

# Danilo R. Souza

Researcher in Mathematical Optimization and Inverse Problems

✉ souzadr@unicamp.br ✉ danilogyn01@gmail.com 📍 Unicamp, Campinas, SP 🔄 Souza-DR 🌐 danilo-r-souza  
🆔 0000-0002-5504-4152

## Professional Summary

Mathematician with B.Sc., M.Sc., and Ph.D. degrees in Mathematics from the Universidade Federal de Goiás (Federal University of Goiás) - UFG. My research focuses on continuous optimization, multiobjective optimization, derivative-free methods, inverse problems, and large-scale stochastic optimization for Full Waveform Inversion. I develop scientific software mainly in Julia, with interests in numerical methods, computational geophysics, high-performance computing, and multi-language scientific computing pipelines.

## Education

- |  |  |
|--|--|
| <b>Ph.D. Universidade Federal de Goiás - UFG</b> , Mathematics   | Goiânia, GO, Brazil<br>Jan 2019 – Jan 2023 |
| <ul style="list-style-type: none"> <li>• Thesis: Métodos de Quasi-Newton com Busca Linear de Wolfe para Otimização Multiobjetivo (Quasi-Newton methods with Wolfe line search for multiobjective optimization).</li> </ul>   |  |
| <b>M.Sc. Universidade Federal de Goiás - UFG</b> , Mathematics   | Goiânia, GO, Brazil<br>Jan 2017 – Jan 2019 |
| <ul style="list-style-type: none"> <li>• Dissertation: Método do gradiente conjugado Dai-Yuan modificado para otimização irrestrita (Modified Dai-Yuan conjugate gradient method for unconstrained optimization).</li> </ul> |  |
| <b>B.Sc. Universidade Federal de Goiás - UFG</b> , Mathematics   | Goiânia, GO, Brazil<br>Jan 2012 – Jan 2016 |

## Experience

- |   |  |
|---|--|
| <b>Universidade Estadual de Campinas - UNICAMP, IMECC</b> , Postdoctoral Researcher<br>FUSP/RCGI/TotalEnergies - project no. 4157. Coordinator: Prof. Dr. Bruno S. Carmo. Supervisor: Prof. Dr. Paulo J. S. Silva.  | Campinas, SP, Brazil<br>Jan 2025 – present<br>1 year 5 months  |
| <ul style="list-style-type: none"> <li>• Project: AVENIR</li> <li>• Imagem quantitativa avançada de carbonatos do pré-sal (Caracterização de reservatórios sísmicos utilizando FWI).</li> <li>• Research on large-scale stochastic optimization algorithms for Elastic Full Waveform Inversion (EFWI), including stochastic gradients, acceleration strategies, and optimized minibatch selection.</li> </ul> |  |
| <b>Universidade de São Paulo - USP, IME - Departamento de Ciência da Computação</b> , Postdoctoral Researcher in Applied Mathematics<br>FAPESP grant no. 2022/16733-6. Coordinator/Supervisor: Prof. Dr. Ernesto G. Birgin. Collaborating researcher: Prof. Dr. Antoine Laurain.  | São Paulo, SP, Brazil<br>Jan 2023 – Jan 2024<br>1 year 1 month |
| <ul style="list-style-type: none"> <li>• Project: Reconstrução de diagramas de Voronoi em tomografia de impedância elétrica (Reconstruction of Voronoi diagrams in electrical impedance tomography).</li> </ul>   |  |
| <b>Instituto Federal de Goiás - Campus Cidade de Goiás</b> , Temporary Professor  | Goiás, GO, Brazil<br>Jan 2020 – Jan 2022<br>2 years 1 month    |
| <ul style="list-style-type: none"> <li>• Taught Calculus II.</li> </ul>   |  |

