

Georgios Rigas

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EXPERIENCE

2019–present **Imperial College London**
Department of Aeronautics
SENIOR LECTURER in Aerodynamics (2022–present)
LECTURER in Aerodynamics (2019–2022)

2016-2019 **Caltech**
Mechanical & Civil Engineering
SENIOR POSTDOCTORAL SCHOLAR

2015-2016 **University of Cambridge**
Department of Engineering
POSTDOCTORAL RESEARCH ASSOCIATE

EDUCATION

2010–2014 **Ph.D. in Aeronautical Engineering, Imperial College London**
Thesis: Modelling and control of turbulent wake flows.
Research advisors: Prof. Aimee S. Morgans, Prof. Jonathan F. Morrison

2005–2010 **Diploma in Mechanical Engineering, National Technical University of Athens**
Thesis: Simulation and low-budget optimization of the active control of flows around airfoils.
Research advisor: Prof. Kyriakos C. Giannakoglou

ADDITIONAL EXPERIENCE

2022 Visiting Research Scholar, Center for Turbulence Research Summer Program, Stanford
2018 Visiting Researcher, NASA Langley (Hosts: Meelan Choudhari, Pedro Paredes)
2016 Visiting Research Scholar, Center for Turbulence Research Summer Program, Stanford
2015 Visiting Research Scholar, ONERA DAFE, Paris (Host: Denis Sipp)
2011–2013 Teaching Assistant, Imperial College London
2009 Intern, Hellenic Aerospace Industry, Athens

PROFESSIONAL ACTIVITY

2022– Steering Committee member of ERCOFTAC SIG on [Machine Learning for Fluid Dynamics](#)
2020– Co-leader of UKFN SIG on [Flow instability, modelling and control](#)
2020– Member of NATO Task Group AVT 346 on Hypersonic Transition
2019– UKFN SIG Committee: Data-driven methods, machine learning and optimization in fluid mechanics

TEACHING

Turbulence and Turbulence Modelling, Year 3/4 UG & MSc (2020-2023)
Applied Aerodynamics, core MSc (2019-2023)

Under review

40. S. Kneer, T. Sayadi, D. Sipp, P. Schmid, and G. Rigas. Symmetry-Aware Autoencoders: s-PCA and s-nlPCA. 2022. [arXiv:2111.02893](#).

2023

39. C. Scherding, G. Rigas, D. Sipp, P. J. Schmid, and T. Sayadi. Data-driven framework for input/output lookup tables reduction: Application to hypersonic flows in chemical nonequilibrium. *Physical Review Fluids*, 8(2):023201, 2023. [arXiv:2210.04269](#), [doi:10.1103/PhysRevFluids.8.023201](#).
38. L. Sliwinski and G. Rigas. Mean flow reconstruction of unsteady flows using physics-informed neural networks. *Data-Centric Engineering*, 4:e4, 2023. [doi:10.1017/dce.2022.37](#).
37. A. Poulain, C. Content, D. Sipp, G. Rigas, and E. Garnier. BROADCAST: A high-order compressible CFD toolbox for stability and sensitivity using Algorithmic Differentiation. *Computer Physics Communications*, page 108557, 2023. [doi:10.1016/j.cpc.2022.108557](#).
36. K. Ozawa, C. Xia, G. Rigas, and P. J. Bruce. Passive control of high-speed boundary layer transition using non-uniform surface temperature distributions. In *AIAA-0849*, 2023. [doi:doi:10.2514/6.2023-0849](#).

