Iago Cupeiro Figueroa, Ph.D., ir.
Curriculum vitae

Personal information

Full name:	Iago Cupeiro Figueroa
(Personal) E-mail address:	iagocupeiro@protonmail.com
Place of birth:	Lugo, Galicia, Spain
Date of birth:	15th February 1990

Employment

Aug 23 - present   **Founder**, Cupeiro Solucións Intelixentes de Enerxía

Jan 22 - present   **Building control expert**, DeltaQ
<u>Department:</u> Development and delivery

March 21 - Nov 21   **Research assistant - Post-doctoral level**, KU Leuven
<u>Department:</u> Mechanical Engineering
<u>Division:</u> Applied Mechanics and Energy Conversion (TME)
<u>Research group:</u> Thermal systems simulation (The Sysi's)
<u>Project:</u> InduFlexControl "Design for flexibility for carbon-free energy-intensive industry"

Nov 16 - March 21   **Research assistant - Doctoral level**, KU Leuven
<u>Department:</u> Mechanical Engineering
<u>Division:</u> Applied Mechanics and Energy Conversion (TME)
<u>Research group:</u> Thermal systems simulation (The Sysi's)
<u>Project:</u> hybrid GEOTABS "Controlling the power of the ground by integration"

Sep 14 - Sep 16   **Research assistant**, Universidade de Vigo
<u>Department:</u> Mechanical Engineering, Heat Engines & Machines, and Fluids
<u>Division:</u> Heat Engines & Machines
<u>Research group:</u> Solar engineering and refrigeration

April 14 - June 14   **Internship**, Lugo's heating and plumbing association (ALUFONCA)
Processing authorizations to industry, council and other parties
Technical advice to installtion companies.
HVAC, DHW and gas projects support.

Education

Nov 16 - March 21	**Ph.D. in Mechanical Engineering** KU Leuven <u>Thesis title</u>: "Short- and long-term optimal control of hybrid GEOTABS buildings"
March 17 - March 21	**InnoEnergy PhD School** EIT-KIC InnoEnergy Entrepreneurial, innovation, business and personal skills <u>Courses followed:</u> Managing Innovation & Entrepreneurship, ESADE Energy Economics, Grenoble École de Management IP Strategy/Academic Innovator Law, Uppsala University Teamwork and Leadership, AGH Krakow
Sep 19 - Jan 20	**Visiting researcher** Polytechnique Montréal
Sep 14 - July 15	**M.Sc Energy and Sustainability** Universidade de Vigo
Sep 13 - March 14	**Erasmus exchange** Cork Institute of Technology
Sep 08 - April 14	**M.Sc Industrial Engineering**, w/ expertise in Mech. Eng. Universidade de Vigo

Teaching

Jan 17 - currently
Thermal Systems & Energy Management, KU Leuven
2020-currently: GEOTABS session; teaching the basics of GEOTABS
buildings using an online platform, where the students have to design a
GEOTABS building, its HVAC energy system and analyze and understand
its dynamic behavior.
2017-2019: Heat pump laboratory; teaching the basics of heat pumps
to small groups of students, where they have to virtually interact with a
real heat pump and demonstrate their understanding of the thermodynamic
cycles.

September 21
Modelica Crash Course, KU Leuven
Day course introducing master students and fellow (PhD) researchers to the
basics of Modelica, Dymola and IDEAS.

Jan 17 - May 21
Integrated project, KU Leuven
Coaching groups of students of the first year in the Master of Engineering
Science (option mechanical engineering) in problem-solving oriented projects
posed by a company. The focus of the course is to challenge the students with
real-life problems. See "Student supervision" section for individual details.

Sep 18 - Dec 18
Problem solving and design, KU Leuven
Guiding groups of students of the second year in the Bachelor in Engineering
Science (option mechanical engineering) in one of their first projects. The
topic of this course was to design a soft robot capable of doing an obstacle
circuit. The focus of the course is on working in a team, reporting a design
process and going through a design process from ideation to prototyping.

Jan 17 - May 17
Integrated project energy,, KU Leuven
Guiding groups of students of the first year in the Master in Engineering
Science (option energy engineering). The topic of this course was to design
a mobiliy solution to reduce the overall CO_2 emissions. The focus of the
course is on working in a team, reporting a design process and being able
to properly report the work.

Jan 17 - May 17
Principles of food machinery, KU Leuven
Teaching exercise sessions for a course on the basics of thermodynamics,
applied to food processing. The course was part of an international master
programme at the Faculty of Bio-Engineering.

