution equations with applications
Lectures series in Nonlinear Dynamics, Dept of Nonlinear Dynamics, Bharatidasan University
9 September 2022

An introduction to the Unified Transform Method and applications
Department of Mathematics and Computing, IIT (ISM)
5 August 2022 Dhanbad

State estimation for shallow-water equations
Prediction and Variability of Air-Sea Interactions: the South Asian Monsoon, ICERM
13–15 June 2022 Rhode Island

Data assimilation, state inference and observability
Department of Applied Mathematics
10 May 2022 University of Washington, Seattle

Observers in dynamical systems and their application to geophysical models
Prediction and Variability of Air-Sea Interactions: the South-Asian Monsoon, ICERM
23–27 August 2021 Rhode Island

Ocean-depth measurement using shallow-water wave models
Asymptotics and Numerics in the Theory of Water waves, SIAM Annual Meeting
19–23 July 2021 (online)

Two unexpected boundary value problems
Department of Mathematics, IIT Bombay
23rd October 2019 Mumbai

Markov random field model for the Indian monsoon rainfall
Department of Applied Physics and Applied Mathematics, Columbia University
27 June 2019 New York, NY

Fractional differential equations and boundary value problems
Applied Mathematics: The next 50 years
20th June 2019 University of Washington, Seattle

PDEs at ICTS
Indo-French scientific workshop, Université Côte d'Azur
7th February 2019
Nice

Applications of differential equations: what can you do with PDEs?
ICTS Colloquium
22nd January 2019
ICTS Bengaluru

Fractional derivatives, boundary value problems and heavy particles in a viscous fluid
ICTS Program on Integrable systems in Mathematics, Condensed Matter and Statistical Physics
16th July - 10th August 2018
ICTS Bengaluru

Analysis of an instability in stratified shear flow
The 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications
July 6 2018
Taipei, Taiwan

Nonlinear waves and coherent structures
Seminar at TIFR Centre for Applicable Mathematics
April 12 2018
Bengaluru

Inverse problems in water waves
Seminar at SN Bose National Centre for Basic Sciences
February 7 2018
Kolkata

Analysis of shear instabilities in fluid mechanics
Climate Seminar Series of Interdiscplinary Program in Climate Studies at IIT Bombay
August 30 2017
Mumbai

The Unified Transform Method for nonlocal PDEs
Recent advances in nonlinear waves: Harvey Segur 75th birthday conference
July 31 2017 Seattle WA

Analysis of an instability in stratified fluid flow
Bouyancy driven fluid flows discussion meeting
June 19 2017 ICTS Bengaluru

Dynamics of free surfaces
Nehru Planetarium Summer Course research talk
May 27 2017 Bengaluru

A model for wind driven water waves
ICERM Water Waves conference
April 28 2017 Providence RI

Pressure boundary conditions in viscous incompressible flows
ICERM Singularities and Waves in Incompressible Fluids
April 19 2017 Providence RI

The bathymetry detection problem: a water wave approach
Department of Applied Physics and Applied Mathematics, Columbia University
March 28 2017 New York, NY

Computational methods for water-waves
ICERM Singularities and Waves in Incompressible Fluids
February 1 2017 Providence RI

Recovering water-wave profiles from pressure measurements
Department of Physics Bharatidasan University
January 18 2017 Trichy

The Uniform Transform Method for degenerate mixed PDEs and interface problems
SIAM Conference on Nonlinear Waves and Coherent Structures
August 8-11 2016 Philadelphia, PA

Gradient descent with nonlinear constraints
Complex systems discussion meeting
July 22 2016 ICTS Bangalore

Some inverse problems in water-waves
Research Seminar in Department of Computational and Data Sciences, Indian Institute of Science
April 22 2016 Bengaluru, Karnataka

A model for wind-driven surface gravity waves
Conference on Computational Mathematics and Nonliner Dynamics, Visva-Bharati
February 19 2016 Santiniketan, West Bengal

Gradient descent with nonlinear constraints
Joint Mathematics Meet
January 9 2016 Seattle, WA

Growth rates for wind-driven surface gravity waves
Joint Mathematics Meet
January 8 2016 Seattle, WA

The bathymetry detection problem: a water-wave approach
Fluid Dynamics Research Consortium
October 2 2014 University Park, PA

Experiments in a fluids laboratory
Applied Mathematics Seminar, Seattle University
May 16 2014 Seattle, WA

Pressure beneath a traveling wave with constant vorticity
SIAM Analysis of Partial Differential Equations
December 8 2013 Orlando, FL

Measuring waves: two inverse problems in the lab
Mathematical methods seminar
Department of Applied Mathematics, University of Washington-Seattle
October 15 2013

