

Pier Giuseppe LEDDA

CURRICULUM VITAE

Contact Information

Department of Civil, Environmental Engineering and Architecture (DICAAR)
University of Cagliari
Via Marengo 2, 09123 Cagliari, Italy
ORCID: 0000-0003-4435-8613
Scopus Author Identifier: 57204566916
Personal website: pgledda [dot] github [dot] io

Research Profile

I am currently tenure-track assistant professor (RTT) at the University of Cagliari, Italy. After obtaining my PhD in 2022 from the École Polytechnique Fédérale de Lausanne (EPFL, Switzerland). My research covers several aspects of fluid mechanics, from small to large scales, combining theoretical developments with numerical and experimental approaches to understand the underlying physical mechanisms and governing parameters. The outcomes, often in the form of general laws, can be used to predict, interpret, and optimize flows of engineering and/or environmental interest.

My interests include:

- Environmental and canopy flows
- Homogenization and transport around and through permeable bodies
- Thin films and capillary flows
- Fluid–structure interactions
- Bio-fluid mechanics
- Soft hydraulics
- Reduced-order modelling, custom CFD simulations, experimental measurements

EDUCATION

- **2022:** PhD in Mechanics, EPFL, Lausanne, Switzerland.
- **2018:** MSc in Aerospace Engineering, University of Pisa, Italy
- **2015:** BSc in Aerospace Engineering, University of Pisa, Italy

PhD OR EQUIVALENT DEGREE OBTAINED IN ITALY OR ABROAD

2022: PhD degree (Docteur ès Sciences), Doctoral Program in Mechanics
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
thesis: “From Coating Flow Patterns to Porous Body Wake Dynamics via Multiscale Models”
supervisor Prof. François Gallaire (EPFL)

DOCUMENTED RESEARCH ACTIVITY AT QUALIFIED ITALIAN OR FOREIGN INSTITUTIONS

- 1) 2025-present:** Full-time Tenure-Track Assistant Professor (RTT) CEAR-01/A – Hydraulics (formerly SSD ICAR/01), University of Cagliari.
- 2) 2026:** Invited Visiting Researcher at Institut Jean le Rond d’Alembert, Sorbonne Université, Paris, France, for a two-week research stay.
- 3) 2023–2025:** Full-time RTD-A, University of Cagliari CEAR-01/A – Hydraulics (formerly SSD ICAR/01)
- 4) 2018–2022:** Doctoral Assistant at the Laboratory of Fluid Mechanics and Instabilities, EPFL, Lausanne, Switzerland.

TEACHING ACTIVITIES IN ITALY OR ABROAD

- 1) **Academic Year 2025/2026:** Assigned lecturer for the bachelor course “Meccanica dei Fluidi” 9 ECTS credits, 90 hours, Bachelor’s Degree in Naval Engineering, Olbia campus, University of Cagliari.
- 2) **2026:** Lecturer of the PhD course “Computational Fluid Mechanics: From Fundamentals to Applications”, PhD Programme in Civil Engineering and Architecture, University of Cagliari. 20 hours of frontal teaching.
- 3) **2024:** Lecturer in the seminar course “La Computational Fluid Dynamics (CFD) con OpenFOAM” for students in Civil, Environmental, Mechanical and Biomedical Engineering at the University of Cagliari.
- 4) **2018:** Teaching Assistant for the EPFL Master-level course “Two-Phase Flows and Heat Transfer” (ME-446), taught by Prof. F. Gallaire.
- 5) **2019:** Teaching Assistant for the EPFL Bachelor-level course “ICC – Information, Calcul, Communication” (CS-119a), taught by Prof. M. Rajman.
- 6) **2019:** Teaching Assistant for the EPFL Master-level course “Hydrodynamics” (ME-444), taught by Prof. F. Gallaire.
- 7) **2019:** Teaching Assistant for the EPFL Master-level course “Two-Phase Flows and Heat Transfer” (ME-446), taught by Prof. F. Gallaire.
- 8) **2020:** Teaching Assistant for the EPFL Master-level course “Hydrodynamics” (ME-444), taught by Prof. F. Gallaire.
- 9) **2020:** Teaching Assistant for the EPFL Master-level course “Two-Phase Flows and Heat Transfer” (ME-446), taught by Prof. F. Gallaire.
- 10) **2021:** Teaching Assistant for the EPFL Master-level course “Hydrodynamics” (ME-444), taught by Prof. F. Gallaire
- 11) **2021:** Teaching Assistant for the EPFL Master-level course “Two-Phase Flows and Heat Transfer” (ME-446), taught by Prof. F. Gallaire

