Roger Ayats

Assistant Professor of Fluids Mechanics
Universitat Politècnica de Catalunya - BarcelonaTech
Castelldefels 08860, Barcelona, Spain

Email: roger.ayats@upc.edu
ResearcherID: AAR-8015-2020
ORCID: 0000-0001-6572-0621
Google-Scholar: scholar.Ayats
Website: www.rogerayats.com

Professional Experience

Assistant Professor of Fluid Mechanics, Department of Physics — Castelldefels, Spain
UPC - Universitat Politècnica de Catalunya - BarcelonaTech — 2026–

Postdoctoral Fellow, FWF ESPRIT — Klosterneuburg, Austria
ISTA - Institute of Science and Technology Austria — 2024–2025

Postdoctoral Fellow, Marie Skłodowska-Curie — Klosterneuburg, Austria
ISTA - Institute of Science and Technology Austria — 2022–2024

Adjunct Professor, Department of Science and Technology — Barcelona, Spain
ELISAVA - Universitat Pompeu Fabra — 2022–2022

Adjunct Professor, Department of Physics — Barcelona, Spain
UPC - Universitat Politècnica de Catalunya - BarcelonaTech — 2017–2020

Education

PhD. Aerospace Science and Technology — Barcelona, Spain
Universitat Politècnica de Catalunya — 2016–2022
Supervisors: Alvaro Meseguer, Fernando Mellibovsky
Thesis: Exact Coherent Structures in the Transitional Regime of Shear and Centrifugal Flows

M.Eng. Aeronautical Engineering — Terrassa, Spain
Universitat Politècnica de Catalunya — 2012–2015

B.Eng. Aeronautical Engineering: Air Navigation — Castelldefels, Spain
Universitat Politècnica de Catalunya — 2008–2012

Indexed Publications

*. [Under revision] **Ayats, R.**, Klotz, L. & Hof, B. "From directed percolation to patterned turbulence". *Under consideration for Nature Physics.* doi:10.48550/arXiv.2501.08014.

8. Wang, B., **Ayats, R.**, Deguchi, K., Meseguer, A. & Mellibovsky, F. (2025) "Feigenbaum universality in subcritical Taylor–Couette flow". *J. Fluid Mech.* **1010**, A36. doi:10.1017/jfm.2025.278.

7. Wang, B., **Ayats, R.**, Deguchi, K., Meseguer, A. & Mellibovsky, F. (2025) "Mathematically established chaos and forecast of statistics with recurrent patterns in Taylor-Couette flow". *J. Fluid Mech.* **1011**, R2. doi:10.1017/jfm.2025.151.

6. Wang, B., Mellibovsky, F., **Ayats, R.**, Deguchi, K. & Meseguer, A. (2023) "Mean structure of the supercritical turbulent spiral in Taylor–Couette flow". *Phil. Trans. R. Soc. A* **381**, 20220112. doi:10.1098/rsta.2022.0112.

5. Wang, B., **Ayats, R.**, Deguchi, K., Mellibovsky, F. & Meseguer, A. (2022) "Self-sustainment of coherent structures in counter-rotating Taylor–Couette flow". *J. Fluid Mech.* **951**, A21. doi:10.1017/jfm.2022.828.

4. Wang, B., **Ayats, R.**, Meseguer, A. & Marques, F. (2022) "Phase-locking flows between orthogonally stretching parallel plates". *Phys. Fluids* **34**, 114111. doi:10.1063/5.0124152.

3. **Ayats, R.**, Marques, F., Meseguer, A. & Weidman, P. D. (2021) "Flows between orthogonally stretching parallel plates". *Phys. Fluids* **33**, 024103. doi:10.1063/5.0037097.

2. **Ayats, R.**, Deguchi, K., Mellibovsky, F. & Meseguer, A. (2020) "Fully nonlinear mode competition in magnetised Taylor–Couette flow". *J. Fluid Mech.* **897**, A14. doi:10.1017/jfm.2020.365.

