Benjamin Herrmann

Assistant Professor
Department of Mechanical and Metallurgical Engineering
Department of Hydraulic and Environmental Engineering
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Research Interests

Fluid dynamics: *Fluid-structure interaction, turbulence and instability, resolvent analysis, aerodynamics.*
Dynamics and control: *Nonlinear dynamics, low-order models, sensor/actuator placement, system identification.*
Data-driven modeling: *Physics informed ML, model discovery, modal decompositions, digital twins.*

Affiliations

Pontificia Universidad Católica de Chile

2025 – present Assistant Professor, Department of Mechanical and Metallurgical Engineering, Department of Hydraulic and Environmental Engineering

Universidad de Chile

2021 – 2025 Assistant Professor, Department of Mechanical Engineering

Education

Universidad de Chile

Ph.D. in Fluid Dynamics, 2018.
Dissertation: *Heat transfer enhancement strategies in a swirl flow channel heat sink based on hydrodynamic receptivity*
Advisor: Williams R. Calderón-Muñoz, wicalder@ing.uchile.cl

M.Sc. in Mechanical Engineering, 2014. GPA 4.0
Dissertation: *Siting of urban wind turbines and available energy potential based on urban configuration*
Advisor: Williams R. Calderón-Muñoz, wicalder@ing.uchile.cl

B.Sc. in Mechanical Engineering, 2014. GPA 4.0

Teaching

Instructor: Pontificia Universidad Católica de Chile, School of Engineering
- Data-driven modeling for science and engineering, Spring Semester 2025.
- Fluid mechanics, Spring Semester 2025.

Instructor: Universidad de Chile, Department of Mechanical Engineering
- Heat transfer, Fall Semesters 2022–2024.
- Statics, Fall Semesters 2022–2023.
- Introduction to nonlinear dynamics, Spring Semesters 2021–2024.

Co-instructor (with S. L. Brunton): University of Washington, Department of Mechanical Engineering
- Machine learning control, Spring Quarter 2020.

Lecturer: University of Chile, Department of Mechanical Engineering
- Fundamentals of heat transfer – Diplomado en climatización 2018.

Teaching assistant: University of Chile, Department of Mechanical Engineering

- Aerodynamics, Mar 2014–Jun 2014.
- Thermal and fluids engineering, Mar 2014–Jun 2014.
- Fluid mechanics, Aug 2011–Jun 2013.
- Solid mechanics, Aug 2009–Nov 2009.

Mentoring & Advising

Current (1 Postdoc, 2 PhD, 2 Masters, 1 Undergraduate)

Postdocs:
Ian Wolde [2025]. PUC.

PhDs:
Nicolás Mancilla [2025–present]. PUC.
Erick Kracht [2023–present]. PUC.

Masters:
Ian Addison-Smith [2024–present]. UChile.
Matías Bahamondes [2022–present]. UChile.

Undergraduates:
Benjamin Reyes [2024–present]. UChile.

Lab Alumni (3 Masters, 5 Undergraduates)

Masters:
Diemen Delgado [2023–2025]. UChile.
Nicolás Torres [2023–2025]. UChile.
Javier Lemus [2022–2023]. UChile.

Undergraduates:
Klaus Gajardo [2024–2025]. UChile.
Juan F. Salvo [2023–2024]. UChile.
Juan P. Caldera [2023–2024]. UChile.
Efraín Magaña Reyes [2022–2023]. UChile.
Ignacio Sanhueza Reyes [2021–2022]. UChile.

Postdoctoral Positions

May 2019 – May 2021	University of Washington, USA. *Data-driven methods for analysis of large-scale dynamical systems.* Supervisor: Steven L. Brunton, sbrunton@uw.edu
Apr 2019 – Nov 2020	Technische Universität Braunschweig, Germany. *Data-driven modeling of aerodynamic systems for experimental feedback control.* Supervisor: Richard Semaan, r.semaan@tu-bs.edu
Jul 2018 – Jan 2019	Universidad de Chile, Chile. *Modeling of conjugate heat transfer and fluid flow in a volumetric solar receiver.* Supervisor: José Miguel Cardemil, jmcardem@uc.cl

Awards and Honors

PRIME Fellowship – DAAD: Postdoctoral Researchers International Mobility Experience, 2019-2020
Beca Doctorado Nacional 2015 – CONICYT: Fellowship for Doctoral Studies, 2015-2018.

Funding

1. **ANID – FONDECYT Regular 1250693,** *Uncovering turbulent flow physics with mean-flow-based analysis and data-driven modeling*, PI, 2025–2029, ***$197M CLP***.