ORGANIZATION, DIRECTION AND COORDINATION OF NATIONAL AND INTERNATIONAL RESEARCH GROUPS, OR PARTICIPATION THEREIN

- Prof. A. Marcotte (Sorbonne Université) & Dr. L. Keiser (CNRS & Univ. Côte d’Azur), bubble blockage in capillaries, surface tension
- Prof. G. Querzoli (University of Cagliari) – project *eINS*, flow across photovoltaic panels (experiments)
- Prof. G. Querzoli (University of Cagliari) & M.D. T. Rossi (Fondazione Bietti) – ophthalmic surgery flows.
- Prof. G. Querzoli (University of Cagliari) & M.D. G. Matta (AOU Brotzu) – cardiovascular flows.
- Prof. G. Querzoli (University of Cagliari) & Prof. P. Monti (La Sapienza) – project *BRIC-INAIL*, indoor flows and dispersion.
- Prof. A. De Simone (Sant’Anna Pisa) – project *I-Seed* (H2020), fluid–structure interaction in free-falling bodies.
- Prof. M. Pezzulla (Aarhus University) – project *Villum Foundation*, FSI.
- Dr. G.A. Zampogna (EPFL, now Univ. Genoa) – project *SNSF PZ00P2_193180*, flow through permeable membranes.
- Prof. F. Gallaire (EPFL) & Prof. P.-T. Brun (Princeton, now KU Leuven) – surface tension & thin-film flows.
- Prof. F. Gallaire (EPFL), Prof. B. Scheid (ULB), Prof. M. Wyart (EPFL, now John Hopkins Univ.) –

thin films & karst formations.

Prof. F. Gallaire & Prof. F. Sorin (EPFL) – dewetting and contact-line instabilities.

Prof. F. Gallaire (EPFL) & Prof. S. Camarri (Univ. Pisa) – porous bluff-body wakes.

Prof. F. Gallaire (EPFL) – project *SNSF 200021_178971*, thin-film instabilities.

INTERNATIONAL JOURNAL ARTICLES

Since 2018, I co-authored 26 peer-reviewed journal articles, including three Physical Review Letters and several papers as first, and/or corresponding author, and/or without my PhD supervisor.

(* = corresponding author, † = equal contribution with first author)

