

Curriculum Vitae

Personal information

Gabriel Hajiri

Born on 22 July 1994
In Nabeul, Tunisia
Nationality: Franco-Tunisian
Single.

Current situation

PhD student, GREEN laboratory, University of Lorraine

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GREEN - Université de Lorraine
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Research Interests

- Multiphysics modeling of superconductors
- Application and integration of superconducting devices in the power grid
- Cryogenics

Keywords: Superconducting cables, fault current limiter, electromagnetic modeling, thermal and hydraulic modeling, Cryogenics.

Languages

Arabic: Native language

French: Fluent

English: Professional

Academic Degrees

2020-2024	PhD thesis in Electrical Engineering: "Modeling and Sizing of Superconducting Cables for the French Railway Network," under the supervision of Professor Jean Lévêque and Associate Professor Kévin Berger. (Defense scheduled for September 2024)
2018-2019	Master's degree in Electrical, Electronics, and Automation, at the Faculty of Science and Technology, University of Lorraine, Nancy.
2017-2018	Master's degree in electrical engineering, electronics and industrial informatics from the Faculty of Science and Technology at the University of Lorraine, Nancy.
2013-2016	Bachelor's degree in Electrical Engineering at the Higher Institute of Technological Studies of Sousse, Tunisia (ISET), Sousse, Tunisia.
2012-2013	High School Diploma in Technical Sciences from Mahmoud El Messadi High School in Nabeul, Tunisia.

Summer Schools and Specialized Workshops

August 31st - September 4th, 2020, in Nancy, France.	7th International Workshop on Numerical Modeling of High-Temperature Superconductors in Nancy, with the theme: "Modeling and Analysis Tools for High-Temperature Superconducting Motors."
September 12th - September 15th, 2022, in Paris, France.	Cryogenics and Superconductivity Commission of the French Association of Refrigeration, Design of cryostats; towards cryogenic autonomy.
October 10th - October 14th, 2022, in Gliwice-Tarnowskie Góry, Poland.	Hi-SCALE COST ACTION in Gliwice-Tarnowskie Góry, Poland: Theme: High-Temperature Superconductivity for Accelerating the Energy Transition. Hi-SCALE 1st Training School Draft Program.
February 13th - February 16th, 2023, in Saint-Nazaire, France.	Winter School: Finite Element Method Applied to Low-Frequency Devices

October 9th - October 12th, 2023, in Pont-à-Mousson, France. Instrumentation School organized by the Cryogenics and Superconductivity Commission of the French Association of Refrigeration (AFF-CCS).

Academic internship and employment

March 1st, 2019 - September 30th, 2020, in Paris, France. Final internship related to the thesis, aimed at developing a superconducting cable sizing tool within a software at SNCF Réseau.

October 1st, 2019 – October 30th, 2020, in Nancy, France. Research Engineer at the GREEN laboratory. Design and testing of a low-temperature cooling system using solid nitrogen for the magnetization of superconducting bulks.

September 1st, 2020 – present, In Nancy, France. PhD candidate at the GREEN laboratory, working on the modeling and sizing of superconducting cables for the railway network.

Industry project Engagement Overview

SMAGRINET

2019-2020

Project Objective: The EU aims to reduce its greenhouse gas emissions by 20% in 2020, and seeks to strengthen research and innovation capabilities in the energy sector to address the challenges of the energy transition.

To find out more: <https://www.smagrinet.eu/about/smagrinet-project/>

Mission:

- Prepare and teach a course on electrical networks to students.
- Teach practical sessions on the design of intelligent buildings.
- Participate in European Utility Week & POWERGEN Europe 2019 in Paris and engage in discussions with industry professionals to stay updated on industrial advancements in the transition to Smart Grids.

IMOTHEP

2020-2024

Project Objective: Investigation and maturation of technology for hybrid electric propulsion, organized by ONERA with 29 partners from European and international countries.

