

Nathan Vani

PhD, ESPCI-PSL

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RESEARCH INTERESTS: Elasticity, Soft Matter, Multiphase flows, Capillarity

My research focuses on both the physical mechanics of soft matter. My main interests lies in capillary flows, confined suspensions, and elasticity. Though first a physicist, I am particularly interested in interdisciplinary approaches: computer graphics, design, mechanics, and engineering.

Last updated: February 2026

RESEARCH EXPERIENCE

Postdoctoral fellow – Institute of Physics, University of Amsterdam – 2026 (ongoing)
Statistics of spray coalescence perturbed by a flexible sheet with Daniel Bonn

PhD Candidate – Laboratoire PMMH, ESPCI-PSL – 2022 to 2025 (3 years)
Under the direction of Étienne Reyssat, José Bico and Benoît Roman
Stiffness Matters: asymmetric bending for shape programming

ENS Internship – University of California, Santa Barbara – 2021 to 2022 (10 months)
Clogging by bridging of suspensions in constricted channels with Alban Sauret

M2 Internship – LPENS, ENS Paris – 2021 (6 months)
Thermally activated wetting motion with Kristina Davitt

M1 Internship – Laboratoire Navier, École des Ponts et Chaussées – 2020 (3 months)
Simulation of porous matrix saturation with Matthieu Vandamme

Industrial Internship – AREP, SNCF – 2019-2020 (3 months)
Blast wave propagation and interaction with steel structures

EDUCATION

PhD in Soft Matter Mechanics – ESPCI-PSL – 2022-2025
Stiffness Matters: Asymmetric Bending for Shape Programming

Diplôme de l'ENS Paris-Saclay – DER GCE – 2018-2022
Department of civil engineering and environmental sciences

Master of Science – École des Ponts et Chaussées – 2020-2021

Master 2 SMCD, Materials Science for Sustainable Construction

Classes préparatoires – Lycée Gustave Eiffel, Cachan – 2016-2018

PUBLICATIONS

6. **Caging and fluid deformations in dense bidisperse suspensions**
V. Thiévenaz, **N. Vani**, and A. Sauret
Pre-print, under review
[\[ArXiv\]](#)
5. **Programming developable surfaces using multilayer inflatables**
O. Mirkin*, **N. Vani***, E. Reyssat, J. Bico, and M. Skouras
Joint first authors
Proceedings of the ACM Symposium on Computational Fabrication, 1-13 (2025)
[\[Journal\]](#)
4. **Asymmetric Bending Boundary Layer: the λ -test**
N. Vani, A. Ibarra, J. Bico, E. Reyssat, and B. Roman
Proceedings of the National Academy of Sciences, 122 (11), e2426748122 (2025)
[\[Journal\]](#) [\[ArXiv\]](#)
3. **Role of the constriction angle on the clogging by bridging of suspensions of particles**
N. Vani, S. Escudier, D-H. Jeong, and A. Sauret
Physical Review Research, 6 (3), L032060 (2024)
[\[PDF open access\]](#)
2. **Deposition and alignment of fiber suspensions by dip coating**
D-H. Jeong, L. Xing, M. Ka Ho Lee, **N. Vani**, and A. Sauret
Journal of Colloid and Interface Science, 650, 407-415 (2023)
[\[Journal\]](#) [\[ArXiv\]](#)
1. **Influence of the solid fraction on the clogging by bridging of suspensions in constricted channels**
N. Vani, S. Escudier, and A. Sauret
Soft Matter, 18(36), 6987-6997 (2022)
[\[Journal\]](#) [\[ArXiv\]](#)

TEACHING AND MENTORING

Teaching Assistant – Sorbonne Université – 2022-2023

Fluid mechanics tutorials and experimentals for 2nd year students

Teaching Assistant – Lycée Saint Lambert – 2020

Lectures on worksite organization for 2nd year technical student (BTS)

Class design – ENS Paris-Saclay – 2019

Designed [a lecture on tensile structures](#) published by the French office of technical engineering teaching

Mentoring – I have supervised several interns:

