



# GABRIEL DOS SANTOS

ELECTRICAL ENGINEER / PhD in Electrical Engineering

## CONTACT

+55 21 979938833

dosgabrielasantos@poli.ufrj.br

Gabriel dos Santos

0000-0003-1989-9880

ABH-6829-2020

Rio de Janeiro, Brazil

## EDUCATION

2021 – 2023 Brazil  
PhD in Electrical Engineering  
Universidade Federal Fluminense

2019 – 2021 Brazil  
MSc in Electrical Engineering  
Universidade Federal Fluminense

2013 – 2018 Brazil  
BSc in Electrical Engineering  
Universidade Federal do Rio de Janeiro

## SKILLS

Programming and Numerical Analysis

- COMSOL    MATLAB    Labview
- Python    PowerFactory    PSCAD

Writing and Editing

- LaTeX    Microsoft Office

Social and Organizational

- Effective Communication
- Teamwork
- Self-management

## PROFILE

Gabriel dos Santos is an Electrical Engineer (UFRJ, 2018) with a Master's (2021) and Ph.D. (2023) in Electrical Engineering from UFF. He is currently a professor at UFRJ, teaching courses in Electromagnetism and related areas.

His research is strongly focused on superconductivity, particularly on the numerical modeling and simulation of superconducting materials and devices. He develops advanced finite element formulations, such as J-A, T-A- $\phi$ , and J-A- $\phi$ , to enable accurate and computationally efficient analyses.

His work contributes to the design and optimization of HTS cables, superconducting electrical machines, fault current limiters, and energy storage systems, aiming to reduce computational cost while preserving high fidelity in electromagnetic and thermal modeling.

## WORK EXPERIENCE

### Federal University of Rio de Janeiro (UFRJ)

Assistant Professor

Teaching undergraduate and graduate courses in Electromagnetism, Electric Circuits, and Electrical Installations.

Supervising Master's and Ph.D. students in the fields of superconductivity, numerical modeling, and advanced electromagnetic simulations.

Leading and conducting research on the numerical modeling of superconducting materials and devices, with emphasis on advanced finite element formulations (J-A, T-A- $\phi$ , J-A- $\phi$ ).

Developing computationally efficient multi-physics simulation frameworks for HTS cables, superconducting fault current limiters (SFCLs), superconducting electrical machines, and energy storage systems.

Establishing and maintaining research collaborations with national and international research groups in superconductivity, computational electromagnetics, and power systems.

Performing electrical studies for high- and extra-high-voltage systems, including power flow, short-circuit, and transient analyses.

Designing electrical machines and applying multi-objective optimization techniques (PSO and GA).

## LANGUAGES

- Portuguese: Native Language
- English: Advanced
- Spanish: Advanced
- French: Basic
- Italian: Basic

## PUBLICATIONS

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- Multiphysics lumped-parameter model of High Temperature Superconducting power cables for DC and AC applications
- Characterization and testing of a multiphase superconducting axial machine for electric aircraft
- Simulating Superconducting Fault Current Limiters With Open-Core and Closed-Core Using the J-A Formulation
- Experimental and Numerical Study of a Trapped-Field Superconducting Machine With Axially Oriented HTS Tape Stacks
- Comparison of Flux-Trapped Superconducting Machine Configurations
- T-A- $\Phi$  and J-A- $\Phi$  formulations for efficient electromagnetic simulations of high-temperature superconductors in 2D
- Simulation of Pulsed-Magnetization of HTS Jointless Loops With J-A Formulation With Circuit Coupling and Thermal Modeling
- J-A Formulation with Homogenizing Technique Used to Efficiently Model HTS Cable-In-Conduit Conductors
- Simulation of DC MRI Coils Using 2G HTS Tapes by the J-A Formulation
- Electromagnetic-thermal modeling of high-temperature superconducting coils with homogenized method and different formulations: a benchmark
- A frequency-domain finite element model for simulating high temperature superconductors using the J-A and T-A formulations
- Enhancing electric field calculation in HTS tape simulations for currents exceeding the critical limit using full HTS tape modeling
- Electrothermal modeling of HTS coils using homogenization and different formulations
- J-A Approach to Simulations of HTS Tapes: How to Couple with Electric Circuits
- FEM-Circuit co-simulation of superconducting synchronous wind generators connected to a DC network using the homogenized J-A formulation of the Maxwell equations
- Fast Coupled Thermoelectric and Magnetic Model to Simulate the Transient Behavior of Inductive and Resistive Superconducting Fault-Current Limiters
- Magnetic bearings with double crossed loops modelled with T-A formulation and electric circuits
- Analysis and experimental tests of a solid-state fault current limiter
- J-A formulation: A finite element methodology for simulating superconducting devices
- Coupling electromagnetic numerical models of HTS coils to electrical circuits: multi-scale and homogeneous methodologies using the T-A formulation
- 2D Modeling of HTS Coils with T-A Formulation: How to Handle Different Coupling Scenarios
- A 3D Finite Element Method Approach for Analyzing Different Short Circuit Types in a Saturated Iron Core Fault Current Limiter
- An integrated methodology to assess AC losses in kHz range using FEM and Partial Element Equivalent Circuit
- Fundamental, topologies and optimization methods of Saturated Iron Core Fault Current Limiter
- HTS Coated Conductor Losses Model Using the Coupling Method and the T-A Formulation
- A coupling method of the superconducting devices modeled by finite element method with the lumped parameters electrical circuit
- Multi-objective optimization for the superconducting bias coil of a saturated iron core fault current limiter using the T-A formulation
- A Novel Configuration for Resistive SFCL with bifilar 2G tapes
- Emulation and experimental analysis of an axial superconductor magnetic bearing