To find out more: <https://www.imothep-project.eu/>

Mission:

- Sizing and selecting the optimal topology for the architecture of superconducting cables for both direct current (DC) and alternating current (AC) applications in aircraft.

SCRYPT

2021 -2024

Project Objective: Design a cooling system utilizing liquid nitrogen circulation to cool the stator of a 50 kW partially superconducting machine for aerospace applications.

Partners: Airbus Up Next, Safran, Absolute Système, GREEN Laboratory, University of Lorraine.

Mission:

- Design and manufacture a heat exchanger for gaseous nitrogen.
- Develop a subcooler capable of cooling 2 kW at 70 K.
- Size, select, and procure all components of the cooling loop (nitrogen circulation pump, flow meter, pressure measurement, vacuum-insulated nitrogen suite).

SuperRail

2022-2025

Project Objective: Installation of the first superconducting cable in France on the DC railway network.

Partners: SNCF Réseau, Nexans, Absolute Système, GREEN Laboratory, University of Lorraine, and GEEPs Laboratory at CentraleSupélec.

To find out more: <https://www.railjournal.com/technology/superconducting-cable-to-be-installed-at-paris-montparnasse/>

Mission:

- Simulate the superconducting cable on the railway network as part of my thesis.
 - Conduct tests on the superconducting cable, including electrical and dielectric current measurements.
 - Perform short-circuit tests reaching 40 kA for 200 ms under 1500 V.
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Academic Collaborations Overview

- **2021-2022:** 3D electromagnetic modeling based on a finite element model of a superconducting foam. Collaborators: Michael Rudolf Koblischka, Anjela Koblischka-Veneva, Experimental Physics, Saarland University, Germany; Denis Gokhfeld, Kirensky Institute of Physics, Federal Research Center KSC SB RAS, Russia.
- **2022-present:** Simulation and coupling of an aeronautical propulsion power chain. Collaborators: Wilder Durante-Gómez, Dr. Frederic Trillaud, UNAM, Mexico; Javier de La Cruz, Felipe, Instituto Nacional de Electricidad y Energías Limpias, Cuernavaca 62490, Mexico; González-Montañez, Departamento de Energía, Universidad Autónoma Metropolitana, CDMX 02200, Mexico. (Work in progress)
- **2023-present:** Electrothermal modeling of superconducting coils using a homogenized method and different formulations: A benchmark. Collaborators: Anang Dadhich and Dr. Enric Pardo, IEE-SAV, Slovakia; Dr. Francesco Grilli, KIT, Germany; Dr. Benoit Vanderheyden, Dr. Christophe Geuzaine, Louis Denis, University of Liège; Dr. Tiina Salmi, TUNI, Finland; and Dr. Dmitry Sotnikov, PSI, Switzerland. (Article currently in publication).
- **2023-Present:** Introduction of the magnetic scalar potential in the **T-A** and **J-A** formulations for efficient electromagnetic simulations of High Temperature Superconductors. Collaborators: Gabriel DOS SANTOS (State University of Rio de Janeiro), Frederic TRILLAUD (Universidad Nacional Autónoma de Mexico), Dr. Bárbara Maria OLIVEIRA SANTOS (State University of Rio de Janeiro), Dr. Kevin BERGER (Université de Lorraine - GREEN). (Article currently in publication).

Teaching Responsibilities and Educational Contributions

- **2019-2020** Master's Degree - Electronics, Electrical Energy, and Automation Practical Work: Practical Work in Electrical Engineering (36 hours)
- **2019-2023** Bachelor's Degree - Electrical and Energy Careers Practical Work: Practical Work in power electronics (38hours)
- **2019-2024** Master's Degree - Electronics, Electrical Energy, Automation, Electrical Energy Practical Work: Application of Superconductors in Electrical Engineering (56 hours)
- **2023-2024:** Supervision of a group of three Master's students for their project in Electrical Energy. Project type: instrumentation. The objective is the realization of a real-time measurement model for mass flow rate, pressure, and temperature.
- **2023-2024:** Supervision of a group of two master's students for their project in electrical energy. Project type: Modeling and design of a superconducting current transformer.