- Tom Joblin (2025, L3 at Paris Cité)
Modeling networks of asymmetric tubes
- Aoi Nohara at ESPCI (2025, Master student at Ochanomizu University)
Destabilization of frustrated inflatables
- Antoine Garine-Witchatitsky at ESPCI (2023, Master 1 at ESPCI)
Design of multi-layered inflatables
- Vanshika Singhania at ESPCI (2023, Master 1 at Sorbonne Université)
Fabrication and characterization of thin sheet inflatables
- Sacha Escudier at UCSB (2022, 2nd year at UCSB)
Influence of the constriction angle in bridging of suspensions
- Sébastien Kuchly at UCSB (2022, Master 1 at ESPCI)
Transport and clogging of a fiber in a bent channel

AWARDS AND SCHOLARSHIP

EuroMech Young Scientist Award – awarded at EMMC19 in Madrid, 2024

Mechanics and shape morphing of asymmetric tubes

PhD scholarship – ENS Paris-Saclay

Bourse normalienne au mérite

CONFERENCES AND WORKSHOPS

- **EuroMech Solids**, Lyon, France – 2025
Asymmetric Bending Boundary Layer
- **Functionality through nonlinearity**, London, UK – 2025

- **Rencontre du non-linéaire**, Paris, France – 2025
Asymmetric Bending Boundary Layer – invited talk
 - **Journées de la Matière Condensée**, Marseille, France – 2024
Asymmetric Bending Boundary Layer
 - **CISM Mechanics of active materials**, Udine, Italy – 2024
Summer school
 - **EuroMech Materials**, Madrid, Spain – 2024
Inflation of asymmetric tubes – best presentation award
 - **GDR MePhy**, Paris, France – 2024
Inflation of asymmetric tubes
 - **Thin Sheets workshop**, James Franck Institute, Chicago, USA – 2024
Inflation of asymmetric tubes – invited talk
 - **March Meeting**, Minneapolis, USA – 2024
Inflation of asymmetric tubes
 - **EuroMech Suspensions**, Nice, France – 2023
Clogging of constrictions by particle bridging
 - **GDR MePhy**, Paris, France – 2023
Harnessing stiffness asymmetry for high deformation shape morphing
 - **Creative Differences**, London, UK – 2023
Harnessing stiffness asymmetry for high deformation shape morphing
 - **March Meeting**, Las Vegas, USA – 2023
Harnessing stiffness asymmetry for high deformation shape morphing
As a replacement of A. Sauret: *Clogging of constrictions by particle bridging*
 - **Graphyz 2**, Arc-et-Senans, France – 2022
Workshop connecting researchers in physics and computer graphics
 - **EuroMech Fluids**, Athens, Greece – 2022
Clogging of constrictions by particle bridging in suspension flows
 - **SoCal Fluids Symposium XV** at UCLA, Los Angeles, USA – 2022
Clogging of constrictions by particle bridging in suspension flows
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MISCELLANEOUS

Languages: French (native), English (fluent), Spanish (basics)

London Design Biennale Creative Differences Pavilion – 2024

Lead the fabrication of a 25-squared meters inflatable ceiling as part of the [Automorph network](#). Our team from ESPCI created an ‘inflatable’ room to showcase the use of shape morphing materials.

Publication of a book at Pearson Editions – 2013-2014

Led the writing of a video game guide which sold 30.000 copies.

Aventure, survie et création : le guide Minecraft

Press coverage

- ‘[Le problème des écoulements de billes, ou comment choisir le bon angle pour éviter les bouchons](#)’ in Le Monde (9th October 2024) about our PRR article
 - ‘[Créer des objets par frustration géométrique](#)’ in La Recherche (4th trimester 2024), about my PhD project
 - ‘[Ten standout pavilions from the 2023 London Design Biennale](#)’ in Dezeen highlighting Creative Differences
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REFERENCES

José Bico

Professor
PMMH, ESPCI-PSL, Paris
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Alban Sauret

Professor
University of Maryland, College Park
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Benoît Roman

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