1. **Ayats, R.**, Meseguer, A. & Mellibovsky, F. (2020) "Symmetry-breaking waves and space-time modulation mechanisms in two-dimensional plane Poiseuille flow". *Phys. Rev. Fluids* **5**, 094401. doi:10.1103/PhysRevFluids.5.094401.

International Conferences and Talks

18. **Ayats, R.** & Hof, B. *Turbulent stripes and bands pattern–formation mechanisms in planar shear flows* in *2nd European Fluid Dynamics Conference* (August 2025, Dublin, Ireland). EFDC2: Cat. 32, Session 5, Talk 677.

17. **Ayats, R.**, Klotz, L. & Hof, B. *Turbulent bands and stripes formation mechanisms in planar shear flows* *3rd Spanish Fluid Mechanics Conference* (June 2025, Málaga, Spain). SFMC25: talk abstract.

16. Mellibovsky, F., Wang, B., **Ayats, R.**, Meseguer, A. & Deguchi, K. *Forecast of chaotic statistics from periodic orbits in Taylor-Couette flow* in *3rd Spanish Fluid Mechanics Conference* (June 2025, Málaga, Spain). SFMC25: talk abstract.

15. **Ayats, R.**, Klotz, L. & Hof, B. *Turbulent-laminar stripe patterns arising within the directed percolation scaling regime* in *1st European Fluid Dynamics Conference* (September 2024, Aachen, Germany). EFDC1: A02-09 Session.

14. Deguchi, K., Wang, B., **Ayats, R.**, Mellibovsky, F. & Meseguer, A. *Chaos and unstable periodic orbits in subcritical Taylor-Couette flow* in *76th Annual Meeting of the Division of Fluid Dynamics. APS* (November 2023, Washington DC, USA). APS76: talk X26.00001.

13. **Ayats, R.**, Yalnız, G., Mellibovsky, F., Meseguer, A. & Hof, B. *Optimal orientation of oblique turbulent stripes in planar shear flows* in *18th European Turbulence Conference* (September 2023, Valencia, Spain).
ETC18: talk 499.

12. Wang, B., **Ayats, R.**, Deguchi, K., Meseguer, A. & Mellibovsky, F. *Chaos and unstable periodic orbits in subcritical Taylor-Couette flow* in *10th International Congress on Industrial and Applied Mathematics* (August 2023, Tokyo, Japan).
ICIAM10: talk 04406.

11. **Ayats, R.**, Wang, B., Deguchi, K., Mellibovsky, F. & Meseguer, A. *Edge states alternation and period doubling cascades in subcritical Taylor-Couette flow* in *2nd Spanish Fluid Mechanics Conference* (July 2023, Barcelona, Spain).
SFMC2: talk abstract p.146 .

10. Wang. B,. **Ayats, R.**, Deguchi, K., Mellibovsky, F. & Meseguer, A. *Self-sustainment, Period Doubling and Boundary Crisis of Subcritical Rotating Waves in Taylor-Couette Flow* in *2nd Spanish Fluid Mechanics Conference* (July 2023, Barcelona, Spain).
SFMC2: talk abstract p.157 .

9. **Ayats, R.**, Wang, B., Deguchi, K., Mellibovsky, F. & Meseguer, A. *Feigenbaum cascades and one dimensional map reduction in subcritical Taylor-Couette flow* in *22nd International Couette-Taylor Workshop* (June 2023, Barcelona, Spain).
ICTW23: talk abstract p.59 .

8. Wang. B., **Ayats, R.**, Deguchi, K., Mellibovsky, F. & Meseguer, A. *Self-sustained Coherent Structures Underlying Spiral Turbulence in Taylor–Couette Flow* in *22nd International Couette-Taylor Workshop* (June 2023, Barcelona, Spain).
ICTW23: talk abstract p.99 .

7. Mellibovsky, F., Wang. B., **Ayats, R.**, Meseguer, A. & Deguchi, K. *Flow field statistics of the supercritical turbulent spiral in counter-rotating Taylor-Couette flow* in *22nd International Couette-Taylor Workshop* (June 2023, Barcelona, Spain).
ICTW23: talk abstract p.61 .