Student supervision

M.Sc. thesis

Jan 21 - Nov 22   Michiel Drenth
Thesis title: "Optimal deployment of thermal energy storage at the demand side of the energy system"
KU Leuven

Sep 20 - June 21   Brett Lambeets
Thesis title: "Integratie van geothermische opslag voor duurzame datacenterkoeling"
KU Leuven

Jan 20 - Aug 20   Bram Van den Broeck
Thesis title: "Ontwerp van een tool voor het inschatten van belastingsduurcurves voor ruimteverwarming en koeling"
KU Leuven

Jan 20 - June 20   Wouter Peere
Thesis title: "Methode voor economische optimalisatie van geothermische verwarmings-en koelsystemen" • Winner of Marcel Herman Thesis Award, Febeliec Energy Award and Encon Enery Prize Master Thesis
KU Leuven

Sep 18 - Aug 19   Bram Stockman
Thesis title: "The influence of different control strategies on the design of geothermal borefields"
KU Leuven

Sep 17 - Aug 18   Enric Perarnau Ollé
Thesis title: "Design and experimental implementation of a data interface for the optimal control of thermal systems"
KU Leuven

Integrated projects - in collaboration with a company

Feb 21 - May 21	Emma Michiels and Dylan Broos Project title: "Solar-assisted heat pumps in EPB" KU Leuven & Vlaams Energie- en Klimaatagentschap
Feb 21 - May 21	Arno Meessens and Anton Bex Project title: "Increasing the long-term efficiency of a zero-fossil--fuel collective energy concept in a historic city center" KU Leuven & Boydens Engineering
Feb 19 - May 19	Hellen De Winter and Hanne Vermeiren and Arno Marechal Project title: "The hurdle of domestic hot water in collective housing projects using heat pumps" KU Leuven & Thermiek
Feb 18 - May 18	Sigrid Feyaerts and Benoît Miserez Project title: "Design and control of a solar assisted ground source heat pump system with seasonal storage" KU Leuven & Boydens Engineering
Feb 17 - May 17	Sam Coen and Samuel Demaerel and Adriaan Van Campenhout Project title: "Evaluation of heat pumps in EPB software: do we approach the reality?" KU Leuven & Boydens Engineerong

Bachelor dissertations

Sep 16 - Jul 17	Serxo Pouso Oujo Dissertation title: "Uso de CYPE para o deseño dunha instalación xeotérmica nunha vivienda unifamiliar" Universidade de Vigo

Publications

Journal articles

Cupeiro Figueroa, I., Cimmino, M., Drgoňa, J., and Helsen, L. Fluid temperature predictions of geothermal borefields using load estimations via state observers. *Journal of Building Performance Simulation 14*, 1 (2021), 1–19

Cupeiro Figueroa, I., Cimmino, M., and Helsen, L. A methodology for long-term model predictive control of hybrid geothermal systems: The shadow-cost formulation. *Energies 13*, 23 (2020). Special Issue: Advances in Ground

Heat Exchangers and Ground-Coupled Heat Pumps

Drgoňa, J., Arroyo, J., Cupeiro Figueroa, I., Blum, D., Arendt, K., Kim, D., Perarnau Ollé, E., Oravec, J., Wetter, M., Vrabie, D. L., and Helsen, L. All you need to know about model predictive control for buildings. *Annual Reviews in Control 50* (2020), 190 – 232

Cupeiro Figueroa, I., Picard, D., and Helsen, L. Short-term modeling of hybrid geothermal systems for model predictive control. *Energy and Buildings 25*, 8 (2019), 1095–1110

Conference proceedings

Cupeiro Figueroa, I., and Helsen, L. Long-term sustainable operation of hybrid geothermal systems through optimal control. In *Proceedings of International Ground Source Heat Pump Association Research Track* (2022). Las Vegas (USA), 6-8 December 2022.

Cupeiro Figueroa, I., and Helsen, L. Application of a long-term MPC formulation to hybrid GEOTABS buildings. In *Proceedings of International Building Simulation Conference 2021* (2021). Brugge (Belgium), 1-3 September 2021.

Cupeiro Figueroa, I., and Helsen, L. A low-order semi-physical borefield model for optimal control applications. In *Proceedings of International Building Simulation Conference 2021* (2021). Brugge (Belgium), 1-3 September 2021.

Peere, W., Picard, D., Cupeiro Figueroa, I., Boydens, W., and Helsen, L. Validated combined first and last year borefield sizing methodology. In *Proceedings of International Building Simulation Conference 2021* (2021). Brugge (Belgium), 1-3 September 2021.