## AWARDS AND SCHOLARSHIPS

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- **Best PhD thesis of Electrical Engineering Post-graduation program (2023)**
- **Best Master thesis of Electrical Engineering Post-graduation program (2021)**
- **Best Master thesis of Federal Fluminense University at field Mathematics earth sciences and engineering (2023)**
- **Master's Scholarship:** Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq (2019 – 2021)
- **Undergraduate Scholarship:** Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq (2016 – 2018)

## ORAL PRESENTATIONS IN CONFERENCES AND WORKSHOPS

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- DOS SANTOS, G DOS; AINSLIE, M.; DU, R. *Dynamo modeling comparison using the J-A- $\Phi$  and H-A formulations considering two distinct operating scenarios. 2025. 17th European Conference on Applied Superconductivity (EUCAS 2025). Porto, Portugal, September 2025.*
- DOS SANTOS, G DOS; SANTOS, B. M. O.; Nicolo Riva; GRILLI, F.; TRILLAUD, FREDERIC. *T-A- $\Phi$  formulation: An efficient way to simulate superconducting devices in 3D problems. The Applied Superconductivity Conference (ASC 2024)*
- DOS SANTOS, G.; SANTOS, B. M. O.; TRILLAUD, FREDERIC; SASS, F.; SOTELO, G.G. *Thermoelectric simulation of a single-phase Saturated Iron Core Superconducting Fault Current Limiter using the finite element lumped parameter technique. The Applied Superconductivity Conference (ASC 2024)*
- DOS SANTOS, G.; TRILLAUD, FREDERIC. *A frequency domain finite element model for simulating high temperature superconductors using the J-A and T-A formulations. 9th International Workshop on Numerical Modelling of High Temperature Superconductors – HTS 2024.*
- DOS SANTOS, G.; SANTOS, B. M. O.; TRILLAUD, FREDERIC; HAJIRI, G.; BERGER, K. *Introduction of the magnetic scalar potential  $\varphi$  in the T-A and JA formulations for efficient electromagnetic simulations of High Temperature Superconductors. 9th International Workshop on Numerical Modelling of High Temperature Superconductors – HTS 2024. Bad Zurzach Switzerland, June 2024.*
- DOS SANTOS, G. *Frequency model for High temperature superconductor power devices. Fundamentals of Electromagnetism, 2024.*
- DOS SANTOS, G. *“Simulación de dispositivos superconductores utilizando la formulación J-A” 7th School of Superconductivity Mexico. 2023.*
- DOS SANTOS, G.; MARTINS, F. G. R.; SASS, F.; SOTELO, G.G.; MORANDI, A.; GRILLI, F. *A method to simulate a SIC-SFCL in 3D FEM coupled to electrical circuits. 8th International Workshop on Numerical Modelling of High Temperature Superconductors – HTS 2021.*

## PARTICIPATION AS TECHNICAL EDITOR IN CONFERENCES

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- 17th European Conference on Applied Superconductivity 2025
- International Conference on Magnet Technology (MT29) 2025
- Applied Superconductivity Conference 2024

## RESEARCH PROJECTS

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### **Study of Short-Circuit Current Limiter Configurations for Electrical Power Systems**

- Financial Support: Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do RJ
- Project Leader: Prof. Guilherme G. Sotelo
- Dates: 03/2019-05/2021

### **Detection of Faults in Submarine Cables and Real-Time Performance Analysis**

- Financial Support: Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP)
- Project Leader: Prof. Robson F. Dias
- Dates: 05/2023-05/2026

### **HVDC and MTDC (Multi-Terminal DC) Systems for the Integration of Offshore Wind Power Generation**

- Financial Support: Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP)
- Project Leader: Prof. Robson F. Dias
- Dates: 05/2023-05/2026