1. **P.G. Ledda**, H. Garg, V. Østergaard-Clausen, L.K. Rudzki, A. Madary, M. Pezzulla.
Fluid-induced snap-through instability of spherical shells.
Physical Review Letters **135**, 234002 (2025).
2. T. Rossi, G. Querzoli, **P.G. Ledda**, B.O. Balzamino, C. Pellizzaro, G. Rosari, D.H. Steel, R. Mastropasqua, M.R. Romano, A. Micera.
Is the Laminar Flow From the Vitrectomy Infusion Cannula Potentially Harmful?
Translational Vision Science & Technology **14**, 29 (2025).
3. K. Wittkowski, **P.G. Ledda**, E.C. Giordano, F. Gallaire, G.A. Zampogna.
Effective flows across diffusio-phoretic membranes.
Journal of Fluid Mechanics **1021**, A16 (2025).
4. **P.G. Ledda**, M.G. Badas, T. Rossi, G. Querzoli.
Fluid dynamics in the vitreous chamber during infusion in ophthalmic surgery: a numerical study.
Flow **5**, E30 (2025).
5. K. Wittkowski, A. Ponte, **P.G. Ledda**, G.A. Zampogna.
Quasi-linear homogenization for large-inertia laminar transport across permeable membranes.
Journal of Fluid Mechanics **1000**, A46 (2024).
6. A. Marcotte, **P.G. Ledda**, V. Buriasco, P. Dené, F. Gallaire, L. Keiser.
Releasing long bubbles trapped in thin capillaries via tube centrifugation and inclination.
Journal of Fluid Mechanics **999**, A9 (2024).
7. H. Garg, **P.G. Ledda**, J.S. Pedersen, M. Pezzulla.
Passive viscous flow selection via fluid-induced buckling.
Physical Review Letters **133**, 084001 (2024).
8. G. Corsi, **P.G. Ledda**†*, G. Vagnoli, F. Gallaire, A. De Simone.
Instability and trajectories of buoyancy-driven annular disks: a numerical study.
Physical Review Fluids **9**, 043907 (2024).
9. **P.G. Ledda**, T. Rossi, M.G. Badas, G. Querzoli.
Can wall shear-stress topology predict proliferative vitreoretinopathy localization following pars plana vitrectomy?
Journal of Biomechanics **162**, 111914 (2024).
10. G.A. Zampogna, **P.G. Ledda**, K. Wittkowski, F. Gallaire.
Homogenization theory captures macroscopic flow discontinuities across Janus membranes.
Journal of Fluid Mechanics **970**, A39 (2023).
11. F. Caruso Lombardi, A. Bongarzone, G.A. Zampogna, S. Camarri, F. Gallaire, **P.G. Ledda**.*
Von Kármán vortex street past a permeable circular cylinder: two-dimensional flow and dynamic mode decomposition-based secondary stability analysis.
Physical Review Fluids **8**, 083901 (2023).
12. **P.G. Ledda**, M.G. Badas, G. Matta, G. Querzoli.
Flow dynamics in a model of dilated thoracic aorta prior to and following prosthetic replacement.
Theoretical and Computational Fluid Dynamics **37**, 375–396 (2023).

13. G. Vagnoli, G.A. Zampogna, S. Camarri, F. Gallaire, **P.G. Ledda***
Permeability sets the linear path instability of buoyancy-driven disks.
Journal of Fluid Mechanics **955**, A29 (2023).
14. **P.G. Ledda***, M. Pezzulla, E. Jambon-Puillet, P.-T. Brun, F. Gallaire.
Gravity-driven coatings on curved substrates: a differential geometry approach.
Journal of Fluid Mechanics **949**, A38 (2022).
15. G.A. Zampogna, **P.G. Ledda**, F. Gallaire.
Transport across thin membranes: effective solute flux jump.
Physics of Fluids **34**, 083113 (2022).
16. M. Ciuti, G.A. Zampogna, F. Gallaire, S. Camarri, **P.G. Ledda***
On the effect of a penetrating recirculation region on the bifurcations of the flow past a permeable sphere.
Physics of Fluids **33**, 124103 (2021).
17. **P.G. Ledda***, E. Boujo, S. Camarri, F. Gallaire, G.A. Zampogna.
Homogenization-based design of microstructured membranes: wake flows past permeable shells.
Journal of Fluid Mechanics **927**, A31 (2021).
18. L. Martin-Monier, **P.G. Ledda†**, P.L. Piveteau, F. Gallaire, F. Sorin.
Prediction of self-assembled dewetted nanostructures for photonics applications via a continuum-mechanics framework.
Physical Review Applied **16**, 034025 (2021).
19. **P.G. Ledda***, F. Gallaire.
Secondary instability in thin film flows under an inclined plane: growth of lenses on spatially developing rivulets.
Proceedings of the Royal Society A **477**, 20210291 (2021).
20. E. Jambon-Puillet, **P.G. Ledda**, F. Gallaire, P.-T. Brun.
Drops on the underside of a slightly inclined wet substrate move too fast to grow.
Physical Review Letters **127**, 044503 (2021).
21. **P.G. Ledda***, G. Balestra, G. Lerisson, B. Scheid, M. Wyart, F. Gallaire.
Hydrodynamic-driven morphogenesis of karst draperies: spatio-temporal analysis of the two-dimensional impulse response.
Journal of Fluid Mechanics **910**, A53 (2021).
22. **P.G. Ledda***, G. Lerisson, G. Balestra, F. Gallaire.
Instability of a thin viscous film flowing under an inclined substrate: the emergence and stability of rivulets.
Journal of Fluid Mechanics **904**, A23 (2020).
23. G. Lerisson, **P.G. Ledda**, G. Balestra, F. Gallaire.
Instability of a thin viscous film flowing under an inclined substrate: steady patterns.
Journal of Fluid Mechanics **898**, A6 (2020).
24. G. Lerisson, **P.G. Ledda**, G. Balestra, F. Gallaire.
Dripping down the rivulet.
Physical Review Fluids **4**, 100504 (2019).
25. **P.G. Ledda**, L. Siconolfi, F. Viola, S. Camarri, F. Gallaire.
Flow dynamics of a dandelion pappus: a linear stability approach.
Physical Review Fluids **4**, 071901(R) (2019).
26. **P.G. Ledda**, L. Siconolfi, F. Viola, F. Gallaire, S. Camarri.
Suppression of von Kármán vortex streets past porous rectangular cylinders.
Physical Review Fluids **3**, 103901 (2018).