6. Meseguer, A., Wang. B., **Ayats, R.**, Mellibovsky, F. & Deguchi, K. *Underlying exact coherent structures within spiral turbulence* in *1st Spanish Fluid Mechanics Conference* (June 2022, Cádiz, Spain).
SFMC1: talk 153 .

5. **Ayats, R.**, Wang, B., Meseguer, A., Mellibovsky, F. & Deguchi, K. *Non-orthogonal computational domains and subcritical stable rotating waves in Taylor-Couette flow* in *Congreso Bienal de la Real Sociedad Matemática Española 2022* (January 2022, Ciudad Real, Spain).
RSME2022: talk abstract p.220 .

4. Wang, B., **Ayats, R.**, Meseguer, A., Mellibovsky, F. & Deguchi, K. *Periodic orbits near the onset of subcritical chaos in Taylor-Couette flow* in *Congreso Bienal de la Real Sociedad Matemática Española 2022* (January 2022, Ciudad Real, Spain).
RSME2022: talk abstract p.210 .

3. Meseguer, A., Wang. B., **Ayats, R.**, Mellibovsky, F. & Deguchi, K. *Stable rotating waves in subcritical counter-rotating Taylor–Couette flows* in *21st International Couette-Taylor Workshop* (July 2021, Online).
ICTW21: talk 9 .

2. Wang, B., **Ayats, R.**, Meseguer, A., Mellibovsky, F. & Deguchi, K. *Period doubling cascade of subcritical rotating waves in counter-rotating Taylor–Couette flow* in *21st International Couette-Taylor Workshop*

(July 2021, Online).
ICTW21: talk 10 .

1. **Ayats, R.**, Meseguer, A. & Mellibovsky, F. *On a new family of Tollmien-Schlichting waves* in *20th International Couette-Taylor Workshop* (July 2018, Marseille, France).
RSME2022: talk abstract p.9 .

Research Projects

- **Pattern Formation Mechanisms in Planar Shear Flows** Sep.24–Aug.27
Principal Investigator of the competitive project funded by the "FWF Austrian Science Fund" FWF ESPRIT program https://research-radar/10.55776/ESP1481224

- **Decoding the Chaos Boundary in Thermal Convection, Shear and Centrifugal Problems with Application to Aerospace Flows** Sep.24–Aug.27
Participating in the competitive project funded by the "Agencia Estatal de Inverstigación" from the Spanish Gov. https://futur.upc.edu/39827907

- **Optimising energy savings in fluid transport pipelines** Sep.22–Sep.24
Principal Investigator of the project supervised by Björn Hof
Marie Skłodowska-Curie IST-BRIDGE https://ist.ac.at/en/research/hof-group/

- **High Performance Computing of Hydrodynamic Coherent Structures** Sep.21–Aug.25
Participating in the competitive project funded by the "Agencia Estatal de Inverstigación" from the Spanish Gov. https://futur.upc.edu/31971739

Teaching Experience

- **Core Project** of PhD. students in Institute of Science and Technology Austria ISTA Sep.24–Jan.25
Teaching Assistant to 1st year PhD. students.
- **Fluids and Electromagnetism** within the B.Eng. in Industrial Design Eng. at ELISAVA-UPF Jan.22–Mar.22
Theory, Laboratory and Problem solving lectures for 2nd year students.
- **Fluid Mechanics** within the B.Eng. in Aeronautical and Telecom Engineering at UPC Sep.17–Jan.20
Problem solving lectures for 2nd year students.
- **Numerical and Computational Methods I** within the B.Eng. in Physics Engineering at UPC Sep.18–Jan.20
Practical lectures for 1st year students.
- **Mechanics** within the B.Eng. in Civil Engineering at UPC Apr.17–July 20
Laboratory and Problem solving lectures for 1st year students.
- **Mechanics** within the B.Eng. in Geological Engineering at UPC Mar.17–July 17
Problem solving lectures for 1st year students.

Languages

- **Catalan:** Native. (C1 Certificate)
- **Spanish:** Native.
- **English:** Advanced. (CAE Cambridge English Advanced Certificate)
- **German:** Basic-Intermediate. (Level B1)
- **French:** Basic. (DELF A2 Certificate)