Academic Achievement Awards

- **March 2023:** Conference Symposium on Advanced Technologies in Electrical Systems (SATES), Arras, France, 2023. Achievement: Selected by the scientific committee of the conference as the recipient of the Electricity de France (EDF) Young Researcher Award.
- **June 2022:** Member of the local organizing committee at GREEN, Université de Lorraine, France, for the 8th edition of the International Workshop on Numerical Modelling of High Temperature Superconductors.
- **September 2023:** Chair of an oral session on superconducting cables at the 16th European Conference on Applied Superconductivity, held in Bologna. Chair of a poster session on superconducting machines at the same conference.
- **October 2023:** Member of the organizing committee for the Cryogenic Instrumentation School, organized by the Cryogenics and Superconductivity Commission of the Association Française du Froid (AFF) and the GREEN laboratory, University of Lorraine.

Other responsibilities and Achievement

- **2018-2024:** Presented fundamental principles of electromagnetism and superconductivity at La Fête de la Science through demonstrations such as the levitation of bulk superconductors. This annual francophone scientific culture event aims to introduce young middle and high school students to the world of science.

- **2021-2022:** Elected member, representative of doctoral students on the administrative council of the doctoral school in Computer Science, Automation, Electronics, Electrical Engineering, and Mathematics.
- **2020-present:** Registered as a volunteer for article review in two journals: IEEE Transactions on Applied Superconductivity (IEEE-TAS) and Superconductor Science and Technology (SUST), in my research areas. Reviewed more than 10 articles so far.

Publications: Journal paper¹⁻⁸

- (1) **Hajiri, G.**; Berger, K.; Dorget, R.; Lévêque, J.; Caron, H. Thermal and Electromagnetic Design of DC HTS Cables for the Future French Railway Network. *IEEE Trans. Appl. Supercond.* **2021**, *31* (5), 1–8. <https://doi.org/10.1109/TASC.2021.3059598>.
- (2) **Hajiri, G.**; Berger, K.; Dorget, R.; Lévêque, J.; Caron, H. Design and Modelling Tools for DC HTS Cables for the Future Railway Network in France. *Supercond. Sci. Technol.* **2022**, *35* (2), 024003. <https://doi.org/10.1088/1361-6668/ac43c7>.
- (3) **Hajiri, G.**; Berger, K.; Lévêque, J. Design and Testing of a New Cooling System Using Solid Nitrogen for Pulsed Field Magnetization and Characterization of HTS Bulks. In *Journal of Physics: Conference Series*; IOP Publishing, 2021; Vol. 2043, p 012002.
- (4) Koblischka, M. R.; Koblischka-Veneva, A.; Nouailhetas, Q.; **Hajiri, G.**; Berger, K.; Douine, B.; Gokhfeld, D. Microstructural Parameters for Modelling of Superconducting Foams. *Materials* **2022**, *15* (6), 2303. <https://doi.org/10.3390/ma15062303>.
- (5) **Hajiri, G.**; Berger, K.; Trillaud, F.; Lévêque, J.; Caron, H. Impact of Superconducting Cables on a DC Railway Network. *Energies* **2023**, *16* (2), 776. <https://doi.org/10.3390/en16020776>.
- (6) **Hajiri, G.**; Berger, K.; Lévêque, J. Optimization of the Terminations of an HTS Cable Operating on a DC Railway Network. *IEEE Trans. Appl. Supercond.* **2024**, *34* (3), 1–8. <https://doi.org/10.1109/TASC.2023.3338603>.
- (7) Allais, A.; Saugrain, J.-M.; West, B.; Lallouet, N.; Caron, H.; Ferandelle, D.; Terrien, L.; Bouvier, G.; **Hajiri, G.**; Berger, K.; Quéval, L. SuperRail – World-First HTS Cable to Be Installed on a Railway Network in France. *IEEE Trans. Appl. Supercond.* **2024**, 1–8. <https://doi.org/10.1109/TASC.2024.3356450>.
- (8) Durante-Gómez, W.; Trillaud, F.; Santos, G. D.; Gonzalez-Montañez, F.; **Hajiri, G.**; Berger, K.; De La Cruz-Soto, J. FEM-Circuit Co-Simulation of Superconducting Synchronous Wind Generators Connected to a DC Network Using the Homogenized J-A Formulation of the Maxwell Equations. *Supercond. Sci. Technol.* **2024**. <https://doi.org/10.1088/1361-6668/ad4a2f>.