PREPRINTS AND SUBMITTED MANUSCRIPTS

1. **P.G. Ledda**, M.G. Badas, G. Querzoli.
Turbulent flow past idealized arrays of photovoltaic panels: an experimental study.
Under revision in **Flow (Cambridge Core)**.

SPEAKER AT NATIONAL AND INTERNATIONAL CONFERENCES AND WORKSHOPS

- 1) **12/2025:** P.G. Ledda, H. Garg, M. Pezzulla.
Passive fluidic control through buckling and snapping of soft valves.
Fluids and Complexity IV Conference, Nice, France.
- 2) **09/2025:** P.G. Ledda, M.G. Badas, G. Leuzzi, P. Monti, A. Pelliccioni, A. Pini, G. Querzoli.
Numerical investigation of natural ventilation and stratification in an amphitheatre classroom.
23rd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, Hamburg, Germany.
- 3) **08/2025:** P.G. Ledda, T. Rossi, M.G. Badas, G. Querzoli.
Assessing Mixing and Transport in the Vitreous Chamber During Infusion in Ophthalmic Surgery.
2nd European Fluid Dynamics Conference (EFDC2), Dublin, Ireland.
- 4) **06/2025–07/2025:** P.G. Ledda, G. Corsi, G. Vagnoli, F. Gallaire, A. De Simone.
Linear stability analysis of freely falling annular disks.
16th ERCOFTAC SIG 33 Workshop – Progress in Flow Instability, Transition and Control, Cagliari, Italy.
- 5) **10/2024:** P.G. Ledda.
Canopy flows of the built environment: the fluid dynamics of photovoltaic farms.
Second Italian OpenFOAM User Meeting, Cagliari, Italy.
- 6) **09/2024:** P.G. Ledda, A. Seoni, M.G. Badas, G. Querzoli.
Experimental assessment of fluid dynamics around scale models of an array of photovoltaic panels.
XXXIX Convegno Nazionale di Idraulica e Costruzioni Idrauliche, Parma, Italy.
- 7) **07/2024:** P.G. Ledda, A. Seoni, M.G. Badas, G. Querzoli.
Toward a micrometeorological assessment of agrivoltaic farms: a feature-tracking velocimetry-based analysis.
21st International Symposium on Applications of Laser and Imaging Techniques to Fluid Mechanics, Lisbon, Portugal.
- 8) **06/2024:** P.G. Ledda.
Low Reynolds number hydraulics: from everyday observations to biomedical and technological applications.
Invited Junior Marchi Lecture. PhD Days and Marchi Lecture (GII), Trieste, Italy.
- 9) **06/2024:** P.G. Ledda, F. Angius, M.G. Badas, G. Querzoli.
Impact of renewable energy integration: a numerical study of atmospheric flow around models of agrivoltaic farms.
22nd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, Pärnu, Estonia.
- 10) **09/2023:** P.G. Ledda, M. Pezzulla, E. Jambon-Puillet, P.-T. Brun, F. Gallaire.
Gravity-driven coatings on three-dimensional curved substrates.
WECM'23 – 2nd Workshop on Experimental and Computational Mechanics, Pisa, Italy.
- 11) **08/2023:** P.G. Ledda, F. Angius, M.G. Badas, T. Rossi, G. Querzoli.
Flow dynamics of silicone oil tamponade in steady and unsteady conditions.
Engineering Mechanics Institute 2023 International Conference, Palermo, Italy.
- 12) **07/2023:** P.G. Ledda, F. Angius, M.G. Badas, T. Rossi, G. Querzoli.
Silicone oil tamponade flow dynamics following everyday movements.
Joint AIMETA GIMC-GMA-GBMA Meeting, Reggio Calabria, Italy.
- 13) **06/2023:** P.G. Ledda, G. Vagnoli, G.A. Zampogna, S. Camarri, F. Gallaire.
Linear path instability of buoyancy-driven permeable disks.
15th ERCOFTAC SIG 33 Workshop, Alghero, Italy.