2022

35. D. Kelshaw, G. Rigas, and L. Magri. Physics-Informed CNNs for Super-Resolution of Sparse Observations on Dynamical Systems. *NeurIPS Machine Learning and the Physical Sciences Workshop*, 2022. [arXiv:2210.17319](#).
34. A. Towne, G. Rigas, O. Kamal, E. Pickering, and T. Colonius. Efficient global resolvent analysis via the one-way Navier-Stokes equations. *Journal of Fluid Mechanics*, 948:A9, 2022. [doi:10.1017/jfm.2022.647](#).
33. X. He, J. Tan, G. Rigas, and M. Vahdati. On the explainability of machine-learning-assisted turbulence modelling for transonic flows. *International Journal of Heat and Fluid Flow*, 97:109038, 2022. [doi:10.1016/j.ijheatfluidflow.2022.109038](#).
32. A. E. Giannenas, S. Laizet, and G. Rigas. Harmonic forcing of a laminar bluff body wake with rear pitching flaps. *Journal of Fluid Mechanics*, 945, 2022. [doi:10.1017/jfm.2022.520](#).
31. J. L. Callaham, G. Rigas, J.-C. Loiseau, and S. L. Brunton. An empirical mean-field model of symmetry-breaking in a turbulent wake. *Science Advances*, 8(19):eabm4786, 2022. [doi:10.1126/sciadv.abm4786](#).
30. O. Kamal, G. Rigas, M. T. Lakebrink, and T. Colonius. Input/output analysis of a Mach-6 cooled-wall hypersonic boundary layer using the One-Way Navier-Stokes (OWNS) Equations. In *AIAA-3556*, 2022. [doi:10.2514/6.2022-3556](#).

2021

29. J. L. Callaham, J.-C. Loiseau, G. Rigas, and S. L. Brunton. Nonlinear stochastic modelling with langevin regression. *Proceedings of the Royal Society A*, 477(2250):20210092, 2021. [doi:10.1098/rspa.2021.0092](#).
28. E. Pickering, G. Rigas, O. T Schmidt, D. Sipp, and T. Colonius. Optimal eddy viscosity for resolvent-based models of coherent structures in turbulent jets. *Journal of Fluid Mechanics*, 917, 2021. [doi:10.1017/jfm.2021.232](#).
27. O. Kamal, G. Rigas, M. Lakebrink, and T. Colonius. Input/Output Analysis of Hypersonic Boundary Layers using the One-Way Navier-Stokes (OWNS) Equations. In *AIAA-2827*, 2021. [doi:10.2514/6.2021-2827](#).

26. J. Tan, X. He, M. Vahdati, and G Rigas. Machine Learning Assisted Turbulence Modelling for Transonic Flows. In *European Turbomachinery Conference*, 2021. URL: https://www.researchgate.net/publication/344903748_Machine_Learning_Assisted_Turbulence_Modelling_for_Transonic_Flows.
25. X. He, Z. Fang, G. Rigas, and M. Vahdati. Spectral proper orthogonal decomposition of compressor tip leakage flow. *Physics of Fluids*, 33(10):105105, 2021. doi:10.1063/5.0065929.
24. G. Rigas, D. Sipp, and T. Colonius. Nonlinear input/output analysis: application to boundary layer transition. *Journal of Fluid Mechanics*, 911:A15, 2021. doi:10.1017/jfm.2020.982.

2020

23. E. Pickering, G. Rigas, P. A. S. Nogueira, A. V. G. Cavalieri, O. T Schmidt, and T. Colonius. Lift-up, Kelvin–Helmholtz and Orr mechanisms in turbulent jets. *Journal of Fluid Mechanics*, 896(A2), 2020. doi:10.1017/jfm.2020.301.
22. O. Kamal, G. Rigas, M. T. Lakebrink, and T. Colonius. Application of the One-Way Navier-Stokes (OWNS) equations to hypersonic boundary layers. In *AIAA-2986*, 2020. doi:10.2514/6.2020-2986.
21. D. Brouzet, A. Haghiri, M. Talei, M. J. Brear, O. T. Schmidt, G. Rigas, and T. Colonius. Role of coherent structures in turbulent premixed flame acoustics. *AIAA Journal*, 2020. doi:10.2514/1.J058480.

