Nathan Vani

PhD Candidate at ESPCI-PSL

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Research Interests: Elasticity, Soft Matter, Multiphase flows, Capillarity

My research focuses on both the physics and mechanics of soft matter. I am interested in complex flows as well as programmable materials from a primarily experimental approach.

Last updated: March 2025

RESEARCH EXPERIENCE

PhD Candidate – Laboratoire PMMH, ESPCI-PSL – since 10/2022
Under the direction of Étienne Reyssat, José Bico and Benoît Roman
Stiffness asymmetry for programmable inflatables

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 asymmetry for programmable inflatables

Diplôme de l'ENS Paris-Saclay – DER GCE – 2018-2022
Department of civil engineering, specialized in mechanics and materials science

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

5. **Caging and fluid deformations in dense bidisperse suspensions**
   V. Thiévenaz, **N. Vani**, and A. Sauret
   Pre-print, under review
   [ArXiv]

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:

- Aoi Nohara at ESPCI (Master student at Ochanomizu University)
  Destabilization of frustrated inflatables
- Antoine Garine-Witchatitsky at ESPCI (Master 1 at ESPCI)
  Design of multi-layered inflatables
- Vanshika Singhania at ESPCI (Master 1 at Sorbonne Université)
  Fabrication and characterization of thin sheet inflatables

- Sacha Escudier at UCSB (2nd year at UCSB)
  Influence of the constriction angle in bridging of suspensions
- Sébastien Kuchly at UCSB (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

- **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
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