- 14) 09/2022: P.G. Ledda, M. Pezzulla, E. Jambon-Puillet, P.-T. Brun, F. Gallaire.
Gravity-driven coatings on three-dimensional substrates.
14th European Fluid Mechanics Conference (EFMC14), Athens, Greece.
- 15) 11/2021: P.G. Ledda, E. Boujo, S. Camarri, F. Gallaire, G.A. Zampogna.
Homogenization-based optimization and design of microstructured membranes: flow past a circular cylindrical shell.
74th Annual Meeting of the APS Division of Fluid Dynamics, Phoenix, USA.
- 16) 09/2021: P.G. Ledda, G. Lerisson, G. Balestra, F. Gallaire.
To drip or not to drip: pattern formation of a thin film flowing under an inclined plane.
European Coating Symposium, Brussels, Belgium.
- 17) 08/2021: P.G. Ledda, G. Lerisson, G. Balestra, F. Gallaire.
Instability of a thin film flowing under an inclined plane.
25th International Congress of Theoretical and Applied Mechanics (ICTAM 2020+1), Milan, Italy.
- 18) 11/2020: P.G. Ledda, G. Balestra, G. Lerisson, B. Scheid, M. Wyart, F. Gallaire.
On the origin of draperies structures in limestone caves: two-dimensional analysis of the impulse response.
73rd Annual Meeting of the APS Division of Fluid Dynamics, virtual.
- 19) 09/2020: P.G. Ledda, G. Lerisson, G. Balestra, F. Gallaire.
Rivulet formation in a thin film flowing under an inclined plane.
Virtual Technical Meeting of the Society of Engineering Science.
- 20) 11/2019: P.G. Ledda, G. Lerisson, G. Balestra, F. Gallaire.
Pattern formation of a thin film flowing under an inclined plane.
72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, USA.

NATIONAL AND INTERNATIONAL AWARDS AND RECOGNITIONS FOR RESEARCH ACTIVITY

- 1) 2025: **Editors' Suggestion** in **Physical Review Letters**: Recognition related to the article "Fluid-induced snap-through instability of spherical shells, *Physical Review Letters* 135, 234002 (2025)", consisting in its selection by the Editorial Board of *Physical Review Letters*. This paper has been selected also for the cover of the journal issue, and its media coverage in a **Focus story in Physics Magazine**.
- 2) 2025: **Italian National Scientific Qualification** for the functions of Associate Professor in **08/A1** – Hydraulics, Hydrology, Hydraulic and Maritime Constructions.
- 3) 2025: **Italian National Scientific Qualification** for the functions of Associate Professor in **09/A1** – Aeronautical, Aerospace and Naval Engineering.
- 4) 2024: Recognition by the **Gruppo Italiano di Idraulica (GII)** through invitation to deliver the **2024 Junior Marchi Lecture**, held at the **PhD Days** in Trieste, with lecture entitled *Low Reynolds number hydraulics: from everyday observations to biomedical and technological applications*.
- 5) 2023: Recognition by the Editorial Board of **Physical Review Fluids** through designation as **Editors' Suggestion** for the article *F. Caruso Lombardi et al., Phys. Rev. Fluids 8, 083901 (2023)*.
- 6) 2023: **SWICCOMAS Prize 2023**, prize for the PhD dissertation, awarded by the **Swiss Community for Computational Methods in Applied Sciences**.
- 7) 2022: **2022 EDME Award**, prize for the best PhD thesis in the **Doctoral Program in Mechanics at EPFL** (Switzerland).
- 8) 2019: Recognition by **Physics Magazine** (APS) through **Featured in Physics** designation for the article *P.G. Ledda et al., Phys. Rev. Fluids 4, 071901(R)*.