2019

20. A. Towne, G. Rigas, and T. Colonius. A critical assessment of the parabolized stability equations. *Theoretical and Computational Fluid Dynamics*, 33:359–382, 2019. doi:10.1007/s00162-019-00498-8.
19. G. Rigas, E. Pickering, O. T. Schmidt, P. A. Nogueira, A. V. Cavalieri, G. A. Brès, and T. Colonius. Streaks and coherent structures in jets from round and serrated nozzles. In *AIAA-2597*, 2019. doi:10.2514/6.2019-2597.
18. E. Pickering, G. Rigas, D. Sipp, O. T. Schmidt, and T. Colonius. Eddy viscosity for resolvent-based jet noise models. In *AIAA-2454*, 2019. doi:10.2514/6.2019-2454.
17. P. A. Nogueira, A. V. Cavalieri, O. T. Schmidt, P. Jordan, V. Jaunet, E. Pickering, G. Rigas, and T. Colonius. Resolvent-based analysis of streaks in turbulent jets. In *AIAA-2569*, 2019. doi:10.2514/6.2019-2569.

2018

16. O. T. Schmidt, A. Towne, G. Rigas, T. Colonius, and G. A. Brès. Spectral analysis of jet turbulence. *Journal of Fluid Mechanics*, 855:953–982, 2018. doi:10.1017/jfm.2018.675.
15. G. Brès, S. T. Bose, M. Emory, Frank E. Ham, O. Schmidt, G. Rigas, and T. Colonius. Large-eddy simulations of co-annular turbulent jet using a Voronoi-based mesh generation framework. In *AIAA-3302*, 2018. doi:10.2514/6.2018-3302.

2017

14. G. Rigas, A. S. Morgans, and J. F. Morrison. Weakly nonlinear modelling of a forced turbulent axisymmetric wake. *Journal of Fluid Mechanics*, 814:570–591, 2017. doi:10.1017/jfm.2017.32.
13. N. P. Jamieson and G. Rigas and M. P. Juniper. Experimental sensitivity analysis via a secondary heat source in an oscillating thermoacoustic system. *Int. J. Spray Comb. Dyn.*, 9:230–240, 2017. doi:10.1177/1756827717696325.
12. G. Rigas, O. Schmidt, T. Colonius, and G. Brès. One Way Navier-Stokes and resolvent analysis for modeling coherent structures in a supersonic turbulent jet. In *AIAA-4046*, 2017. doi:10.2514/6.2017-4046.

11. G. Rigas, T. Colonius, and M. Beyar. Stability of wall-bounded flows using one-way spatial integration of Navier-Stokes. In *AIAA-1881*, 2017. doi:10.2514/6.2017-1881.

2016

10. A. Orchini, G. Rigas, and M. P. Juniper. Weakly nonlinear analysis of thermoacoustic bifurcations in a Rijke tube. *Journal of Fluid Mechanics*, 805:523–550, 2016. doi:10.1017/jfm.2016.585.
9. R. D. Brackston, J. M. Garcia de la Cruz, A. Wynn, G. Rigas, and J. F. Morrison. Stochastic modelling and feedback control of bistability in a turbulent bluff body wake. *Journal of Fluid Mechanics*, 802:726–749, 2016. doi:10.1017/jfm.2016.495.
8. G. Rigas, N. P. Jamieson, L. K. B. Li, and M. P. Juniper. Experimental sensitivity analysis and control of thermoacoustic systems. *Journal of Fluid Mechanics (Rapid Communication)*, 787 R1, 2016. doi:10.1017/jfm.2015.715.
7. G. Rigas, L. Esclapez, and L. Magri. Symmetry breaking in 3D wakes. In *Proceedings of the Summer Program*. Center for Turbulence Research, Stanford University, 2016. arXiv:1703.07405.
6. P.J. Blonigan, P. Fernandez, S.M. Murman, Q. Wang, G. Rigas, and L. Magri. Towards a chaotic adjoint for LES. In *Proceedings of the Summer Program*. Center for Turbulence Research, Stanford University, 2016. arXiv:1702.06809.