2. **Center for Turbulence Research, Stanford University – CTR Summer Program 2024,** *Data-driven linear analyses of turbulent flows,* PI, June–July 2024, ***$7.3k USD.***

3. **ANID – FONDECYT Iniciación 11220465,** *Methods for data-driven modeling of dynamical systems with applications to control, optimization and analysis of fluid flows*, PI, 2022–2024, ***$85M CLP***.

4. **Universidad de Chile – U-Inicia UI-003/21,** *Métodos para el modelamiento basado en datos de sistemas dinámicos con aplicaciones a control, optimización y análisis de flujos de fluido*, PI, 2022–2023, ***$8M CLP***.

5. **DAAD – PRIME Fellowship**, *Data-driven feedback control of a turbulent flow around a D-shaped body for drag reduction*, 2019–2020, ***$125k €.***

Journal Publications

494 Google Scholar citations; h-index 10; i10-index 10

1. J. Lemus and **B. Herrmann**
   Multi-objective SINDy for parameterized model discovery from single transient trajectory data
   Nonlinear Dynamics, 1–17, 2024.

2. F. Escudero, V. Chernov, J. J. Cruz, E. Magaña, **B. Herrmann**, and A. Fuentes
   Robust automatic retrieval of soot volume fraction, temperature and radiation for axisymmetric flames.
   Proceedings of the Combustion Institute, *40* (1-4), 105493, 2024.

3. **B. Herrmann**, P. Baddoo, R. Semaan, S. L. Brunton, and B. J. McKeon
   Interpolatory input and output projections for flow control
   Journal of Fluid Mechanics, **971:** A27, 2023.

4. P. Baddoo, **B. Herrmann**, B. J. McKeon, J. N. Kutz, and S. L. Brunton
   Physics-informed dynamic mode decomposition
   Proceedings of the Royal Society A, **479:** 20220576, 2023.

5. **B. Herrmann**, J. E. Pohl , S. L. Brunton, and R. Semaan
   Gust mitigation through closed-loop control. II. Feedforward and feedback control
   Physical Review Fluids, **7**: 024706, 2022.

6. J. E. Pohl, R. Radespiel, **B. Herrmann**, S. L. Brunton, and R. Semaan
   Gust mitigation through closed-loop control. I. Trailing-edge flap response
   Physical Review Fluids, **7**: 024705, 2022.

7. P. Baddoo, **B. Herrmann**, B. J. McKeon, and S. L. Brunton
   Kernel learning for robust dynamic mode decomposition: linear and nonlinear disambiguation optimization (LANDO)
   Proceedings of the Royal Society A, **478:** 20210830, 2022.

8. M. Behzad, **B. Herrmann**, W. R. Calderón-Muñoz, J. M. Cardemil, and R. Barraza
   Thermo-structural analysis of a honeycomb-type volumetric absorber for concentrated solar power applications
   International Journal of Numerical Methods for Heat and Fluid Flow, **32**: 598-615, 2022.

9. **B. Herrmann**, P. Baddoo, R. Semaan, S. L. Brunton, and B. J. McKeon
   Data-driven resolvent analysis
   Journal of Fluid Mechanics **918:** A10, 2021.

10. **B. Herrmann**, P. Oswald, R. Semaan, and S. L. Brunton

Modeling synchronization in forced turbulent oscillator flows
Communications Physics, **3**: 195, 2020.

11. **B. Herrmann**, M. Behzad, J. M. Cardemil, W. R. Calderón-Muñoz, and R. M. Fernández
Conjugate heat transfer model for feedback control and state estimation in a volumetric solar receiver
Solar Energy, **198**: 343-354, 2020.
12. **B. Herrmann-Priesnitz**, W. R. Calderón-Muñoz, G. Diaz, and R. Soto
Heat transfer enhancement strategies in a swirl flow minichannel heat sink based on hydrodynamic receptivity
International Journal of Heat and Mass Transfer, **127**: 245-256, 2018.
13. **B. Herrmann-Priesnitz**, W. R. Calderón-Muñoz, and R. Soto
Stability and receptivity of boundary layers in a swirl flow channel
Acta Mechanica, **229**: 4005-4015, 2018.
14. **B. Herrmann-Priesnitz**, W. R. Calderón-Muñoz, A. Valencia, and R. Soto
Thermal design exploration of a swirl flow microchannel heat sink for high heat flux applications based on numerical simulations
Applied Thermal Engineering, **109**: 22-34, 2016.
15. **B. Herrmann-Priesnitz**, W. R. Calderón-Muñoz, E. A. Salas, A. Vargas, M. A. Duarte, and D. A. Torres
Hydrodynamic structure of the boundary layers in a rotating cylindrical cavity with radial inflow
Physics of Fluids, **28**: 033601, 2016.
16. **B. Herrmann-Priesnitz**, W. R. Calderón-Muñoz and R. LeBoeuf
Effects of urban configuration on the wind energy distribution over a building
Journal of Renewable and Sustainable Energy, **7**: 033106, 2015.

