

Benjamin Herrmann

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Department of Mechanical Engineering
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Research Interests

Machine learning: *Physics informed ML, dimensionality reduction, sparse regression, dynamic mode decomposition.*
Dynamics and control: *Koopman theory, nonnormal systems, sensor/actuator placement, machine learning control.*
Fluid dynamics: *Bio-inspired flow control, unsteady aerodynamics, hydrodynamic stability, resolvent analysis.*

Education

University of 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

Research Experience

Research associate: University of Washington, USA, May 2019-present.

Supervisor: Steven L. Brunton, sbrunton@uw.edu

Development of data-driven methods for stability and receptivity analyses of large-scale dynamical systems.

Research associate: Technische Universität Braunschweig, Germany, Apr 2019-Nov 2020.

Supervisor: Richard Semaan, r.semaan@tu-bs.edu

Data-driven modeling of aerodynamic systems for experimental feedback control.

Researcher: University of Chile, Chile, Jul 2018-Jan 2019.

Principal investigator: José Miguel Cardemil, jcardemil@ing.uchile.cl

Model development for the conjugate heat transfer and fluid flow in a volumetric solar receiver.

Visiting graduate student: University of California-Merced, Jun-Aug 2017.

Hosted by Gerardo Diaz, gdiaz@ucmerced.edu

Experimental work on the performance of a swirl flow minichannel heat sink subject to flow pulsations.

Research assistant: CSIRO Chile International Centre of Excellence, Santiago, Chile, Nov 2014- Dec 2015.

Principal investigator: Manuel Duarte, mduarte@ing.uchile.cl

Research on the fluid dynamics of a parallel disc turbine for energy recovery from mineral pipelines.

Intern engineer: Keppel Offshore and Marine Technology Centre, Singapore, Jan-Feb 2012.
Supervised by: Quek Choon Kiat, choonkiat.quek@keppelshipyard.com
Research and development in shipyard processes.

Teaching Experience

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.

Awards and Service

PRIME Fellowship – DAAD: Postdoctoral Researchers International Mobility Experience, 2019-2020

Beca Doctorado Nacional 2015 – CONICYT: Fellowship for Doctoral Studies, 2015-2018.

Scientific societies: SIAM, APS Division of Fluid Dynamics, ASTFE.

Paper reviewer: *Int. J. Heat Mass Transfer*, *Int. J. Mech. Sci.*, *J. Appl. Comput. Mech.*, *Proc. 2nd Th. Fluids Eng. Conf.*

Journal Publications

1. **B. Herrmann**, P. Baddoo, R. Semaan, S. L. Brunton, and B. J. McKeon
Data-driven resolvent analysis, 2020. arXiv: 2010.02181
2. **B. Herrmann**, P. Oswald, R. Semaan, and S. L. Brunton
Modeling synchronization in forced turbulent oscillator flows
In production in Communications Physics, 2020.
3. **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.
4. **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.
5. **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.
6. **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.

7. **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.
8. **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. 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.
2. 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.
3. **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**, P. J. Baddoo, R. Semaan, S. L. Brunton, B. J. McKeon
Data-driven resolvent analysis
To be presented at SIAM Conference on Computational Science and Engineering, SIAM CSE 2021.
2. **B. Herrmann**, J. Pohl, S. L. Brunton, R. Semaan
Experimental gust mitigation using model based feedforward and feedback control
To be presented at 73rd Annual Meeting of the APS Division of Fluid Dynamics, DFD 2020.
3. **B. Herrmann**, S. L. Brunton, R. Semaan
Modeling synchronization in forced turbulent oscillator flows
Second Symposium on Machine Learning and Dynamical Systems, Fields Institute, MLDS 2020.
4. **B. Herrmann**, P. Oswald, S. L. Brunton, R. Semaan
Modeling drag reduction in forced turbulent oscillator flows
Internal seminar of the Institute of Fluid Mechanics at Technische Universität Braunschweig, 2020.
5. **B. Herrmann**, S. L. Brunton, R. Semaan
Modeling synchronization in forced turbulent oscillator flows
B. McKeon's group seminar at the Graduate Aerospace Laboratories of the California Institute of Technology, 2020.
6. **B. Herrmann**, S. L. Brunton, R. Semaan
Synchronization in periodically forced oscillator flows
72nd Annual Meeting of the APS Division of Fluid Dynamics, DFD 2019.

7. **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.
8. **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.
9. **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.

Supervised student projects

Co-advisor

1. Analysis of the interaction between a photovoltaic panel and a vertical axis wind turbine in an urban environment using CFD simulations, Vicente Saavedra, 2018.
2. Effect of the thermal interaction on the efficiency of an array of photovoltaic panels, Sebastián Hurtado, 2018.
3. Computational model of the insulation system for a magnetic induction heater, Joaquín Carrasco, 2018.
4. Three-dimensional thermal modeling of a photovoltaic panel, Viviana Olivares, 2018.
5. Thermal modeling of a photovoltaic solar farm from the perspective of cyber-physical systems, Rodrigo Cordero, 2018.

Member of committee

6. One-dimensional and unsteady thermal model of a bifacial photovoltaic cell, Carolina Bernuy, 2018.
7. Siting of urban wind turbines using CFD simulation and entropy generation analysis, Mariana Gallardo, 2018.
8. Design and modeling of a passive heat sink for temperature reduction and redistribution in photovoltaic panels, Daniel Espinosa, 2017.