Cupeiro Figueroa, I., Drgoňa, J., and Helsen, L. State estimators applied to a linear white-box geothermal borefield controller model. In *Proceedings of International Building Simulation Conference 2019* (2019). Rome (Italy), 3-5 September 2019

Jorissen, F., Picard, D., Cupeiro Figueroa, I., Boydens, W., and Helsen, L. Towards real MPC implementation in an office building using TACO. In *Proceedings of 5th International High Performance Buildings Conference* (2018). West Lafayette (USA), 9-12 July 2018

Cupeiro Figueroa, I., Drgoňa, J., Abdollahpouri, M., Picard, D., and Helsen, L. State Observer for Optimal Control using White-box Building Models. In *Proceedings of 5th International High Performance Buildings*

Conference (2018). West Lafayette (USA), 9-12 July 2018

Cupeiro Figueroa, I., Cigler, J., and Helsen, L. Model Predictive Control formulation: A review with focus on hybrid GEOTABS buildings. In *Proceedings of the REHVA Annual Meeting Conference* (2018), pp. 1–9. Brussels (Belgium), 24-26 April 2018

Cupeiro Figueroa, I., Fernández-Seara, J., and Fernández Cid, D. Análisis teórico de los refrigerantes alternativos adecuados para bombas de calor de alta temperatura. In *VIII Congresso Ibérico & Congresso Ibero-Americano. Ciências e técnicas do frio.* (2016). Coimbra (Portugal), 3-6 May 2016

Cupeiro Figueroa, I., Ares, E., and Cotterell, M. Evaluation and optimization of sustainable parameters in machining. In *31st International Manufacturing Conference* (2014). Cork (Ireland), 3-5 September 2014

Presentations/Posters

Cupeiro Figueroa, I., Picard, D., and Helsen, L. Development and impact of a borefield controller model for model predictive control. In *Intelligent Buildings Operation Workshop, Date: 2019/08/07-2019/08/08, Location: Boulder, Colorado, USA* (2019)

Drgoňa, J., Cupeiro Figueroa, I., and Helsen, L. State estimation of control-oriented white-box models for buildings. In *Intelligent Buildings Operation Workshop, Date: 2019/08/07-2019/08/08, Location: Boulder, Colorado, USA* (2019)

Other research related activities

Conference organization

Building Simulation Conference 2021: 7 blind reviews • 1 session chair • co-organization of the BOPTEST workshop • helping hand

IBPSA Project 1

Organizational participant: IBPSA Project 1 is an international collaboration that aims to create open-source software that builds the basis of next generation computing tools for the design and operation of building and district energy and control systems • Task 1.2.2. leader

Contributions to open-source development

IDEAS: Modelica library for integrated building and district energy simulations developed at KU Leuven

`github.com/open-ideas/IDEAS`

modelica-ibpsa: Modelica library for building and district energy systems developed within IBPSA Project 1
`github.com/ibpsa/modelica-ibpsa`

pygfunction: An open-source toolbox for the evaluation of thermal response factors (g-functions) of geothermal borehole fields
`github.com/MassimoCimmino/pygfunction`

BOPTEST: An open and level playing field on which different control algorithms can be quantitatively benchmarked and compared.
`github.com/ibpsa/project1-boptest`

BeSim: Matlab toolbox for quick design and simulation of advanced climate control algorithms.
`github.com/drgona/BeSim`

Webmaster

Webmaster of the Sysi's research group in the period 2016-2021
`mech.kuleuven.be/en/tme/research/thermal systems`

Other followed courses

Nov 18   Optimal control with CasADi
Yacoda

Jul 17   TEMPO Summer School on Hardware Implementation of Embedded Optimization
Slovak University of Technology

Nov 16   GENSIM (new Generation building ENergy SIMulation tools)
IBPSA France

Nov 13   HVAC with ground-souce heat pumps
ACLUXEGA

Languages

Galician:	Native (mother tongue)
Spanish:	Native
English:	C1: Certificate in Advanced English, Cambridge
Portuguese:	B2: Diploma Intermédio de Português Língua Estrangeira, CAPLE
French:	B1: Centrum voor Levende Talen

Main references

Professor Lieve Helsen, KU Leuven, lieve.helsen@kuleuven.be
Professor Massimo Cimmino, Polytechnique Montréal, massimo.cimmino@polymtl.ca
Stephane Jans, DeltaQ, stephane.jans@deltaq.io