Conference Papers

1. **B. Herrmann**, E. Kracht, S. L. Brunton, and B. J. McKeon
Sparse sensor placement for turbulent flow field reconstruction based on mean-flow-linearized dynamics
Thirteenth International Symposium on Turbulence and Shear Flow Phenomena, TSFP 2024.
2. C. Sarmiento, J. M. Cardemil, **B. Herrmann**, and W. R. Calderón-Muñoz
Heat Transfer Framework for Selecting the Structure of Open Volumetric Air Receivers
Proceedings of the ISES Solar World Congress and IEA SHC International Conference on Solar Heating and Cooling for Buildings and Industry 2019, SWC 2019.
3. M. Behzad, **B. Herrmann**, W. R. Calderón-Muñoz, and J. M. Cardemil
Thermo-structural analysis of a honeycomb type volumetric absorber for a concentrated solar power plant
Proceedings of the ISES Solar World Congress and IEA SHC International Conference on Solar Heating and Cooling for Buildings and Industry 2019, SWC 2019.
4. **B. Herrmann-Priesnitz** and W. R. Calderón-Muñoz
Effect of hydrodynamic boundary layer structure on the performance of a swirl flow microchannel heat sink for high heat flux applications
2nd Thermal and Fluids Engineering Conference, TFEC 2017.

Contributed Talks

1. **B. Herrmann** K. Cao, C. Gonzalez, S. L. Brunton, and B. J. McKeon
Data-driven linear analysis of turbulent flows via nonlinearity-subtracted dynamic mode decomposition
77th Annual Meeting of the APS Division of Fluid Dynamics, DFD 2024.
2. **B. Herrmann**, P. J. Baddoo, S. T. M. Dawson, R. Semaan, S. L. Brunton, and B. J. McKeon

Interpolatory input and output projections for flow control
76th Annual Meeting of the APS Division of Fluid Dynamics, DFD 2023.

3. **B. Herrmann**
Modelamiento de sistemas dinámicos basado en datos: desafíos y oportunidades
Jornadas de Mecánica Computacional, JMC 2023.

4. **B. Herrmann**, P. J. Baddoo, S. T. M. Dawson, R. Semaan, S. L. Brunton, and B. J. McKeon
From resolvent to Gramians: forcing and response modes for control
22nd Computational Fluids Conference, CFC 2023.

5. **B. Herrmann**, P. J. Baddoo, S. T. M. Dawson, R. Semaan, S. L. Brunton, and B. J. McKeon
From resolvent to Gramians: forcing and response modes for control
75th Annual Meeting of the APS Division of Fluid Dynamics, DFD 2022.

6. **B. Herrmann**, P. J. Baddoo, S. L. Brunton, and B. J. McKeon
Nonlinearity-subtracted Dynamic mode decomposition
U.S. National Congress on Theoretical and Applied Mechanics, USNC/TAM 2022.

7. **B. Herrmann**
Physically meaningful dimensionality reduction of dynamical systems
CMM Pucón Symposium, 2022.

8. **B. Herrmann**
Dinámica, control y datos
I Congreso de Postgrado de la Facultad de Ciencias Físicas y Matemáticas U. de Chile, 2022.

9. **B. Herrmann**
Estructuras coherentes para control de flujos de fluido
Jornadas de Mecánica Computacional, JMC 2022.

10. **B. Herrmann**, P. J. Baddoo, S. L. Brunton, and B. J. McKeon
Linearized analyses of fluid flows from nonlinear simulation data
74th Annual Meeting of the APS Division of Fluid Dynamics, DFD 2021.

11. **B. Herrmann**, P. J. Baddoo, S. L. Brunton, and B. J. McKeon
Análisis lineal de flujos de fluido a partir de simulaciones no lineales
Jornadas de Mecánica Computacional, JMC 2021.

12. **B. Herrmann**, P. J. Baddoo, R. Semaan, S. L. Brunton, and B. J. McKeon
Data-driven resolvent analysis
SIAM Conference on Computational Science and Engineering, SIAM CSE 2021.

13. **B. Herrmann**, J. Pohl, S. L. Brunton, and R. Semaan
Experimental gust mitigation using model based feedforward and feedback control
73rd Annual Meeting of the APS Division of Fluid Dynamics, DFD 2020.

14. **B. Herrmann**, S. L. Brunton, and R. Semaan
Modeling synchronization in forced turbulent oscillator flows
Second Symposium on Machine Learning and Dynamical Systems, Fields Institute, MLDS 2020.

15. **B. Herrmann**, S. L. Brunton, and R. Semaan
Synchronization in periodically forced oscillator flows
72nd Annual Meeting of the APS Division of Fluid Dynamics, DFD 2019.