## Publications

---

- A Partially Derivative-Free Proximal Method for Composite Multiobjective Optimization in the Holder Setting** Jan 2026  
V. S. Amaral, P. B. Assuncao, *D. R. Souza*  
[10.48550/arXiv.2508.20071](https://arxiv.org/abs/2508.20071) (arXiv:2508.20071 [math.OC])
- Reconstruction of Voronoi diagrams: the case of inverse conductivity problems** Jan 2025  
E. G. Birgin, A. Laurain, *D. R. Souza*  
[10.1088/1361-6420/adcb68](https://doi.org/10.1088/1361-6420/adcb68) (Inverse Problems 41, 055007)
- Reconstruction of Voronoi diagrams in inverse potential problems** Jan 2024  
E. G. Birgin, A. Laurain, *D. R. Souza*  
[10.1051/cocv/2024072](https://doi.org/10.1051/cocv/2024072) (ESAIM: Control, Optimisation and Calculus of Variations 30, 85)
- Global convergence of a BFGS-type algorithm for nonconvex multiobjective optimization problems** Jan 2024  
L. F. Prudente, *D. R. Souza*  
[10.1007/s10589-024-00571-x](https://doi.org/10.1007/s10589-024-00571-x) (Computational Optimization and Applications 88, 719-757)
- Métodos Quase-Newton com Busca Linear de Wolfe para Otimização Multiobjetivo** Jan 2023  
*D. R. Souza*  
[repositorio.bc.ufg.br/teseserver/api/core/bitstreams/64bb2388-607a-4877-ac69-38b989f74579/content](https://repositorio.bc.ufg.br/teseserver/api/core/bitstreams/64bb2388-607a-4877-ac69-38b989f74579/content) (Ph.D. thesis in Mathematics, Universidade Federal de Goiás)
- A quasi-Newton method with Wolfe line searches for multiobjective optimization** Jan 2022  
L. F. Prudente, *D. R. Souza*  
[10.1007/s10957-022-02072-5](https://doi.org/10.1007/s10957-022-02072-5) (Journal of Optimization Theory and Applications 194, 1107-1140)
- Método do gradiente conjugado Dai-Yuan modificado para otimização irrestrita** Jan 2019  
*D. R. Souza*  
[repositorio.bc.ufg.br/teseserver/api/core/bitstreams/ed33baf8-2725-4d5f-a174-167794f4f7ad/content](https://repositorio.bc.ufg.br/teseserver/api/core/bitstreams/ed33baf8-2725-4d5f-a174-167794f4f7ad/content) (M.Sc. thesis in Mathematics, Universidade Federal de Goiás)

## Skills

---

**Applied Mathematics and Optimization:** Continuous Optimization, Multiobjective Optimization, Quasi-Newton Methods, Conjugate Gradient Methods, Derivative-free Methods

**Inverse Problems and Computational Applications:** Inverse Problems, Full Waveform Inversion, Elastic Full Waveform Inversion, Electrical Impedance Tomography

**Scientific Programming:** Julia, Python, MATLAB, Fortran, FEniCS

## Languages

---

### Portuguese

Native speaker

### English

Intermediate reading and writing; limited speaking proficiency

## Interests

---

**Multiobjective Optimization:** Direct vector methods, Pareto optimality, Quasi-Newton methods, Derivative-free methods

**Scientific Software in Julia:** Julia packages, Multiobjective optimization solvers, Benchmark problems, Metrics and performance profiles

**Large-Scale Optimization:** Scalar optimization, Stochastic optimization, Minibatch strategies, High-performance computing

**Inverse Problems and Applied Mathematics:** Full Waveform Inversion, Elastic Full Waveform Inversion, Electrical Impedance Tomography, Inverse problems

## Projects

---

### VectorOptimizationGroup

GitHub organization focused on software for multiobjective/vector optimization, with Julia packages for solvers, benchmark problems, and experimental evaluation.

- Co-founder of the organization together with L. F. Prudente and Pedro Assuncao Filho.
- MOSolvers.jl: Julia package for multiobjective optimization solvers.
- MOProblems.jl: Julia package for benchmark problems in multiobjective optimization.
- MOMetrics.jl: Julia package for metrics and evaluation utilities for multiobjective optimization experiments.

## References

---

### Leandro F. Prudente

Associate Professor at the Institute of Mathematics and Statistics of the Federal University of Goias (UFG). His research interests include nonlinear programming, multiobjective optimization, numerical optimization, and numerical linear algebra for optimization.

### Ernesto G. Birgin

Full Professor at the Department of Computer Science, Institute of Mathematics and Statistics, University of Sao Paulo. Member of the Continuous Optimization group at IME-USP. His research interests include nonlinear programming, optimization, and operations research.

### Paulo J. S. Silva

Full Professor at the Department of Applied Mathematics, Institute of Mathematics, Statistics and Scientific Computing, University of Campinas. His main research area is continuous optimization, particularly convex programming, with additional interests in pattern recognition and support vector machines.