

Mario Alves da Silva

University Academic Curriculum Vitae

Personal information Name: Mario Alves da Silva

Education since leaving school

- **2020 – Bachelor's Degree in Architecture and Urban Planning at the Federal University of Viçosa - UFV, Brazil**
 - **BSc Thesis title:** "Design to regenerate: proposing a new building for the Architecture and Urban Planning Graduate program of the Federal University of Viçosa" (the original publication is in Portuguese).
 - **Supervisor:** Prof. Joyce C. Carlo (UFV).
 - **Final mark:** 86.1/100.
- **2022 – Master's Degree in Architecture and Urban Planning at the Federal University of Viçosa - UFV, Brazil**
 - **MSc Thesis title:** "A benchmark of optimization algorithms for thermal, luminous and energy multi-objective analysis on Grasshopper for Rhino".
 - **Supervisors:** Prof. Joyce C. Carlo (UFV) and Prof. Rafael de P. Garcia (UFV).
 - **Final mark:** 98.4/100.
- **2024 – PhD in Architecture and Urban Planning at the Federal University of Viçosa - UFV, Brazil**
 - **PhD thesis title:** "Multi-scale analysis of weather data for building performance assessment".
 - **Supervisors:** Prof. Joyce C. Carlo (UFV), Prof. Andrea Gasparella (Unibz), and Prof. Giovanni Pernigotto (Unibz).
 - **Period abroad:** Building Physics Group (Unibz) from November/2023 to August/2024.
 - **Final Mark:** 98.1/100.

Habilitations

Admitted as an Architect and Urban Planner in 2020, according to the Brazilian Council of Architecture and Urban Planning (CAU).

Academic and Professional experience

- **Technologist at the Free University of Bozen-Bolzano, Faculty of Engineering**
 - **Period:** from 01.06.2025 to 30.11.2026.
 - **Employer:** Free University of Bozen-Bolzano, Faculty of Engineering.
 - **Supervisor:** prof. G. Pernigotto.
 - **Activities:**
 - Main project: CoolST - Adapting to Climate Change Impact: Crafting South Tyrol's Cooling Future for Energy Resilience.
- **Research Assistant at the Free University of Bozen-Bolzano, Faculty of Engineering**
 - **Period:** from 01.01.2025 to 31.05.2025.
 - **Employer:** Free University of Bozen-Bolzano, Faculty of Engineering.
 - **Supervisor:** prof. A. Gasparella.
 - **Activities:**
 - Main project: Metamaterials and training

applied to multi-storey timber buildings (METAWOOD).

Experience in academic teaching

- **Academic year of 2023**
 - **Performance assessment of residential buildings according to the Brazilian regulations** (Lecture hours: 45 h. Bachelor Degree in Architecture and Urban Planning, UFV, Brazil).
 - **Design Laboratory V: Industrial Complex** (Lecture hours: 120 h. Bachelor Degree in Architecture and Urban Planning, UFV, Brazil).
- **Academic year of 2022**
 - **Design Laboratory III: Social Housing** (Lecture hours: 90 h. Bachelor Degree in Architecture and Urban Planning, UFV, Brazil).

Research and scholarships

- **2023 to 2024 – Evaluation and updating of Brazilian weather files for building performance simulation.**
 - Exchange period at Unibz.
 - Funded by the Brazilian Federal Agency for Support and Evaluation (CAPES).
 - Coordinated by Prof. Joyce C. Carlo (UFV).
 - Supervised by Prof. Andrea Gasparella (Unibz) and Prof. Giovanni Pernigotto (Unibz).
- **2022 to 2024 – Technologies for adaptation of buildings to climate changes: energy efficiency, photovoltaic generation and reduction of emission in schools**
 - **Brief description:** This study aims to develop a methodology for incorporating passive strategies and active-passive building technologies to scholar building, focusing on the energy balance in face of climate change. The analysis will focus on identifying the best approach to create climate change weather files for building performance simulation. Since natural ventilation represents a good strategy for Brazilian buildings, we intend to quantify its contribution mitigate climate change effect and reduce energy consumption. We will focus on different locations, selected according to the Brazilian bioclimatic zoning, to provide a comprehensive analysis to support future retrofit decisions.
 - Funded by the Brazilian National Council for Scientific and Technological Development (CNPq).
 - Coordinated by Prof. Joyce C. Carlo (UFV).
 - Supervised by Prof. Clarissa F. Albrecht (UFV), Prof. Olga M. Toledo (CEFET-MG, Brazil), and Prof. Francisco J. R. Martinez (University of Valladolid).
- **2021 to 2024 – Machine learning methods applied to building performance assessment**
 - **Brief description:** Simulation-based optimization (SBO) processes are computationally expensive and the combination of it with machine learning (ML) methods appears as an alternative capable of reducing computational time consumption without losing the robustness of the solutions. This study compares different machine learning algorithms as an approach to replace simulations during the SBO processes. The main objective is to define the best machine learning algorithm and the most reliable ratio between simulations and predictions. The problems focus on the Grasshopper + Rhino platform and address different building performance situations..
 - Funded by the Brazilian National Council for Scientific and Technological Development (CNPq) and the