Publications: Conference paper⁹⁻¹⁵

- (9) Durante-Gómez, W.; González-Montañez, F.; **Hajiri, G.**; Trillaud, F.; Berger, K.; Dorget, R.; de la Cruz-Soto, J. Coupled FEM-Circuit Analysis of Interconnected High Temperature Superconducting Machines and Components. In *8th International Workshop on Numerical Modelling of High Temperature Superconductors (HTS 2022)*; Kévin Berger (Université de Lorraine - GREEN): Nancy, France, 2022.
- (10) Durante-Gómez, W.; Trillaud, F.; Berger, K.; **Hajiri, G.**; Dorget, R.; de La Cruz, J.; González-Montañez, F. Finite Element Model of a Superconducting Generator for Aircraft Application Coupled to an External Electrical Circuit. In *23rd International Conference on the Computation of Electromagnetic Fields, Compumag 2021*; Proceedings of the 23rd International Conference on the Computation of Electromagnetic Fields; Cancun, Mexico, 2022; p PA-A1: 13 (ID 155).
- (11) **Hajiri, G.**; Berger, K.; Lévêque, J. Modelling of the Pulsed Field Magnetization of HTS Bulks in Solid Nitrogen at 40 K. In *8th International Workshop on Numerical Modelling of High Temperature Superconductors (HTS 2022)*; Kévin Berger (Université de Lorraine - GREEN): Nancy, France, 2022.
- (12) **Hajiri, G.**; Berger, K.; R. Koblischka, M.; Koblischka-Veneva, A.; Nouailhetas, Q.; Lévêque, J. Numerical Modelling of a Compact Trapped Field Magnet Using an HTSc Tape as Energizing Coil during PFM. In *8th International Workshop on Numerical Modelling of High Temperature Superconductors (HTS 2022)*; Kévin Berger (Université de Lorraine - GREEN): Nancy, France, 2022.
- (13) **Hajiri, G.**; Douine, B.; Berger, K.; Trillaud, F. Study of AC Losses in HTS Tapes Coupling FEM and Electrical Circuits with Harmonics. In *8th International Workshop on Numerical Modelling of High Temperature Superconductors (HTS 2022)*; Kévin Berger (Université de Lorraine - GREEN): Nancy, France, 2022.
- (14) **Hajiri, G.**; Berger, K.; Dorget, R.; Laïb, Y.; Nouailhetas, Q.; Lévêque, J. Study of the Current Limiting Capacity of 2G HTS Tapes. In *8th International Workshop on Numerical Modelling of High Temperature Superconductors (HTS 2022)*; Kévin Berger (Université de Lorraine - GREEN): Nancy, France, 2022.
- (15) **Hajiri, G.**; Berger, K.; Trillaud, F.; Lévêque, J.; Caron, H. Superconducting Cables and Their Benefits for DC Railway Network. In *Symposium on Advanced Technologies in Electrical Systems (SATES 2023)*; Arras, France, 2023.

Scholarly Impact

Google Scholar: <https://scholar.google.com/citations?user=aLfh6U8AAAAJ&hl=fr>