16. **B. Herrmann-Priesnitz**, W. R. Calderón-Muñoz, J. M. Cardemil, and M. R. Fernández
Catastrophic dynamics of volumetric solar receivers
71st Annual Meeting of the APS Division of Fluid Dynamics, DFD 2018.

17. **B. Herrmann-Priesnitz**, W. R. Calderón-Muñoz, G. Diaz, and R. Soto
Hydrodynamic stability in a swirl flow channel
7th International Symposium on Bifurcations and Instabilities in Fluid Dynamics, BIFD 2017.

18. **B. Herrmann-Priesnitz,** and W. R. Calderón-Muñoz
Effect of hydrodynamic boundary layer structure on the performance of a swirl flow microchannel heat sink for high heat flux applications

2nd Thermal and Fluids Engineering Conference, TFEC 2017.

Invited Talks (BH Invited)

1. Aprendiendo dinámica a partir de datos espacio-temporales ***(Tutorial)***
   Escuela de Verano en Inteligencia Computacional, EVIC 2023.
2. Modelamiento de sistemas dinámicos: desafíos y oportunidades
   Lecture for PDEs course at FCFM U Chile, 2023.
3. Hecho en Beauchef: Estudio Lightboard para clase invertida
   Teaching seminar at FCFM U Chile, Encuentro de docencia 2022.
4. Data-driven analysis of non-normal systems ***(Minisymposium Keynote)***
   U.S. National Congress on Computational Mechanics, USNCCM 2021.
5. Modelamiento de sistemas dinámicos: relevancia y desafíos modernos
   Seminar of the Dept. of Mechanical Eng. at U Chile, Ciencia de datos para sistemas dinámicos 2021.
6. Mecánica computacional y ciencia de datos
   Undergraduate seminar at FCFM U Chile, Feria vocacional 2021.
7. Ciencia de datos para sistemas dinámicos
   Seminar of the Department of Mechanical Engineering at U Chile, Semana mecánica 2021.
8. Data-driven analysis of non-normal systems
   R. Vinuesa's group seminar from the Department of Mechanics at KTH, 2021.
9. Deep learning en ciencia e ingeniería
   Deep learning seminar at FCFM U Chile, 2021.
10. Machine learning informado por física para gemelos digitales
    XIXX Encuentro de gestión de activos físicos, EGAF 2021.
11. Learning what tickles your flow from data
    Seminar of the Department of Mechanical Engineering at U Hawaii Manoa, 2021.
12. Modeling drag reduction in forced turbulent oscillator flows
    Seminar of the Institute of Fluid Mechanics at TU Braunschweig, 2020.
13. Modeling synchronization in forced turbulent oscillator flows
    B. J. McKeon's group seminar from the Graduate Aerospace Laboratories at Caltech, 2020.

Other Talks

2023, Nov. APS DFD, Washington, DC (G-Hernandez, Herrmann, Cao, Colbrook, Brunton, McKeon)
2023 Oct. JMC, Santiago, Chile (Lemus, Herrmann)
2023 Oct. JMC, Santiago, Chile (Torres, Herrmann)
2023 Oct. JMC, Santiago, Chile (Delgado, Herrmann)
2023 Oct. JMC, Santiago, Chile (Magaña, Herrmann)
2022, Nov. APS DFD, Indianapolis, IN (McKeon, Herrmann, Baddoo, Brunton; **Keynote**)
2022 Oct. JMC, Valdivia, Chile (Lemus, Herrmann)
2022 Oct. JMC, Valdivia, Chile (Bahamondes, Herrmann)
2022 Oct. JMC, Valdivia, Chile (Magaña, Herrmann)
2021, Nov. APS DFD, Phoenix, AZ (Baddoo, Herrmann, McKeon, Kutz, Brunton)
2020, Nov. APS DFD, Virtual (Brunton, Baddoo, Herrmann, McKeon)

Service

Service at U Chile:
ME PhD Program Committee [2023–present].
ME Department Council [2022–present].

Scientific societies: *SIAM, APS, SCMC.*

Grant reviewer: *Fondecyt.*

Journal referee:
Nature Computational Science
Proceedings of the Royal Society A
SIAM Journal of Scientific Computing
Journal of Fluid Mechanics
Physical Review Fluids
AIAA Journal
Nonlinear Dynamics
Chaos: An Interdisciplinary Journal of Nonlinear Science
Physica D: Nonlinear Phenomena
International Journal of Mechanical Sciences
Mechanical Systems and Signal Processing
Expert Systems with Applications
International Journal of Heat and Mass Transfer
Journal of Applied and Computational Mechanics
Chemical Engineering Research and Design
Journal of Power Sources