- State of Minas Gerais Research Support Foundation (FAPEMIG).
 - Coordinated by Prof. Rafael de P. Garcia (UFV).
- **2019 to 2020 – Analysis of the feasibility of photovoltaic systems in Brazil according to the Brazilian regulations for distributed solar energy generation in Brazil**
 - **Brief description:** The photovoltaic system integrated into the building (BIPV) emerges as a sustainable alternative for reducing energy demand, presenting advantages such as the possibility of replacing traditional construction elements, allowing the BIPV system to simultaneously perform the sealing and energy generation functions. The evaluated the feasibility of using BIPV systems to replace the outside layer of the building envelope, in the construction phase, of single and multifamily dwellings with artificial conditioning systems, in the Southeast region. The analysis focused on 5 multi-family and 3 single-family models, simulated in EnergyPlus 8.7, using climate files of 55 cities in the southeast region.
 - Funded by the Energy Company of Minas Gerais (CEMIG).
 - Coordinated by Prof. Joyce C. Carlo (UFV).
 - Supervised by Prof. Antônio Sônia A. C. Diniz (PUC-Minas), Prof. Delly O. Filho (UFV), Prof. Denise M. dos Santos (UFV), Prof. Olga M. Toledo (CEFET-MG, Brazil) and Prof. Roberto P. Lopes (UFV).
- **2018 to 2019 – Weather files impact on building performance during early design stages**
 - **Brief description:** Building performance is directly related to the outdoor environment. Therefore, building design should always consider the multivariate characteristic of climate. Using the city of Viçosa-Brazil, we used different weather files compiled according to different methodologies to represent the same multi-year records to analyze the impact of using different weather files to propose new building designs. The research used the parametric capacity of Grasshopper for Rhino associated with the Ladybug Tools package and the Octopus optimizations engine to quantify the impacts of using different reference years.
 - Funded by the State of Minas Gerais Research Support Foundation (FAPEMIG).
 - Coordinated by Prof. Joyce C. Carlo (UFV)

Publications

- **On peer-review journals**
 - SILVA, M. A.; PERNIGOTO, G.; PRADA, A.; GASPARELLA, A.; CARLO, J. C. Weather files for building simulation in Brazil: A national benchmark. **Building Simulation**, v.19, p.619–638, 2026.
 - DA SILVA, M. A.; BORELLI, G.; GASPARELLA, A.; PERNIGOTTO, G. Confronting Land Surface Temperature and Ground Station Data for Urban Heat Island Assessment and Urban Building Energy Modeling—A Case Study for Northern Italy. **Energies**, v.19, p.724, 2026.
 - SILVA, M. A.; GARCIA, R. P.; CARLO, J. C. Multi-objective optimization algorithms for building performance assessment – A benchmark. **International Journal of Architectural Computing**, v.24, 2024.
 - DA SILVA, M.A.; PERNIGOTTO, G.; GASPARELLA,