2015

5. G. Rigas, A. S. Morgans, R. D. Brackston, and J. F. Morrison. Diffusive dynamics and stochastic models of turbulent axisymmetric wakes. *Journal of Fluid Mechanics (Rapid Communication)*, 778 R2, 2015. doi:10.1017/jfm.2015.390.
4. A. R. Oxlade, J. F. Morrison, A. Qubain, and G. Rigas. High-frequency forcing of a turbulent axisymmetric wake. *Journal of Fluid Mechanics*, 770:305–318, 2015. doi:10.1017/jfm.2015.153.

2014

3. G. Rigas, A. S. Morgans, and J. F. Morrison. Stability and coherent structures in the wake of axisymmetric bluff bodies at high Reynolds numbers. In *Instability and Control of Massively Separated Flows, Fluid Mechanics and Its Applications*, volume 107, pages 143–148. Springer, 2015. doi:10.1007/978-3-319-06260-0_21.
2. A. R. Oxlade, J. F. Morrison, and G. Rigas. Open-loop control of a turbulent axisymmetric wake. In *Instability and Control of Massively Separated Flows, Fluid Mechanics and Its Applications*, volume 107, pages 137–142. Springer, 2015. doi:10.1007/978-3-319-06260-0_20.
1. G. Rigas, A. R. Oxlade, A. S. Morgans, and J. F. Morrison. Low-dimensional dynamics of a turbulent axisymmetric wake. *Journal of Fluid Mechanics (Rapid Communication)*, 755 R5, 2014. doi:10.1017/jfm.2014.449.

PATENTS

1. G. Rigas, R. D. Brackston, J. M. Garcia de la Cruz Lopez, J. F. Morrison, and A. Wynn. Adaptive Base-Flaps Under Variable Cross-Wind, filed Feb 07, 2018. PCT/GB2018/050348.
2. G. Rigas, R. D. Brackston, J. M. Garcia de la Cruz Lopez, J. F. Morrison, and A. Wynn. Drag reduction method, filed Oct 31, 2016, and issued May 4, 2017. WO Patent App. PCT/GB2016/053364. URL: <https://www.google.com/patents/WO2017072530A1>.

AWARDS & FUNDING _____

5. **2022: QinetiQ (co-PI, PI P. Bruce)**
 “A novel surface for passive control of hypersonic boundary layer transition”
3. **2021: US AirForce, AFOSR-EOARD (PI)**
 “Nonlinear Flow Receptivity in Shock-Wave Boundary-Layer Interaction”
2. **2020: UK-France Joint Research Program, French Ministry of Defence (co-PI)**
 PI: D. Sipp, ONERA
 “Optimization of a control device to trigger laminar/turbulent transition in hypersonic flows”
 Joint ONERA-IC PhD studentship (2yrs at ONERA, 1yr at IC)
1. **2020: Imperial-CNRS joint PhD program (Imperial PI)**
 “Model design and model reduction for fluid flows using machine-learning techniques”
 2 PhD studentships: 1 hosted at IC, 1 at Sorbonne
 co-PIs: P. Schmidt (Dept. of Mathematics, IC), D. Sipp (ONERA), T. Sayadi (Sorbonne PI)