Some inverse problems related to the theory of water waves
Invited talk part of Chacha Days Seminar
Department of Mathematics, University of North Carolina-Chapel Hill
August 23 2013 Chapel Hill, NC

The numerical simulation of time-dependent water waves in two and three dimensions
AMS Spring Western Section Meeting, University of Colorado
April 13-14 2013 Boulder, CO

The inverse water wave problem of bathymetry detection
The Eighth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory
March 25-28 2013 Athens, GA

Traveling water waves in three dimensions
SIAM Conference on Nonlinear Waves and Coherent Structures
June 13-16 2012 Seattle, WA

The Inverse Problem: Reconstructing the bottom topography from surface measurements
SIAM Analysis of Partial Differential Equations
November 14-17 2011 San Diego, CA

Well-posedness of boundary-value problems for Linear BBM
AMS Fall Western Section Meeting, University of Utah
October 22-23 2011 Salt Lake City, UT

Boundary-value problems for linear PDEs with mixed derivatives
7th International Congress on Industrial and Applied Mathematics - ICIAM 2011
July 18-22 2011 Vancouver, BC

Boundary-value problems for the Linear Benjamin-Bona-Mahony Equation
The Seventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory
April 4-7 2011 Athens, GA

Green Meets Jordan: How to Solve PDEs using Complex Analysis
The Pritchard Lab seminar at the Department of Mathematics, Pennsylvania State University
September 13 2010 University Park, State College, PA

Direct numerical simulations of stratified turbulence at higher Reynolds numbers
Annual Meeting of the American Physical Society–Division of Fluid Dynamics
November 23 2008 San Antonio, TX

On spin-up and spin-down in axisymmetric containers
Fifth International Symposium on Evironmental Hydraulics
December 4-7 2007 Phoenix, AZ

Mentoring and Advising

Students mentored

Advisor of doctoral candidate Vishal Neeraje (ICTS)

Joint-advisor of doctoral candidate Jigyasa Watwani (ICTS)

Joint-advisor of doctoral candidate Divya Jaganathan (ICTS)

Advisor of doctoral candidate Manisha Goyal (ICTS)

Co-advisor of Patrick Sprenger (with Katie Oliveras of Seattle University).

Co-advisor of Edward Charlesworth (with Katie Oliveras of Seattle University).

Postdocs mentored

Present position indicated in parentheses.

Dr Sharath Jose 2021-2024

Dr Sangeeth Krishnan 2019-2022 (Asst. Professor, Mech Engg NIT Calicut)

Dr Sunil Bharadwaj 2019-2022 (Scientist at ABB)

Dr Urbashi Satpathi 2018-2021 (Asst. Professor, Physics & Material Science JIIT Noida)

Dr Shibi Vasudevan 2017-2020 (Asst. Professor, Mathematics KREA University)

Dr Adway Mitra 2016-2018 (Asst. Professor, Centre of Excellence in AI IIT Kharagpur)

Dr S Vijay Prakash 2015-2017 (Faculty, Gram Vikas, Berhampur, Odisha)

Minisymposia/Workshops organized

Co-organizer of *Mathematical and Computational Foundations of Climate Modeling: from Low-Dimensional Dynamics to Earth System Models*
BIRS-CMI Chennai
August 17-22 2025

Co-organizer of *ICTS Discussion Meeting: Monsoon Day*
ICTS-TIFR Bengaluru
Feb 2019

Co-organizer of *ICTS Program on Integrable Systems in Mathematics, Condensed Matter Physics and Statistical Physics*, ICTS-TIFR Bengaluru, July 16-Aug 10 2018

Co-organizer of *ICTS Summer School and Discussion Meeting on Bouyancy-Driven Fluid Flows*, ICTS-TIFR Bengaluru,June 12-20 2017

Co-organizer of *Minisymposia on Water waves*, 8th IMACS Conference on Nonlinear Waves, Athens, GA, March 25-28 2013

Co-organizer of *Minisymposia on Water Wave Bifurcations: Theory and Numerics*, SIAM Nonlinear Waves and Coherent Structures, Seattle, WA, June 13-16 2012

Co-organizer of *Minisymposia on Analysis and Numerics of Euler Water Wave Equations*, SIAM Analysis of PDEs, San Diego, CA, Nov 14-17 2011

Referee for

Water Waves, Studies in Applied Mathematics, Journal of Fluid Mechanics, Environmental Fluid Mechanics, European Journal of Fluid Mechanics B/Fluids, Journal of Computational Physics, Discrete and Continuous Dynamical Systems - Series A, MDPI Remote Sensing, Pramana

Last updated: October 7, 2024