9) 2018: 2018 APS/DFD Milton van Dyke Award at the DFD Gallery of Fluid Motion, awarded by the American Physical Society, for the video *Dripping down the rivulet*.

SELECTED THESIS SUPERVISION

Master's theses

1. *Three-dimensional instability of the von Kármán vortex street past a porous cylinder* – F. Caruso Lombardi, University of Pisa, 2022, during his visiting at EPFL.
2. *Wakes and paths of buoyancy-driven permeable disks: a linear stability approach* – G. Vagnoli, University of Pisa, 2022, during his visiting at EPFL.
3. *Wake flow past a permeable sphere: characterization, stability and design* – M. Ciuti, University of Pisa, 2021, during his visiting at EPFL.

Bachelor's theses

1. *Analisi sperimentale del flusso attorno ad un impianto agrivoltaico*. O. Pittau, University of Cagliari, 2024.
2. *Analisi sperimentale del flusso attorno ad ali bio-mimetiche*. M. L. Schirru, University of Cagliari, 2024.
3. *Analisi del flusso nella radice aortica in presenza di una valvola meccanica*. F. Cotza, University of Cagliari, 2025
4. *Studio sperimentale del flusso di velocità attorno a pannelli fotovoltaici a diversi livelli di altezza e angoli di inclinazione*. P. Palimodde, University of Cagliari, 2026
5. *Progettazione e realizzazione di un modello sperimentale dell'atrio destro per l'analisi del flusso ematico*. G. Zedda, University of Cagliari, 2026

INVITED SEMINARS

1. **2025:** *Wake instabilities and trajectories of porous bluff bodies*. LadHyX, École Polytechnique, Palaiseau, France.
2. **2024:** *Low Reynolds number hydraulics: from everyday observations to biomedical and technological applications*. **Junior Marchi Lecture**, Trieste, Italy.
3. **2024:** *Canopy flows of the built environment: numerical and experimental assessment of flow dynamics around photovoltaic farms*. MechE Seminar Series, EPFL, Lausanne, Switzerland.
4. **2023:** *From coating flow patterns to porous body wake dynamics via multiscale models*. University of Genoa, Italy.
5. **2023:** *What can we learn from flying seeds and deep-sea sponges? Flow around and through permeable bluff bodies*. IBIM Seminar Series, online.
6. **2021:** *Non-uniform spreading on curved substrates: from sphere to ellipsoid through a spheroid*, given at Complex Fluids Group, Princeton University, USA.

OTHER ACTIVITIES

Organization of conferences and scientific activities

- **2025:** Member of the organizing committee of the 16th ERCOFTAC SIG 33 Workshop, Cagliari, Italy, estimated 60 participants.
- **2020–2022:** Member of the organizing committee of the MEGA Seminar Series at EPFL.

Reviewer activity

Reviewer for journals including:

- Journal of Fluid Mechanics

- Physical Review Fluids
- Physics of Fluids
- Langmuir
- International Journal of Heat and Fluid Flow
- Meccanica

Outreach and additional activities

- Participation in **Pint of Science 2025**, Cagliari, Italy, with outreach activity on fluid–structure interaction and soft robotics.

Media Coverage

2026 *From Inside-out Umbrellas to Soft Robotics*. SIAM News

(<https://www.siam.org/publications/siam-news/articles/from-inside-out-umbrellas-to-soft-robotics/>)

2025 *Valve Design Employs Umbrella-Flipping Phenomenon*. Physics Magazine

(<https://physics.aps.org/articles/v18/193>)

2019 *Dandelion Fluff Perfected for Flight*, Physics Magazine

(<https://physics.aps.org/articles/v12/s76>).

2019 *The uplifting science of how dandelion seeds stay aloft*, PBS Magazine

(<https://www.pbs.org/wgbh/nova/article/dandelion-seed-flight/>).