SUPERVISION: PHD _____

	Student Name	Title	Start	End	Supervisor	Funding
7.	Gupta, Priyam (current)	Model design and model reduction for fluid flows using machine-learning techniques	2022	2026	Georgios Rigas	IC-CNRS & EPSRC DTA
6.	Savarino, Flavio (current)	Nonlinear flow receptivity of SWBLI	2021	2025	Georgios Rigas, Denis Sipp	AFOSR
5.	Xia, Chengwei (current)	Flow Control with Reinforcement Learning	2021	2025	Georgios Rigas, Eric Kerrigan	
4.	Pullain, Arthur (current)	Nonlinear stability of high-speed flows	2020	2024	Denis Sipp, Georgios Rigas	UK-France joint PhD program
3.	Scherding, Clément (current)	Model design and model reduction for fluid flows using machine-learning techniques	2020	2024	Taraneh Sayadi, Georgios Rigas	IC-CNRS (CNRS side)
2.	Patel, Yusuf (current)	Machine learning based flow sensitivity	2020	2024	Georgios Rigas	EPSRC DTA
1.	Zhu, Taihang (current)	Turbulent wake modelling and control	2019	2023	Jonathan Morrison, Georgios Rigas	

SUPERVISION: POSTDOC _____

1. Ding, Shan-shan
 (2021 Oct-, visiting researcher, with Dr O. Buxton)

SUPERVISION: MENG 4TH YEAR, MSc, UROP _____

30+ students in 2019-2022

PROFESSIONAL ACTIVITY

Reviewer	Journal of Fluid Mechanics, Nature, Nature Communications, Physical Review Letters, Physical Review Fluids, Journal of Computational Physics, Experiments in Fluids, Physics of Fluids, Journal of Heat and Fluid Flow, Journal of Fluids and Structures, Fluid Dynamics Research, Experimental Thermal and Fluid Science, Journal of Wind Engineering & Industrial Aerodynamics, Flow Measurement and Instrumentation, AIAA Journal, AIAA Aviation proceedings
Panel member	Engineering and Physical Sciences Research Council (EPSRC), French National Research Agency (ANR), U.S. Army Research Office (ARO)
Session chair	APS DFD, Indianapolis, 2022. Session: Experimental Techniques: Data Assimilation, Bias and Uncertainty IUTAM Transition, London, 2019. Session: Dynamical Systems I Wavepacketfest, Poitiers, 2019. Session: Supersonic flow with shocks AIAA SciTech Forum, Grapevine TX, 2017. Session: Flow Stability Analysis
Memberships	American Physical Society, American Institute of Aeronautics and Astronautics

INVITED TALKS (2021-2022)

2022 Dec	Keynote UKFN SIG, Leeds Fluids Institute
2022 Jun	Keynote ERCOFTAC SIG 33, Cadiz, Spain
2022 Feb	Newton Institute, Cambridge video link
2022 Feb	Seminaire de Mecanique d'Orsay series, Paris
2022 Feb	ONERA Meudon, Paris
2022 Feb	Sorbonne University, Paris Youtube link
2021 Dec	Australasian Fluid Mechanics Society (AFMS) Youtube link
2021 Nov	TU Delft / Faculty of Aerospace Engineering Youtube link
2021 Jun	SIAM Conference on Computational Science and Engineering

PUBLIC ENGAGEMENT

4. [Sense about Science](#), UK Parliament, Nov 2022
3. Co-organiser of 2 online meetings on UKFN SIG Flow Instability with > 150 attendees, 2020
2. [Youtube](#) channel for UKFN SIG on [Flow instability, modelling and control](#)
1. Department of Aeronautics showcase. "Data Science, Optimisation and Control" [Youtube link](#)

ROLES IN THE IC AERO DEPARTMENT

2022-	Fluids seminar series organiser.
2021-	Health & Safety Committee, experimental aerodynamics representative
2021-	Junior Research Fellowship departmental panel
2021-	Equipment bid panel
2020-	Departmental Careers Advisor (UG and PG). Aero Careers website
2020-	Year in Industry Coordinator (UG). Aero Year in Industry website

PHD COMMITTEES

3. (2022 Dec) Paris, Romain (ONERA Meudon)
2. (2022 Apr) Frantz, Ricardo (Arts et Métiers ParisTech)
1. (2021 Dec) Jiao, Yuxin (IC Aero)