- A.; CARLO, J.C. Towards Climate, Bioclimatism, and Building Performance—A Characterization of the Brazilian Territory from 2008 to 2022. **Buildings**, v.14, n.8, p.2568, 2024.
 - SILVA, M. A.; GARCIA, R. P.; CARLO, J. C. Performance assessment of RBFMOpt, NSGA2, and MHACO on the thermal and energy optimization of an office building. **Journal of Building Performance Simulation**, v. 16, p. 1-15, 2022.
- **Conference papers accepted for publication**
 - DA SILVA, M. A.; BORELLI, G.; GASPARELLA, A.; PERNIGOTTO, G. Analysis of the Resilience of the Alpine Residential Building Stock to Climate Change. In: SDEWES 2026.
 - DA SILVA, M. A.; BORELLI, G.; GASPARELLA, A.; PERNIGOTTO, G. Urban Weather Boundary Conditions for Building Simulation: Multi-Year Station Sensitivity and UWG Testing. In: SDEWES 2026.
 - BORELLI, G.; DA SILVA, M. A.; GASPARELLA, A.; KÄMPF, J. H.; PERNIGOTTO, G. A Single-Building Surrogate Model for UBEM application integrating Spatial Features. In: SDEWES 2026.
- **Proceedings of conferences**
 - DA SILVA, M. A.; PERNIGOTTO, G.; PRADA, A.; CARLO, J. C.; GASPARELLA, A. On the Use of Both Typical and Extreme Weather Data for Climate Classification and Building Energy Analyses: The Case of Brazil. In **Lecture Notes in Civil Engineering**, 1277–1288, 2026.
 - DA SILVA, M. A.; PERNIGOTTO, G.; PRADA, A.; GASPARELLA, A.; CARLO, J. C. Typical and extreme Weather files for Building performance assessment in Brazil. In **Proceedings of XVIII ENCAC & XIV ELACAC**, 2025.
 - VERGINIO, I. P.; GARCIA, R. P.; SILVA, M. A.; CARLO, J. C. Computational cost reduction of a simulation-based optimization process through machine learning methods: neural networks vs. random forest. **Proceedings of Building Simulation Applications (BSA 2024)**, p.25-30, 2025.
 - SILVA, M. A.; PERNIGOTTO, G.; PRADA, A.; GASPARELLA, A.; CARLO, J. C. Impact of the type of weather files on the outcome of a weather-based climate classification: the case of Brazil. In: Berardi, U. (eds) **Multiphysics and Multiscale Building Physics**. IABP 2024. Lecture Notes in Civil Engineering, vol 553. Springer, Singapore.
 - SILVA, M. A.; GARCIA, R. P.; CARLO, J. C. Assessing RBFMOpt and HypE's Performance Based on the Number of Fitness Functions. In: Wang, L.L., et al. **Proceedings of the 5th International Conference on Building Energy and Environment**. COBEE 2022. Environmental Science and Engineering. Springer, Singapore.
 - SILVA, MARIO. GARCIA, RAFAEL. CARLO, JOYCE. "Daylight and Energy Consumption Assessment of a School Building Through Multi-Objective Optimization and Clustering Technique". In: **XXV International Conference of the Iberoamerican Society of Digital Graphics**, 2021, online. Blucher Design Proceedings, 2021. p. 229.

Participation to scientific

- **Participation to conferences in the last 3 years**
 - 2026 - Building Simulation Applications 2026,

conferences

- Bolzano, Italy, 24th - 26th June 2026.
Number of papers as presenting author: 1.
- 2025 - 15th REHVA HVAC World Congress, Milan, Italy, 4th - 6th June 2025.
Number of papers as presenting author: 1.
 - 2024 - Building Simulation Applications 2024, Bolzano, Italy, 26th - 28th June 2024.
Number of papers as presenting author: 1.
 - 2023 - VII Latin American Congress of Building Simulation (IBPSA LATAM 2023), Florianópolis, Brazil, 9th - 10th March 2023.
Number of papers as presenting author: 1.

**Statement of
research interest**

- Building performance simulation and building resilience.
- Integration of measuring and simulation techniques for performance evaluation.
- Climate change and weather data analysis.

Additional skills

- **Building performance analysis**
 - Advanced knowledge: EnergyPlus, Ladybug Tools, Optimization engines (Opossum and Octopus).
 - Good knowledge: TRNSYS and IES VE.
- **3D modeling**
 - Advanced knowledge: Grasshopper, Sketchup, AutoCAD.
 - Good knowledge: Rhinoceros.
- **Programming**
 - Advanced knowledge: Python.
 - Basic knowledge: R.
- **Statistical analysis**
 - Good knowledge: SPSS and Minitab.

**Language
competence**

Mother tongue: Portuguese.
Other languages: English (C1), Italian (B1).

Bolzano, 02.07.2025
Mario Alves da Silva